GRAND prix 2

Manual

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Contents

Jean Alesi in the Ferrari takes a tight left bend at Monaco, a circuit where steering lock is increased to take the bends faster. Unfortunately, this wears out the tyres much quicker than usual.

Introduction

Grand Prix 2 is simply the most advanced racing simulation to date. MicroProse has long prided itself on the realism of its simulations. New heights of accuracy and attention to detail have been scaled in the process of developing *Grand Prix 2*.

The original Formula One Grand Prix was recognised by the software industry and game players alike as the ultimate racing simulation. In fact the game was so realistic that real racing drivers have been known to familiarise themselves with circuits using the game.

Geoff Crammond, the legendary designer of the original game, has proved himself equal to the task of, once again, producing a game that sets new standards for the industry and genre.

The game is modelled on the 1994 Championship Season and, thanks to a licence from Fuji TV, we are able to include all the real teams, all the real drivers, all the real cars, the real engines, the real tracks, the real rules, the real everything.

Of course, realism is not everything and everything is what we were after. A new 3-D engine, VGA graphics, full texture-mapping and light-sourcing have helped make *Grand Prix 2* visually stunning. The final touch was creating a car that handled just like the real thing. Springs, dampers, wing downforce, gear ratios, brake balance and ride height are fully adaptable and really do affect the way the car performs. Check out performance data graphs to compare the effects of different set-ups. Just watch as your car roars around the track. Mount a rumble strip and see the wheels accurately adjust themselves. Watch the sun glint off the bodywork. You really will become convinced that you are driving a real car.

When all is said and done, what you have is the ultimate racing simulation produced by a team dedicated to perfection. We are sure you will not be disappointed. All that remains is for you to take a deep breath, increase the revs, depress the clutch, place the car into 1st gear, wait for the green lights to appear and then roar away from the grid as you compete against the world's best Grand Prix drivers.

Good Luck!

Sorting the Materials

Your *Formula One Grand Prix 2* package should contain this Manual, a Technical Supplement with a Circuit/Key Guide, a Registration Card and a CD.

THIS MANUAL

Provides a Quickstart driving lesson for beginners, including circuit diagrams, detailed operating instructions, Team, Driver and Results details of the 1994 Formula One Grand Prix Season, Car Set-up Reference sections and a Data Logging Guide to help you improve your performance.

THE TECHNICAL SUPPLEMENT

Gives specific instructions for loading and/or installing the simulation on your computer. Also includes last minute software updates.

CIRCUIT/KEY GUIDE

Gives at-a-glance information for all the 1994 Circuits and all keys used in the game. The Circuits have Notes sections for you to write details of your best car set-ups, lap times or records. The Circuit guide is located in the technical supplement.

WHAT'S NEW FOR F1GP VETERANS?

- Teams, drivers and sponsors identical to the real sport.
- State-of-the-art 3-D Engine.
- VGA graphics, full texture-mapping and light-sourcing.
- Superb realism, pitching, rolling, and spins.
- Incorporates 1994 FIA rule changes.
- Save hot laps and replay them from any of the available camera angles.
- Full race strategy planning.
- New cockpit design.
- New improved, realistic sound.
- Wide range of possible failures from transmission or suspension failure to throttle and electrical problems.
- Adjust suspension settings and monitor plank wear.
- Custom control settings.
- Performance graphs.

OVERVIEW

MicroProse *Formula One Grand Prix 2* is a complete simulation of the full 1994 Championship Season; the sequel to the world-wide best-selling F1GP, it sets a new benchmark for racing game simulations.

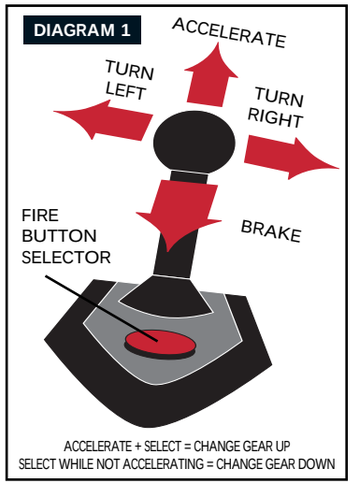
Your ultimate aim, at the end of the 16 Formula One races, is to win the Drivers' Championship and help your team win the Constructors' Championship. We think you'll find it tough to win at the highest level so, for the less experienced drivers, we have included 5 levels of difficulty with 7 major driving aids that, when fully implemented, will leave you free to race the car on the tracks' best racing lines. You can even choose to re-distribute the driving performance of all the other drivers. You can win the Championship at the lowest level of difficulty but it will only be at the highest level that you will receive the ultimate accolade.

QUICKSTART DRIVING INSTRUCTIONS

Joystick/Keyboard Control

This manual will refer to the Accelerator, the Brake, Changing Gear and Steering. You will be able to control these functions by keyboard, joystick and mouse. The simulation is initially in Joystick Mode; the recommended method.

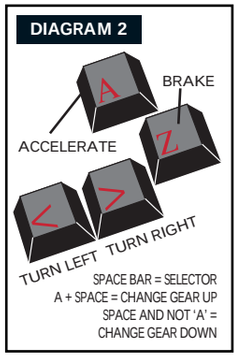
If you have a Joystick fitted on your computer, study diagram 1.



Joystick = Controller

Fire Button = Selector

If you are driving using the keyboard study diagram 2.



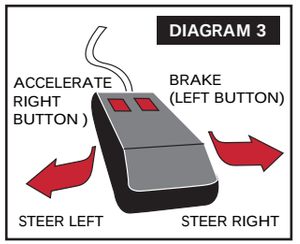
A/Z = Controller - Accelerate/Brake

</> = Controller - Steer Left/Steer Right

Spacebar = Selector

The keyboard cursor keys can also be used to highlight menu options.

If you are using a mouse, the controls are as follows.



Accelerate = Right Mouse Button

Brake = Left Mouse Button

You are able to set the 'travel distance' of the mouse in the Advanced Control Method Menu. This setting represents the distance the mouse needs to move, to generate maximum lock on the steering. You are also able to set the maximum lock from 3° to 35°.

One Lap of Monza for Rookies

• Install and/or load the simulation as explained in the Technical Supplement.

• Follow any on-screen prompts until you see the **Main Menu**.

• Choose **Drive Menu**.

• Choose **Drive Options.**

• Find **Race Distance** and reduce the figure to 10%.

• Find **Opposition Standard** and select **Rookie**.

• Select OK to return to the **Drive Menu.**

• Return to **Main Menu**.

• Select **Choose a Driver/Team.**

• Select a driver and team. If you wish, you may edit the team and driver names. To change the team name, select **Edit Team Name.** Place the cursor in the team name box. Delete the existing name and enter a new name. Select **OK**.

To change the driver name, place the cursor in the driver name box that you wish to alter. Delete the existing name and enter a new name. You can also save and load driver names.

• Press **OK**.

• Select **Drive Menu**.

• Choose **Practise Any Circuit**.

• Select **Italy**. You will see a view of the circuit.

• Select **Info**. This gives you the Lap Records and Distance. Select **OK**.

• Select **OK**.

You will now find yourself in the Pits at Monza.

• Look at the cockpit controls.

• Press the **Function Keys** F1, F2, F3, F4, F5, F7 and check that each Function key has turned on 1 of the 7 symbols that appear on the right of the dashboard panel. Each key turns on a Driving Aid to help you control the car. Do not press Function Key F6.

You won't need to worry about changing gear or braking. You may crash if you stray from the racing line, but you will not be damaged by any 'shunt'. If you spin off, the car will right itself, once it has come to rest. It will face the correct direction to continue the race.

• Turn to the Monza Circuit in the manual or Circuit Guide. You will see a diagram of the track at Monza.

• Find the Start Line then follow the circuit with your finger to the finish.

You are still in the Pits, on the jack. Select **'Leave the Pits'** from the cockpit LCD.

• Press the Selector and, when you have been lowered off the jack, accelerate using your Controller. You will begin to move forward. If not, check that you have pressed Function Key F2 and that the symbol on the display is lit.

When you leave the pits you will join the circuit by driving to one side of a yellow dotted line. Once you are on the circuit the yellow line will disappear and you will see a white long dotted line.

• Try to line up the middle of the steering wheel with the dotted line as you move around the circuit. This is the **Best Driving Line**; the ideal path to take so that you can go into and out of bends at the fastest possible speed. You should attempt to follow the dotted line, even though it may sometimes appear to aim away from the track.

• If a joystick is being used, press the Spacebar to Pause the simulation. Otherwise, press Key P.

The first bend at Monza turns to the left then quickly to the right followed by another left and right. This is a double chicane called the Variante Goodyear.

If a joystick is being used, press 'Space' to pause the simulation. Otherwise, press P.

Find the Variante Goodyear on your manual map and also examine the following bend: the Curva Grande.

Now press the pause key again to re-start the game.

You should now see a white sign with a black arrow bending to the left. Then countdown markers signs: 200 and 100.

These signs tell you how many metres to go before the approaching left-hand bend.

Steer carefully around the chicane. Try to follow the dotted line, even though it sometimes appears to be aiming away from the track.

Continue along the short straight and steer around the long sweeping right-hander Curva Grande. You will find that you can drive through this corner quite fast.

Just after the bridge you will see another sign warning you of a right turn. Press the pause key to pause the game and have another look at the map in the manual.

This is the Curva della Roggia: another chicane.

Look ahead on the map to the next 3 bends. Try to imagine what they will look like from your cockpit view.

Press the pause key to continue.

Steer through the chicane then carefully along the two right-hand curves. You will then see a long downhill straight.

Accelerate on the straight.

Driving through the Variante Ascari chicane

Take time to glance at the red gear indicator above the steering wheel as the car changes gear automatically. Listen to the sound of the engine and watch the rpm indicator light up.

At the end of the straight is an unusual chicane called the Variante Ascari.

Pause the simulation again and study it on the map. Try to memorize the shape of all the bends, then continue and try to drive through the series of bends.

Gradually, you will find that the more you know about the approaching corners the easier they will be to drive through at the correct speed.

Accelerate along the straight and see if the automatic gear change will put you into 6th gear before the auto-brakes slow you down for the Curva Parabolica. Don't worry if it doesn't. Try to accelerate around this bend.

As you come out of the corner you will see two grandstands, the pits and a yellow dotted line that marks the pit lane entrance. Keep following the white dotted line.

You are now on the finishing straight.

You will then see the Starting Grid, the 26 spaces where the cars are placed to start the race, and a thick solid white line across the track will mark the end of one lap.

Cross this line (the start/finish line). This is the end of the first lap but you will not be given a lap time until you complete a lap started from the Start/Finish line.

Pause the game and have a look at the map, try to remember the corners and straight sections. Now continue into another lap. When you finish this lap you will be given a lap time. Try another lap. Beat your previous time. Soon you will be ready to race in the Grand Prix Championship!

CONTROLLING YOUR OWN BRAKES

When you feel confident of racing around the circuit press Function Key F1. Check that the first symbol light has gone out. Now, you will have to control your own brakes.

Remember how brakes are operated by your Controller. This time you will have to cope with braking *and* steering around the same bends.

Try another lap of Monza. It will feel different this time but try to gauge the right moment to apply the brakes.

CONTROLLING YOUR OWN GEARS

• Stop on a straight part of the circuit.

• Press Function Key F2 once, and then press Function Key F6.

This will cancel Auto Gear Change and switch on the Suggested Gear Indicator. The 'gate' symbol should go out and, if you are near a corner, a blue gear indicator should appear slightly above it.

Now you will be in control of all gear changes but when you see a blue number that will be the suggested gear to be in at the following corner.

Check the method of gear change for your Controller (refer to the Quickstart diagrams - see page 7). Practise changing gear and watch the red gear indicator. Try to get N on the indicator. When you are in Neutral, accelerate. The engine should rev and make a high pitched noise.

• Push the Accelerator until the rpm indicator lights, to the left of the red gear indicator, illuminate. Then press the Selector to change gear, but keep it pressed in.

You should have changed into 1st gear; shown by the 1 on the gear change indicator. If not then the Controller was not pressed forward when you pressed the Selector, try again.

You will not be moving forward because you are holding the car on the clutch (the Selector pressed and held).

• Now, with the Controller pressed forward, let the Selector go!

You will be moving forward. Listen to the change of tone in the engine noise. The mph indicator should show the speed you are travelling at.

• Accelerate again and watch the rpm indicator lights illuminate as the revs increase. When the red light appears change up again in the same way as before. The indicator will now show 2.

Try to change up to at least fourth gear.

Then try changing down to take a bend by taking note of the suggested gear indicator. Note that it is not necessary to brake when changing down but it is essential that you do not accelerate.

You have six forward gears, Neutral, Power Turn (you can only change down into this gear) and Reverse. The Power Turn gear is not available with some steering configurations.

When you are in Reverse you will see R on the gear indicator. Accelerate with the Controller, just like in a real car, to move backwards.

DRIVING INTO THE PITS

The pit straight at the San Marino Grand Prix. The Tyrell team pit board on the right of the track confirms the driver's position - 10th.

When you think you are familiar with the Monza circuit and the basic car controls, practise driving into the Pits. The Pits are where car set-up changes are carried out and where your car is refuelled and fitted with new tyres.

You will have already noticed the Yellow Dotted Line: this is the line leading to the Pit Lane.

Drive a complete circuit. At any time, you may press 'Return/Enter' to inform your pit crew of your intention to stop. You will see the pit signal on your instrument panel light up in green. This enables you to enter the pit lane by following the dotted line.

• Drive slowly into the Pit Lane. You may see several pit crews waiting as you aim the car towards the Pit bays. The programme will direct you into the correct bay but you must brake just in front of the crewman directly ahead of you.

You will be jacked up and a sign will be placed in front of the car telling you to keep your brakes on. A pit menu will appear on your cockpit LCD offering you the chance to refuel or change tyres.

Refuel

• Select Fuel from your cockpit LCD menu.

• Use the steering controls to alter the amount of fuel held in the car.

• When you are happy with the amount of fuel and the number of pit stops to go, press the fire button or the spacebar to quit the fuel menu.

Tyres

• Select Tyres from your cockpit LCD menu.

• Along the bottom of the cockpit LCD will appear your available sets of tyres. Above each set is a figure in brackets. This figure represents the number of laps each tyre set has completed. Select the desired tyre set using the steering, brake and throttle controls. Press fire or the spacebar when you are happy with your selection. Note that the sets marked r1, r2, r3 and r4 are the tyre sets allocated for the race, with r1 starting the race and r2 being used in the first pitstop, etc. You are free to use these in practise/qualifying if, for example, you have used up the other sets. This would especially be the case if you did not wish to make three pitstops. However, you should bear in mind that you will not wish to race on worn tyres.

Rejoining the circuit

• Press the Selector and you will be jacked down. You can now drive away from the Pits, weave through the Pit lane, then carefully re-join the circuit.

A TIMED PRACTISE/ QUALIFYING SESSION

• Press Esc. You will enter the **Practice Frozen Menu**.

• Select **Leave Practise.**

• Select **Non-Championship Race**.

• Select a circuit of your choice then select **OK**.

• Select the first **Qualifying Session**.

You will be placed back in the Pits and jacked up but this time you will have a monitor appear in front of your car.

The Monitor will list drivers in the Qualifying session including yourself (highlighted).

You are still in Rookie level. If you want to drive with all Driving Aids on you can.

• Press the Selector. The monitor will move out of the way and your car will be jacked down.

Drive away from the Pits, then complete one lap. You will not be timed until you have passed the Start/Finish Line. You will now see that the car timer has begun.

Race around the circuit for one lap. As you cross the line, your lap time will be displayed. You are allowed up to 12 qualifying laps. When you have completed all available qualifying laps, or when you are happy with your qualifying time, you should return to the pits. You should be aware that the lap which started when you left the pits (the out lap) and the lap that ends in the pits (the in lap) both count towards the 12 lap limit.

Drive to your bay and wait to be jacked up. The monitor should reappear in front of you, showing various times from the other drivers in the qualifying session. The qualifying session lasts up to 60 minutes.

• To speed up the time select >> from the cockpit LCD menu.

If you want to leave the session, press Esc.

When the Qualifying session is over, you will be given the option of viewing session times, saving hot laps or continuing the game.

• Select **Continue** and you will be given the option of a final day's free practise/qualifying session or the opportunity to take part in a Pre-Race Warm up Session.

If you feel ready to race immediately, then do not choose either option, but go straight to the race itself by selecting **Race.**

A NON-CHAMPIONSHIP RACE

You will find yourself on the Starting Grid at Monza with 25 other cars. If you have achieved a reasonable lap time, you will be placed relative to the other drivers' performance. If you failed to get a time, got a very bad time, or have just jumped in at this stage, then you will begin from the back of the grid.

Wherever you are, you will see the starting gantry: a bank of 4 red lights and a bank of 4 green lights. None should be illuminated.

Wait for the red lights to come on. This is the warning that the start will take place within 4 to 7 seconds.

• Hold the car on the 'clutch' with 1st gear engaged (see earlier).

• When the green lights come on, accelerate!

Try to keep out of trouble for the first bend until the cars sort themselves out.

Race around the circuit for the number of laps shown on the display but keep an eye on the Pits Indicator (bottom right in the cockpit). If the indicator turns yellow, you are being called by radio to go into the Pits to change tyres, refuel or repair damage. Drive into the Pits as soon as possible, otherwise your cars performance will worsen. The pit stop will be timed!

If you do not wish to pit, inform the pit crew by pressing Return, which cancels the pit signal.

Complete the required number of laps.

When the race is over, continue around the circuit. When all running cars have completed that lap you will see a 'race over' message after which you will be shown the results menu.

If you wish to retire early from the race, press 'ESC'. This will take you to the **Race Frozen** screen. From here you can abandon the race, continue, allow the other drivers to complete the race in accelerated time or save the game/hot lap.

QUICKSTART GUIDE TO WINNING THE WORLD CHAMPIONSHIP

The Other Circuits

If you think you know Monza quite well after following the Quickstart Tutorial, you must study all the other 15 tracks with equal intensity to win the World Championship. You can win the World Championship at the lowest level with all Driving Aids (F1 to F7) turned on and the opposition at their lowest performance level, but you must still know the courses like the back of your hand.

Making use of the Driving Aids

You may find that you start the season with all driving aids turned on but as you progress you might prefer to control your own brakes and gears. If you win a World Championship, you will win at only the lowest level. When competing at the topmost level you can go faster without driving aids.

Probably the most difficult part of the simulation to master is the correct driving line; to win the Championship at Ace level, you'll have to get used to driving without it.

• Press Function Key F5 to turn off the ideal line and try to drive round a circuit without it. You will find that the most important guide will be the coloured rumble strip kerbs that appear on the approach of each corner. Try to remember the places where you begin to brake and turn on the approach to each bend and consult the Manual for Driving Hints.

Making use of the Manual

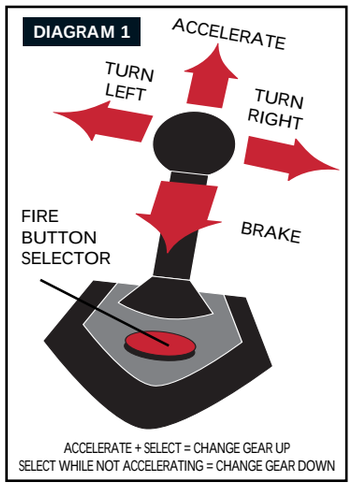
A computer game manual is sometimes seen as unimportant to the winning of the game but it is recommended that you read all of the manual. It will give you a complete understanding of attitude, general approach to races and other drivers on the circuit, plus numerous hints and tips to help you win. Remember that MicroProse *Grand Prix 2* is a simulation not just a racing game.

METHODS OF CONTROL

This manual will refer to the Accelerator, the Brake, Changing Gear and Steering. You will be able to control these functions by keyboard, joystick, and mouse.

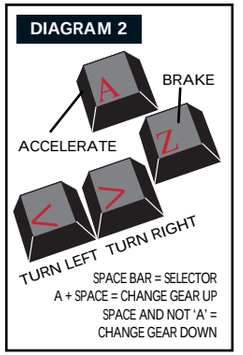
From the **Main Menu** select **Control Method** then select your preferred control method from those listed. If you wish to select a previously saved set of custom controls or you wish to change the control settings, select **Advanced Control**.

If this is the first time you have played *Grand Prix 2*, and you wish to use a joystick, you must first calibrate your joystick. To do this, select joystick in the **Control Method** and then select OK. You will automatically be guided through joystick calibration. Once your joystick has been calibrated, the setting will automatically be saved. You will only need to calibrate again if you change the joystick (in this case select **Calibrate Joystick** in the **Advanced Control Menu**) or install the game again.



If you have a joystick fitted on your computer, study diagram 1.

Joystick = Controller
Fire Button = Selector



If you are using the keyboard, study diagram 2.

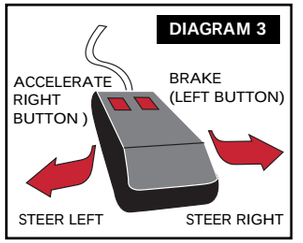
A/Z = Controller-Accelerate/Brake

</> = Controller-Steer Left/Right

Spacebar = Selector

If you are using the mouse, study diagram 3.

Accelerate = Right Mouse Button
Brake = Left Mouse Button



You are able to set the 'travel distance' of the mouse in the **Advanced Control Method** Menu. This setting represents the distance that the mouse needs to move on the desk to generate maximum lock on the steering. You are also able to set the maximum lock from 3 degrees to 35 degrees.

When using the mouse the spacebar is used as the selector.

ADVANCED CONTROL

This menu allows you to change many aspects of the way in which your car is controlled in *Grand Prix 2*. From this menu you can also create custom control sets, save and load custom control sets and calibrate joysticks. In addition you can edit the names of the custom control sets and select control driven calibration.

STEERING

• Steering Device

Select your **steering device** using the pull down menu. Click on the **steering device** and hold down the left mouse button (LMB). Then highlight your preferred steering device and release the LMB to select.

*Note: **Joystick Horiz** means that the function is operated by moving the joystick along its horizontal axis. **Joystick Vert** means that the function is operated by moving the joystick along its vertical axis.*

• Steering Mode

You can choose from 2 **steering modes** using the pull down menu system outlined above. These are Switched and Analog. Switched means that an action is either on or off; whereas, Analog means that the action is performed to a lesser or greater extent. Therefore, if the steering mode were set to Analog and you moved the joystick slightly left then the car would make a slight alteration to its course.

• Steering Help

Steering help estimates the amount of steering your car requires by taking account of your control input and the manoeuvre on the track you are trying to perform. Steering help only affects the angle of the front wheels and can be set to either on or off. Select the desired option by highlighting it.

• Maximum Lock

Maximum lock can range from 3 degrees to 35 degrees. This affects the overall sensitivity of your steering control if you are using analogue steering. At a high setting your car will be less sensitive to your steering control. At a low setting the car will be less sensitive to your steering control. Alter the setting by selecting the + and - icons.

• Reduce With Car Speed

This feature helps to compensate for the small travel of a joystick or limited turn of a steering wheel (a real F1 steering wheel can turn nearly three quarters of a turn each way). The maximum lock sensitivity setting is automatically reduced as the car speed increases. Big steering locks are really only needed at low speed corners. At high speeds, by reducing the overall sensitivity, you get more precision in steering the car. This feature has no effect if the slider is at 0% (max lock unchanged) and maximum effect at 100%.

• Low Sensitivity Zones

The low sensitivity zone enables you to control how sensitive the controls are as you move your control from the centre. For example, if you set the low sensitivity zone to 30% then the first 30% of travel, from the centre of the control, is progressively sensitive and the remaining 70% of the control remains at the sensitivity level reached at the end of the low sensitivity zone. This is useful to make steering, throttle and brake controls less sensitive to small control changes. A setting of 0% will give you constant sensitivity. A setting of 100% will give you progressive sensitivity across the full range of the control device.

• Mouse Travel

Mouse travel sets the distance your mouse must move in order to reach full lock on the steering. Mouse travel can range between 2” and 8”. Alter the setting by selecting the + and - icons.

ACCELERATE/BRAKE

• Acceleration Device

Select your acceleration device using the pull down menu.

• Acceleration Mode

Select the acceleration mode using the pull down menu. Two settings are available: Switched and Analog.

• Brake Device

Select your brake device using the pull down menu.

• Braking Mode

Select the braking mode using the pull down menu. Two settings are available: Switched and Analog.

• Clutch Device

The clutch control is either automatic or for use with an analog pedal. The main benefit being help controlling wheelspin at race starts.

GEAR CHANGE

• Change Up

Select the device used to change gears up using the pull down menu.

• Change Down

Select the device used to change gears down using the pull down menu.

CONTROL DRIVEN CALIBRATION

This option is used to calibrate non-standard control sets. For example, you could calibrate a steering wheel and pedal set using this option. Calibration measurements would be taken for the clutch, brake and accelerator pedals, and for the steering wheel.

SOUND

All music and sound in *Grand Prix 2* is fully adjustable.

• From the **Main Menu** select **Options**

• From the **Options Menu** select **Sound Set-Up**

• From **Sound Set-Up** you can adjust the following sound options: Music volume, car engine volume, car skid volume, fx volume, ambient sound volume. Each of these options can be set anywhere in the range 0% to 100% using the slide bar or by selecting the +/- buttons. You can also select whether the sound is stereo or mono by highlighting the required choice.

• When you are happy with your **Sound Set-Up** select **OK**

In Race Sound (+/-)

The sound of the Formula One engine is very important in the simulation for, as in real racing, it is a good indication of when to change gear.

Cycle through the available sound options, in race, using +/- keys.

Default Sound Level:	Full Sound (Engine, Skids & Other FX)
Sound Level One:	Partial Sound (Engine & Other FX)
Sound Level Two:	No Sound

THE BASIC DRIVING CONTROLS

Gear Change: Up

The sequence is Reverse-Neutral-1st-2nd-3rd-4th-5th-6th.

Start in Neutral. Accelerate with the Controller and press the Selector once, the red gear indicator will show 1 and the car will begin to move. Accelerate again until the red rpm light illuminates. Then while still accelerating, press the Selector. You will have now changed gear. The indicator now shows the number 2 and the tone of the engine will have changed. Accelerate again and increase the power, then press the Selector again. You have now changed up into third gear!

Gear Change: Down

The sequence is 6th-5th-4th-3rd-2nd-1st-Power Turn (if using steering help) -Neutral-Reverse.

With the Controller not accelerating, press the Selector. The number on the Gear Indicator will change down.

Power Turn

You can only change down into this gear. If you have not implemented Function Key F3 or are racing at a Level that does not allow you to use it, you may recover from any spin by changing down to this gear. The red indicator will show the power turn icon.

To straighten out a spin, accelerate from rest, steering momentarily in the opposite direction to where you want to turn, before steering in the desired direction, keeping the accelerator depressed throughout, but change up to first gear as soon as you are facing in the right direction.

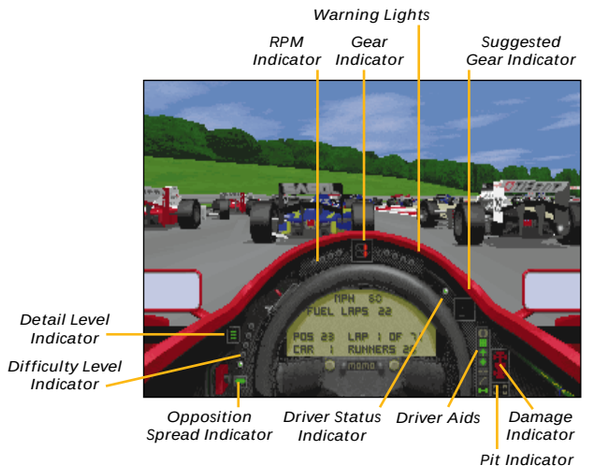
Reverse

You must change down into Reverse. Once the R appears on the gear indicator accelerate with the Controller, as in a real car, to move backwards.

SUMMARY

Before you start any race, qualifying lap, or practice session you must familiarise yourself with the Formula One car cockpit. You must be able to take in all information presented to you at a glance, because at the speeds you will be travelling, a lost second is all it takes to make the difference between a devastating shunt and a brilliant overtaking manoeuvre. At 200 mph the car will travel 90 metres in that second!

It's very important to know who is behind you and who is trying to overtake. Some cars may weave from side to side looking for an opening at a crucial corner, be conscious of their presence. They will try to pass if you show any weakness or leave a gap where they might dart past. While not advocating a breach of Racing Etiquette it is not unusual for drivers to 'shut the door' on other cars behind them.



Five levels of difficulty (Accessed from Drive Options within the Drive Menu)

The difficulty level you have chosen is shown by five lights in a row on the left of the steering wheel. If the lowest green light is shining, you are racing at Rookie level; if the highest light is on, you are competing at Ace level. The levels are related to, and control, the number of Driving Aids you can access.

The levels are: Ace
Pro
Semi-Pro
Amateur
Rookie

Opposition Spread (Accessed from Drive Options with the Drive Menu)

Just below the Difficulty Level indicators there is a panel that shows your choice for the distribution of performance among the other drivers. These are:

All teams and drivers at the same potential performance

1994 performance for drivers and teams

Random distribution of performance throughout the grid

The Rev Counter

In the centre of the screen, just above and to the left of the top of the steering wheel, you will see the RPM Indicator, a series of lights that illuminate as your revs increase. If you 'blip' the accelerator to rev the engine in Neutral you will notice that the rev lights come on. This is the most important indicator of how fast your engine is running when in a particular gear.

You must be aware of being in the right gear at the right moment. The basic guideline is to change up a gear as the red light illuminates and change down when all the lights have gone off. This will avoid rev limiting occuring as soon as you change down into a new gear. Changing into the wrong gear will lose you power or you may overrev and hit the rev limiter, thus losing speed.

Gear Indicator

Above the steering wheel, in the middle of the rev counter is the Gear Indicator. This tells you which gear you are in. There are 6 forward gears, neutral N, reverse R, and, if using steering help, a 'spin recovery' gear.

Suggested Gear Indicator (Activated by F6)

If F6 driving aid is on, you will see a blue indicator, to the right of the steering wheel, that tells you the suggested gear to be in at the next corner. This is an 'intelligent' aid which will vary depending on the car set-up.

Warning Lights

To the right of the gear change display are 4 warning lights. They are from left to right:

red - reliability problem (a descriptive message will appear on the cockpit LCD).

red - less than 2 laps of fuel remaining.

amber - split time (in practise/qualifying) or car gap (in race) is on the cockpit LCD.

amber - general pit message is on the cockpit LCD.

Driver Status Indicator

On the right of the steering wheel there is another small LED. If it is Green, you are currently in your own car cockpit. If you choose to see other drivers' cockpit views by pressing the Up/Down Arrows, the light will go off. Unless you are in Replay Mode, use this facility at your peril for the car will not be controlled by the computer.

Detail On/Off indicator (Alt/D)

The level of track-side detail will affect the speed at which the game plays. The amount of track-side detail can be adjusted prior to racing or during a race.

Adjusting track-side detail prior to racing

- From the **Main Menu** select **Options.**
- Select **Graphics Detail Level.**
- In the track-side objects box select the level of detail you require: None, Low, Medium or All.

Adjusting track-side detail during a race

- Alt & D will cycle through the different levels of detail.

The cockpit detail indicator will show which level of detail is currently selected.

ALL   LOW

MEDIUM   NONE

Damage Indicator

To the right of the help options indicators is the Damage Indicator operated by Radio Telemetry from the Pits. The Damage Indicator lights up the faulty or damaged section of the vehicle. If any section of the Damage Indicator is lit, extreme caution is advised in driving. Returning to the Pits will repair any damage.

Pits Indicator

Below the Damage Indicator is the Pits Indicator operated by Radio Telemetry from the Pits.

There are 3 modes:

GREY	Pits are empty. Call in at any time.
YELLOW	You have been called in to the Pits or have indicated an intention to call in.
RED CROSS	Pits are occupied by your other team car. The pit crew is not available to you, so you may have to wait longer if you go in.

Driving Aids

The Driving Aids panel is the bank of 7 boxes to the right of the cockpit. Driving Aids correspond directly to the Difficulty Level you have chosen.

F1 Auto Brakes

The computer applies braking functions for you to suit the circuit, but will not brake to avoid other cars.

F2 Auto Gears

The computer changes all gears for you when it thinks it is the appropriate moment.

F3 Self-Correcting Spin

In the event of you spinning off the track, when you have come to rest, the computer will point you in the correct direction to continue the race, assuming you are in a fit state of repair.

F4 Indestructible

No damage will be sustained in this mode, no matter how serious the shunt.

F5 Ideal Line

This lays down a white striped line to show you the best line to drive on the circuit you have chosen. Ideally, you must keep the line on the centre point of the cockpit to get the benefit of the best driving line.

F6 Suggested Gear

Indicates which gear to be in at the following corner.

F7 Throttle Help

Reduces the throttle when the rear wheels spin. This is designed not to be performance enhancing unlike the banned traction control.

The Driving Aids F1 to F7 can be turned on at any time from the cockpit if you are in Rookie Mode. However, if you are racing at higher levels you will have less help available to you.

LEVEL OF DIFFICULTY/ DRIVING AIDS AVAILABLE SUMMARY

Ace	F2, F7
Pro	F2, F5, F6, F7
Semi-Pro	F2, F3, F4, F5, F6, F7
Amateur	F2, F3, F4, F5, F6, F7
Rookie	F1, F2, F3, F4, F5, F6, F7

DIGITAL DISPLAYS

Monitor

During Qualifying you will be placed in the Pits and a Telemetric Monitor is placed in front of your cockpit. The Monitor lists the other drivers in the race by:

POS	current grid position
N	racing number
DRIVER	driver's name
LAPTIME	current best laptime
TIME	the amount of time left for practice/qualifying
CARS OUT	the number of cars already out on the track.

If you watch the monitor, you will see the other drivers' best lap times for the circuit. The fastest laptime is placed above all the others. You will be positioned in the middle of the monitor display with your nearest rivals on either side of you, unless you are the fastest driver!

You may speed up the time it takes for all drivers to finish qualifying by pressing 'Q' (if you are on the track) and then selecting '>>' from the cockpit LCD menu. Or, if you are in the pits, you may quit Timed Practice/Qualifying by pressing ESC.

QUALIFYING/PRACTICE DISPLAY:

During Qualifying and Practice the following information will be displayed on the cockpit LCD:

KPH/MPH	Your speed.
FUEL LAPS	The number of laps of fuel the car currently holds.
POS	Your current position on the grid.
LAPTIME	Your current lap time.
CAR	Your team car number.
BEST	Your previous best laptime.

RACING DISPLAY

During a race the following information will be displayed on the cockpit LCD:

KPH/MPH	Your speed.
FUEL LAPS	How many laps worth of fuel your car currently holds.
POS	Your position in the race.
LAP/OF	Your current lap out of the total number of laps.
CAR	Your car number.
RUNNERS	The number of cars left running in the race.

SPLIT TIMES AND GAP MEASUREMENTS

On each circuit there are two intermediate timing points as well as the start/finish line timing point.

In practise as you do a timed lap, a 'split time' will be displayed on your cockpit LCD. This is a time you are trying to beat at the next intermediate timing point. The split times themselves belong to the best laptime you have achieved so far. After the second intermediate timing point the next split time becomes the actual laptime that you are trying to beat. As you cross the intermediate timing point you will see a difference time displayed in the centre of your cockpit LCD. If this starts with a minus sign then you know that you are ahead!

In a race, a timed gap will be displayed on your cockpit LCD as you cross the intermediate timing points and the start/finish line timing point. This figure represents the time difference between you and the car in front of you.

SUMMARY

You begin any practice or timed/qualifying session in the pit lane. From here you can choose to drive straight away with the current Set-Up, or change any of the car settings. You can also drive into the pits at any time during practise to change your car Set-Up.

For the Rookie Driver, the car Set-Up will seem very complex at first. Do not worry! Accept the current Set-Up, learn to drive fast around the circuits, then return to this section and adjust the settings. Do not adjust more than one setting at a time before trying it out in a practice session. This is when you will notice the difference in performance.

Each of the 16 circuits is unique so it's necessary to Set-Up your Formula One car with the correct combination of Wing, Gear Ratios and Brake Balance. You are advised to study the track layouts and take note of all the track notes and summaries; these will give you an indication of the type of car Set-Up required, but there is no substitute for experience.

Try a few laps with various settings, get an idea of how the car is running through corners and along straights. Compare your performance with other cars in practice, go into the pits and adjust a setting then try again.

A good pit strategy can make all the difference. You can decide your strategy just prior to racing or you can make your choice in the Car Set-Up screen. You can also change your strategy during the course of the race by entering the pits and changing the number of pit stops to go and which lap to stop next on.

If you are having problems with your car Set-Up and are finding it difficult, for example, to drive into corners please consult the Car Set-Up Procedure Guide and the Car Set-Up Reference Guide.

FRONT/REAR WING DOWNFORCE ADJUST

In general terms the wings on a Formula One racer push the car down on the track. This achieves more grip and less roll giving better control in corners, but less speed on the straights because of more drag.

You can adjust the amount of front and rear wing used by the car. This is on a scale from 1 to 20. The higher the number, the more Downforce. Adjust the wing front and back by selecting +/- .

FRONT/REAR BRAKE BALANCE

Grand Prix cars have a low centre of gravity, centred just behind the driver. If you brake hard at speed, the weight shifts onto the front of the car. Therefore, brakes must be balanced to cope with the transfer of weight during deceleration (slowing down).

You can change the brake balance of your car by altering the way in which the front and rear brakes are applied. It's always best to have more brake bias at the front than at the rear.

The scale goes from 50% to 75%. The lower the figure the more balance is applied to the rear of the car. Adjust the balance by selecting +/-.

GEAR RATIOS

You must set the gear ratios of your gearbox to suit each circuit. This is usually done by setting the 6th gear for the fastest possible speed along the longest straight, then setting the lowest gear for the slowest corner. The rest of the gears are ranged evenly between the two.

Gear ratio selection is very important. Different cogs can be fitted to the gearbox which can have a major effect on the car's acceleration, performance in bends and top speed.

Twisty circuits with few long straights and plenty of chicanes demand 'short' gearing for quick acceleration.

Other circuits with long straights require 'long' gearing to give the car the top speed it will need to keep up with the opposition.

The gearbox has a range from 1 to 64. Select +/- to change the gear ratios.

The nearer the cogs are to each other, the less work the lower gear has to do to get to the higher gear (short gearing).

The further away the cogs are from each other the more work it has to do to get up to the higher gears but the faster the speed at the top gear (long gearing).

SAVE THE CAR SET-UP

You can save the Set-Up you have chosen for your car when you are in the Pits, by selecting **Car Setup** and then selecting **Save Car Setup**. From the **Save Car Setup Menu** enter the name by which you wish to save your car setup in the filename section and press Enter.

ADVANCED CAR SETUP

For advanced changes to your car setup select **Advanced** from the **Car Setup Menu**. The changes to your car setup that you make in **Advanced Car Setup** will affect your vehicle's suspension. For each wheel, you will be able to adjust the settings for the following:

Advanced Level 1

- Damper
- Spring
- Ride height
- Anti-roll bars

Advanced Level 2

- Packers
- Damper fast bump
- Damper fast rebound
- Damper slow bump
- Damper slow rebound
- Spring
- Ride Height
- Anti-roll bars

NB: For a full explanation of the above please consult Appendix D: Car Set-Up Reference Guide.

(STANDARD SET-UP)

Problem: The car does not want to steer into the corners.

Cause: Understeer.
Remedy: Increase Front Wing or Decrease Rear Wing Values.
Further Options: Bias Brake Balance towards rear (-).

Problem: The car turns too quickly into corners or spins too easily when cornering.

Cause: Oversteer
Remedy: Decrease Front Wing or Increase Rear Wing.
Further Options: Bias Brake Balance to the front (+).

Problem: Rival cars are much faster on long straights.

Cause: Too much downforce /Gear ratio too 'short'/ Not enough speed through previous corner.
Remedy: Reduce Wings front and back/ Space out higher gear ratios/Use more throttle.
Further Options: Check correct driving line.

Problem: Car does not grip in corners/ Other cars are faster in corners.

Cause: Too little downforce/ Speed too high.
Remedy: Increase Wing front and back/ Slow down in corner.

Problem: Car lacks acceleration over short distances.

Cause: Gear ratios too 'long'.
Remedy: Close down gaps between gears.

Problem: Car tends to spin-off when braking into corners.

Cause: Underbraking/ Braking too late.
Remedy: Move Brake Balance towards front/ Brake earlier.
Further Options: Increase Wing.

Problem: Car is slow in corners and straights.

Cause: Gearing.
Remedy: Lengthen the gears.
Further Options: Reduce Wing.

Problem: A gradual worsening of performance.

Cause: Tyres wearing out.
Remedy: Fit a new set of tyres.
Further Options: None.

Problem: Sudden loss of performance.

Cause: Car damaged in accident.
Remedy: Return to pits.
Further Options: Check outside views for obstructions.

Problem: Car stops suddenly.

Cause: No fuel.
Remedy: None.
Further Options: None.

CAMERA VIEWS & TV DIRECTOR

The camera can be moved around at any time by using the camera control keys. Some camera options are suitable for replay or when you are out of a race and watching other cars. It would be difficult to drive from those viewpoints.

Cockpit View

(Right Cursor Key)

You can press the right cursor key to view the race from the cockpit of your car.

On Car Cockpit Views

(PgUp Key)

You can view all the action from the perspective of a camera attached to your car. Subsequent presses of the PgUp key give you different camera views.

Trackside Camera Views

(Left Cursor Key)

You can view all the action centred on any car, at any time during a race, by pressing the Left Cursor Key. The Right Arrow Key will return you to the cockpit view of the selected car.

Chase View

(PgDn Key)

You can view any car from just behind and above the cockpit.

Reverse Chase View

(Delete Key)

View any car from the front with all the action behind it.

Other Car Views

(Up Arrow/Down Arrow/Home)

You can move forward into the cockpit of the car ahead by pressing the Up Arrow Key. Further presses will move you forward one car per press.

Similarly, you can move back one car by pressing the Down Arrow Key and further presses will move you further back. 'Home' will return you to your own car. A small LED on the right of the control panel will light up when you are in your own car but will go out when you are viewing from other cockpits.

TV Director

(Insert Key)

The Insert Key turns the TV Director on and off. The TV Director automatically shifts the track-side view between different cars and different camera angles. When you turn the TV Director on a clapper board will appear for five seconds in the top right hand corner of the screen. When you turn the TV Director off the same clapper board will appear with a cross through it.

Camera Zoom and Height

Some camera views allow limited changes to zoom and camera height. You can adjust the camera zoom using the '6' key to zoom out and the '7' key to zoom in. You can also adjust the height of the camera using the '3' key to move the camera up and the '4' key to move the camera down. The '5' key returns the camera to the normal zoom and height settings.

Replay Mode

(Pause/Replay (R))

The Pause key pauses the action and 'R' key replays the previous 20 seconds of action. You can freely move the camera around during Replay. At the end of Replay the game is left paused, ready to continue the race. At this point, you can restart the game and the camera will return to its original position, and you will be back in control of your car. Or, if you wish, press 'R' for another Replay with the camera starting from its current position.

There is no limit to the number of times you can Replay an event on the track.

Demo Mode

You can watch a race in Demo Mode from any circuit by de-selecting all drivers then entering any driving or race mode. It's often a good way to see the circuit; how fast it is, how twisty. It will also help if you have the manual open on the circuit diagram; follow the car as it races through the straights and corners, watch where most drivers overtake and take note of such features as 'slipstreaming'. Press ESC to return to the Main Menu.

CRASHES AND DISCIPLINE

Spinning off

The most common cause of spinning off is taking a bend too quickly. You will find this will happen quite often at first. If the circuit is one with wide grassy areas and run-off strips, you can re-join the race, but you will find it slow going trying to accelerate smooth Grand Prix tyres on slippy surfaces. You are advised to drop to the spin recovery gear (if using steering help), straighten up, then engage 1st gear. Watch out for faster cars crossing your path, and get back to the track. Your tyres might feel strange for a while.

Crashes

Crashing into other cars on the circuit may damage both vehicles and one of you may go into an uncontrollable spin. If you can still race, the damage will not be serious enough to stop you competing, but you should enter the Pits as soon as possible for repairs. Crashing into walls or barriers will have a similar effect.

If you have crashed, you might be lifted off the track by crane or pushed out of the way by track marshals.

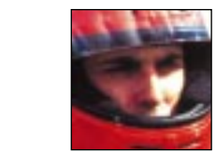
If you have sustained a crash that has ended your chances in a Championship Race you can choose to speed up the events and get the race result, or watch the race unfold from another driver's cockpit. When you are Practising Any Circuit you can start again with a spare car from the Pits.

Race Circuit Discipline

You will be warned of any dangerous incident such as a shunt by a Yellow Flag.

A Green Flag will inform you that it is all clear.

Consult the Flags section in this manual for a full description of racing flags.



The Main Menu is the screen you will see most often in the simulation. It is the start and finish point of all races, practices, loads and saves. It presents the player with 6 options:

Drive Menu

Load Game or Hot Lap Replay

Choose a Driver/Team

Control Method

Options

Exit from Game

DRIVE MENU

Selecting this Menu will give you the following options:

Quickrace
Practise any Circuit
Non-Championship Race
Championship Season
Drive Options
Return to Main Menu

Quickrace

This option can be accessed from either the **Drive Menu** or the initial menu which only appears at the very start of the game.

Once you select the **Quickrace** option you will be asked to select your required control method: keys or joystick. If you select joystick, you will be guided through the calibration process.

After selecting a control method you will see the **Track Select** screen. Here you can choose any of the 16 Grand Prix circuits to race at. When you are happy with your choice select **OK**.

You will now be in the cockpit and ready to race.

PRACTISE ANY CIRCUIT

This option allows you to get to know all the circuits without competing against other cars. Selecting **Practise any Circuit** will take you into the **Track Select** screen.

On the left of the screen is the circuit window where you can select which track you would like to practise on. You may practise on all of them in any order. It is only when you start the World Championship season that you will have to race each in turn in a pre-determined order. Highlight your chosen track by selecting the box opposite it.

You will see a view of the circuit in the window on the right of the screen. To see a full screen view of the circuit select View. To return to the Track Select screen, press the left mouse button, the spacebar, or your joystick fire button.

Selecting the Info box will display information relevant to the circuit you have selected. You will see details of the qualifying lap record and the race lap record.

When you are ready to practise on your chosen circuit select OK. You will then be put into the pits in the car of your choice.

PRACTISE

Your car will appear in the Pits garage ready for you to make adjustments to your car Set-Up or for you to practise with the current Set-Up on the circuit of your choice. In this session, you will not be in a race and there will be no other drivers practising on the same track. Return to the Pits by driving in.

NON-CHAMPIONSHIP RACE

Selecting this option will take you into the Track Select screen where you can choose which circuit you wish to race on. When you are happy with your choice select OK, which will take you into the Grand Prix Menu.

You are now faced with a number of options:

Thursday/Friday Free Practise

Thursday/Friday Qualifying Session

Saturday Free Practise

Saturday Qualifying Session

Pre-Race Warm Up

Race

Save Game

Abandon Event

Note: You can only access Saturday Free Practise/Qualifying Session once you have completed Thursday/Friday Free Practise/Qualifying Session.

Thursday/Friday Free Practise

Your car will appear in the pits garage for its first free practise. Before you commence your practise you can alter your existing Set-Up. During practise you always have the option to Save or Abandon.

Thursday/Friday Qualifying Session

This is your first qualifying session. Your car will appear in the pits, from where you can alter your car Set-Up. During Qualifying you can choose to go into the Pits at any point if you feel you have achieved a good enough time. A Telemetric Monitor will be placed above your cockpit panel and you can watch the times of other drivers. If you notice that other drivers are improving on your lap times, you can go out again (as long as there is enough time remaining for qualifying). There is a maximum qualifying session lap limit of 12 laps. Exceeding this limit will result in disqualification of your times for that day.

Pressing 'Q' during Qualifying will return your car to the pits. From the pits you have the option of accelerating time for the other drivers. This gives you the option of monitoring how the other drivers are performing. If you wish to rejoin Qualifying press 'ESC' and select **Leave The Pits.**

During Qualifying 'Esc' freezes qualifying and takes you to the **Qualifying Frozen** screen from where you can return to the cockpit, accelerate time, save the game/hot lap, or abandon qualifying.

If you manage to set a lap record in any race or qualifying session, the computer will automatically save that information under your chosen driving name, if, when you exit the game, you use the **Save Changes** option.

Pre-Race Warm Up

You will also have the option of Pre-Race Warm Up in full racing trim (fuel, settings). This session has a time limit of 30 minutes or your preferred practise time limit if shorter. This is your final chance to get to know how well your car will perform in the race itself. Beware, there may be a lot of other cars on the circuit.

Race

Once you have practised, got to know the circuit, then qualified for a good grid position, you can enter the race itself. If you have not achieved a good time, or any time at all, you will still be on the starting grid but at the back.

You will be shown the position of all cars on the starting grid. When you are ready to race, select OK and you will be placed on the starting grid among all the other 25 cars waiting for the Red and Green lights. After completing the specified amount of laps, you will be given the Final Race Positions. The Race will not count towards any Championship points.

CHAMPIONSHIP SEASON

Selecting this option will take you into the Track Select screen. If you are starting a new Championship Season, you have no option but to start from the first Grand Prix circuit of the season; Interlagos, Brazil.

Selecting **OK** will take you into the Grand Prix Menu.

You will now be presented with the following options:

Thursday/Friday Free Practise

Thursday/Friday Qualifying Session

Saturday Free Practise

Saturday Qualifying Session

Pre-Race Practise

Race

Save Game

Abandon Event

Thursday/Friday Free Practise

Your car will appear in the pits garage for its first free practise. Before you commence your practise you can alter your existing Set-Up. During practise you always have the option to Save or Abandon.

Thursday/Friday Qualifying Session

This is your first qualifying session. Your car will appear in the pits, from where you can alter your car Set-Up. During Qualifying you can choose to go into the Pits at any period, if you feel you have achieved a good enough time. A Telemetric Monitor will be placed above your cockpit panel and you can watch the times of other drivers. If you notice that other drivers are improving on your lap times, then you can go out again (as long as there is enough time remaining for qualifying).

Pressing 'Q' during Qualifying will return your car to the pits. From the pits you can accelerate time for the other drivers. 'Esc' freezes qualifying and takes you to the **Qualifying Frozen** from where you can return to the cockpit, accelerate time, save the game/hot lap, or abandon qualifying.

If you manage to set a lap record in any race or qualifying session, the computer will automatically save that information under your chosen driving name, if, when you exit the game, you use the 'Save' option.

Pre-Race Warm Up

You will also have the option of the Pre-Race Warm Up in full racing trim (fuel, settings). This session has a time limit of 30 minutes, or your preferred practise time limit if shorter. This is your final chance to get to know how well your car will perform in the race itself. Beware, there may be a lot of other cars on the circuit.

Race

Once you have practised, got to know the circuit, then qualified for a good grid position, you will enter the race itself and find yourself on the starting grid among all the other 25 cars waiting for the Red and Green lights. After completing the race, you will be shown the Final Race Positions, then the Drivers' Championship Positions and Constructors' Championship Positions.

If you wish to continue the championship at a later date you could Save the season. Otherwise you will be given the option to continue to the next Circuit. If you have completed the last race of the season, you will see the final points table.

DRIVE OPTIONS

Selecting this screen, from the **Drive Menu**, allows you to alter a number of options.

Quickrace Options

You can change the initial track selection and you can alter the grid position from which you start the race.

Race Options

You can change the time of practise periods, qualifying periods, the race distance and your pitstop strategy.

The Pitstop Strategy can be set to Automatic, Use car setup or Decide pitstop strategy at race start.

Automatic, means that the computer will select a fairly optimum strategy as it would for a computer car.

Use Car Set-Up will follow the strategy selected in the **Car Set-Up Menu**.

Decide pitstop strategy at race start will allow you to determine your strategy prior to leaving the pits at the beginning of the race.

OPTIONS

Accessible from the **Main Menu**, this lets you change the number of turns each player has in multi-player mode, the opposition standard and the spread.

In addition, from this screen you can **Review Performance Data**, from where you can access **View Performance data** and view graphs, stored from practise sessions, illustrating relevant performance data about your car (e.g. Revs, speed, etc.) You can also superimpose data from different laps on top of each other, so that you can instantly view a performance comparison. This is useful for judging how different car set-ups affect your performance. In addition, you can access **Extract and save hot lap replay** which converts your hot laps to graphs (**See Performance Analysis Section).**

From the **Drive Options** screen you can also access the **Car Set-ups** Menu and the **Car Realism** Menu.

Car Set-ups Menu

Here you can alter the angle of the front and rear wings, the brake balance, gear ratios and your pit stop strategy. You can select different set-ups for qualifying and racing. In addition, you are able to create different set-ups for every circuit. There is the facility to load a previously stored set-up or to save your current set-up.

View will allow you to compare set-ups from different tracks.

Copy Set-Ups will allow you to copy the car set-up from one circuit to the currently selected circuit.

From **Car Set-Up** you can select **Advanced Options** which allows you to make more detailed alterations to your vehicle set-up.

Advanced Options Level 1 allows you to alter the following:

Damper

Spring

Ride height

Anti-roll bars

Advanced Options Level 2 allows you to alter the following:

Packers

Damper Fast Bump

Damper Fast Rebound

Damper Slow Bump

Damper Slow Rebound

Spring

Ride Height

Anti-roll bars

Note: For a comprehensive guide to the above set-up features refer to **Appendix C: Car Set-Up Procedure Guide** or **Appendix D: Car Set-Up Reference Guide.**

From **Advanced Options** you can select **Inspect Vehicle** which allows you to inspect the degree of plank and tyre wear. If your plank wear falls below the legal minimum of 9mm then you will experience extra drag as the plank rubs on the ground. If you notice that your plank is suffering severe plank wear then it would be a good idea to alter your car set-up to reduce plank wear. E.g. Increasing ride height could help avoid plank wear.

Selecting **View** will allow you to compare your current set-up with set-ups for other circuits.

Car Realism Menu

Allows you to select which of the following failures may occur during a race:

Suspension failure
Loose Wheel
Puncture
Engine Failure
Transmission Failure
Oil or Water Leaks
Throttle or Brake Problems
Electrical Problems

Note: These selections are for the player's car. Computer cars cannot turn them off.

LOAD GAME OR HOT LAP REPLAY

This option will take you to the Load Game screen. Different windows display drives,

directories, files, filenames, and information about the files (eg file not found, etc.)

You can load a game or a hot lap. A hot lap is a full lap replay, which can be saved to disk. Hot lap replays are loaded from the load game menu and lead to a replay of the hot lap. Before the replay, a menu gives you options to cycle the replay, show the replay or return to the main menu.

CHOOSE A DRIVER/ TEAM

This option allows you to select a driver and team. You are also able to change team and driver names. Once you have made any changes you can save them and reload them at a later date.

CONTROL METHOD

From this menu you can select Keyboard, Mouse, Joystick, or one of three custom sets of controls. To enter a custom set of controls, you must select the Advanced Menu which will allow you to select advanced steering, accelerate/brake and gear controls. Once you have entered your control selections you can save them to reload at a later date.

OPTIONS

The Options screen allows you to select any of the following:

About Formula One Grand Prix 2

Printer Setup

Graphics Detail Level

Sound Setup

Track Records

Linkup Menu

Advanced Options

Return to Main Menu

Printer Setup

Select Printer Type, Printer Port, Send at end of line or Send from feed after print. You can also do a test print.

In Printer Options 'Send at end of Line' you can select CR+LF, which will move the carriage of the printer back to the left and feed one line of paper through. Alternatively you can select LF which will just feed one line of paper through the printer. 'Send form feed after print', if selected, instructs the printer to start a new page after the print job is completed.

Graphics Detail Level

A range of graphic detail levels are adjustable from this menu. You should be aware that the level of graphic detail and the amount of texture mapping will affect the speed of the game.

• Select which of the following features are texture mapped: kerbs, fences, verges, track, banks, hills, cars, sky and all. For each of these features you can choose which appear in the mirrors, and whether they are untextured or as the forward view.

• The frame rate can be set using the +/- buttons. Alternatively, you can choose to select the frame rate estimated by the computer.

Note: whenever you are within the 3-D, you can press the occupancy key 'O'. If this is on average less than 100%, you could increase your frame rate. If it is consistently a lot more than 100% you could try reducing detail level or the frame rate.

• Select the level of track-side detail you require from the following options: None, Low, Medium and All.

Sound Setup

Allows you to amend the following:

Music volume

Car Engine volume

Car Skid volume

FX volume

Ambient sound volume

Stereo/Mono

Track Records

Allows you to view track records. **Selecting Merge Track Records** allows you to load different saved records and merge them together creating a definitive set of track records.

Linkup Menu

Offers you the opportunity to play against other computer users either by a direct machine to machine link or via a modem.

You can select which communication port you use.

You can select baud rate and link type (direct/modem).

If direct link is selected then the one computer must be set to 'lead' and the other to 'follow'.

You can select your modem link to dial or wait for a call.

You can select dial type (Pulse/Tone).

For details of using this option see **Appendix E: Link And Modem Play**.

Advanced Options

Allows you to amend the following:

Distance displayed in miles/kilometres

Date Format

Mouse Speed

Disable joystick control in menus Yes/No

Use hard disk swap file Yes/No - The full lap replay and performance analysis functions in *Grand Prix 2* function best with a large amount of memory. With this option enabled, the program will use your hard disk as a temporary buffer for hotlap and performance data, if your machine does not have enough memory. If this option is disabled, the program will not use the hard disk and machines with insuffiecient memory may be restricted in the number of laps that can be stored at any one time, when the car is being driven.

Use bios for palette Yes/No - Select 'Yes' if you have problems with screen fades on your machine.

Menu delay time - Controls the speed at which a menu is popped up over a new picture.

Fade Speed - The speed at which menu pictures fade in and out.

Performance Analysis utilises data obtained from your car's on-board computer and allows you to create graphs showing every vital aspect of your car's performance. For example, using **Performance Analysis**, you could compare your braking technique on different laps. This would help you realise how you managed to perform better on one lap than another. A range of features allows you to plot graphs containing many types of data. Formula One teams depend on performance analysis to maximise the efficiency of their drivers and cars. If you are to become a Grand Prix champion then you cannot under-estimate the importance of this useful tool.

HOW TO ACCESS PERFORMANCE ANALYSIS

You can access **Performance Analysis** in two ways.

1. From the **Main Menu.**

- Select **Drive Menu.**
- Select **Drive Options.**
- Select **Review Performance Data.**
- Highlight the circuit from which you wish to analyse your performance.
- Select **View Performance Data.**

2. From within any non-race session.

- When you have completed at least one data logged lap enter the pits.
- Select **Car Set-Up.**
- Select **Fetch Logged Data.**
- Select **View Logged Data.** You will now be taken into the **Performance Analysis** screen.

HOW TO CREATE A PERFORMANCE ANALYSIS FILE

You need raw data in order to produce performance analysis graphs. This can be obtained from a previously stored hot lap or from logged data (from practise laps you have just completed).

1. Creating A **Performance Analysis** File From A Hot Lap.

- From the **Drive Options Menu** select **Review Performance Data.**
- Select the circuit from which you wish to take your hot lap.
- Select **Extract & Save Hot Lap Replay.** This will take you into the load screen.
- Highlight the hot lap file you wish to analyse.
- Select **OK.**
- **Performance Analysis** data will be saved to your hard drive. You can now enter **Performance Analysis** and graph the data from that file.

2. Creating a **Performance Analysis** file from logged data.

- From the pits select **Car Set-Up.**
- Select **Fetch Data.**
- Select **View Performance Data.**
- You will be taken into the **Performance Analysis** screen.

In the lap window you will notice details of the performance data. You can graph this data immediately, but if you wish to view it at any other time you must create a **Performance Analysis** File. Highlight the lap you wish to store as a **Performance Analysis** file. Select **Save Lap.** Enter the filename by which you wish to store the **Performance Analysis** file. Select **OK**.

HOW TO USE PERFORMANCE ANALYSIS

The **Performance Analysis** screen allows you to perform a number of functions: load lap data, save lap data, lap selection, graph selected laps.

Loading a Lap

- Select **Load or Add a Lap.**
- Highlight the **Performance Analysis** file you wish to load. **Performance Analysis** files are suffixed with a three letter code. The first two letters of this suffix are PA (**Performance Analysis).** The third letter represents the circuit from which the data is taken. If you wish to examine the data from a hot lap you must first create a **Performance Analysis** file as detailed above.
- After you have highlighted the required **Performance Analysis** file select **OK.** You will now be returned to the **Performance Analysis** screen, where the file will be displayed in the Lap Entries 'window'.

Saving Lap Data

- Highlight the lap you wish to save in the Lap Entries 'window'.
- Select **Save Lap.**
- Enter the name by which you wish to store the lap data in the filename box.
- Select **OK.**

Selecting A Lap To Graph

- Highlight the lap you wish to graph, in the Lap Entries 'window'.
- Highlight **Copy To Foreground.**
- If you wish to compare the data from two laps, highlight the lap you wish to use for your comparison and select **Copy To Background**.

Graph Selected Laps

- Select the lap/laps you wish to graph.
- Select **Graph Selected Laps.** You will be taken into the **Performance Display** screen.

Lap Entries 'Window'

You can determine the way in which **Performance Analysis** lap data is displayed, in the Lap Entries 'window', by highlighting any of the following:

Sort by Lap Number - arranges the lap data in order of lap number.

Sort by Time - arranges the lap data in order of time.

Sort by Lap Time - arranges the lap data in order of the fastest laps.

Note: Once the lap has a filename, then the filename is displayed instead of the time. This is useful as the filename may suggest the significance of the lap in terms of, for example, a set-up experiment.

Remove Foreground Lap

Selecting **Remove Lap** will remove the lap from the list.

Remove All Laps

Selecting **Remove All Laps** will remove all laps from the Lap Entries 'window'.

PERFORMANCE DISPLAY SCREEN

This is the screen in which you will produce graphs of your selected lap data. Using this information, you can judge how your car set-up affects particular aspects of your performance, and also judge on which areas of the course you could improve your performance.

For those wishing to improve their car's performance it is a good idea to change a particular aspect of the car set-up, drive a practice lap, save the lap data and then compare this data against a lap of the same circuit driven, prior to making any set-up changes.

The **Performance Display Screen** allows you to view your performance data in an extremely wide range of ways which should prove very useful, especially to the more advanced driver.

Graph

Using the pull down menu you can create graphs displaying any of the following: Speed & RPM, Gear & Throttle & Brake & Steer, All Ride Heights, All Suspension Travel, All Wheelspin and Custom.

Creating Custom Graphs

- Select **Custom** from the **Graph** pull down menu.

- Each of the above icons has a pull down menu from which you can select a data type to display on the graph. By selecting a data type from each icon you can display up to four data types at a time on the graph. You can select any of the following data types from each of the icons: None, Speed, Steer, RPM, Throttle, Brake, Gear, Lr Ride Ht (Left Rear Ride Height), Rr Ride Height (Right Rear Ride Height), Lf Ride Ht (Left Front Ride Height), Rf Ride Ht (Right Front Ride Height) Lr Travel (Left Rear Travel), Lf Travel (Left Front Travel), Rf Travel (Right Front Travel), Rr Travel (Right Rear Travel), Lr Wheelspin (Left Rear Wheelspin), Lf Wheelspin (Left Front Wheelspin), Rf Wheelspin (Right Front Wheelspin), Rr Wheelspin (Right Rear Wheelspin)

Inverse

Selecting **Inverse** turns the graph background colour from grey to black and vice-versa.

Zoom In/Out

You are able to zoom in and out of both the horizontal (x) and vertical (y) axes of the graph.

- To zoom in and out of the horizontal (x) axis select +/- on the x axis 'window'.

- When you zoom in on the horizontal (x) axis, the graph will become larger than the screen size. To view the plotted line, you will need to scroll along the graph using the scroll bar at the bottom of the graph. You will see that on the left hand side of the scroll bar are two - icons. The far left - icon scrolls the graph to the left. The other icon is used for fine adjustments, scrolling the graph partially to the left. On the right hand side of the scroll bar there are two + icons. The far right + icon scrolls the graph to the right. The other icon is used for fine adjusments, scrolling the graph partially to the right.

- To zoom in and out of the vertical (y) axis select +/- on the y axis 'window'.

- When you zoom in on the vertical (y) axis the plotted line may disappear from the screen. This is simply because the graph is now bigger than the screen. In such a case you will need to scroll the window up or down using the scroll bar to the right of the graph window.

Foreground Lap

Selecting **Foreground Lap** displays the plotted line for this lap onto the graph. This depends, of course, on your having selected a data type, or group of data types, to be displayed.

Background Lap

Selecting **Background Lap** displays the plotted line for this lap onto the graph. This depends, of course, on your having selected a data type, or group of data types, to be displayed.

Note: You can display both background and foreground laps on the graph at the same time.

Map

Selecting **Map** places a map 'window' of the circuit onto the graph 'window'. The highlighted section of the circuit indicates the area of the course to which the plotted line/lines, covered by the map 'window', relate. Using the map you can examine your performance at any stage of the circuit. For example, you could examine the speed at which you took certain bends, or how long it took you to reach maximum speed on the straights (this could lead you to adjust your gear ratio settings). Try zooming in 'x' and then dragging the red slider left and right. Notice how the highlighted portion of the track moves as you scroll the data.

USING THE SAVE AND LOAD CONTROLS

You are able to store a number of different *Grand Prix 2* file types. You can save and load **Championship Seasons, Individual Races, Hot Laps** and **Performance Analysis** files.

Using the save/load screen you can enter the name by which you wish your stored *Grand Prix 2* files to be known and select *Grand Prix 2* files that you wish to load. Each different file type has its own file suffix to enable you and the computer to recognise every file type. The first two letters of the suffix indentify the file type while the third letter represents a race circuit.

FILE SUFFIX CODES

File Type

Championship Season files **-** the first two letters of the file suffix are CH

Individual Race files - the first two letters of the file suffix are RA

Hot Lap files - the first two letters of the file suffix are HL

Performance Analysis files - the first two letters of the file suffix are PA

Race Circuit

Brazil - the final digit of the file suffix is A

Pacific - the final digit of the file suffix is B

San Marino - the final digit of the file suffix is C

Monaco - the final digit of the file suffix is D

Spain - the final digit of the file suffix is E

Canada - the final digit of the file suffix is F

France - the final digit of the file suffix is G

Great Britain - the final digit of the file suffix is H

Germany - the final digit of the file suffix is I

Hungary - the final digit of the file suffix is J

Belguim - the final digit of the file suffix is K

Italy - the final digit of the file suffix is L

Portugal - the final digit of the file suffix is M

Europe - the final digit of the file suffix is N

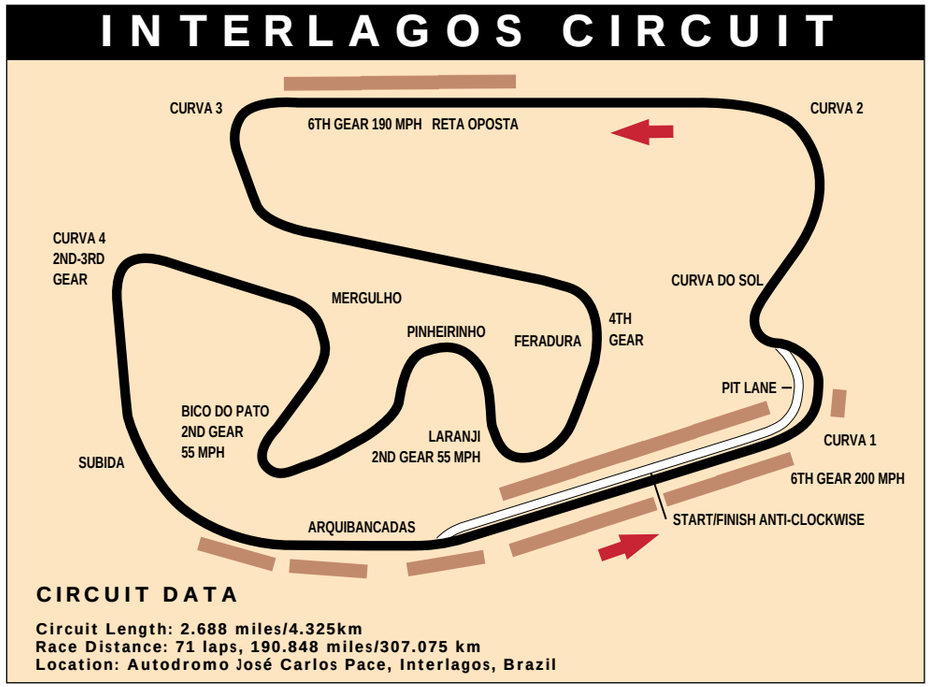
Japan - the final digit of the file suffix is O

Australia - the final digit of the file suffix is P

Mika Hakinnen discussing his grid position with Ron Dennis, General Director at McLaren. In the Pacific Grand Prix, Hakinnen started in fourth and drove a good race until he was forced to retire with engine trouble on the 17th lap. Car handling information is relayed via headsets to all relevant pit personnel by the driver.

GRANDE PREMIO DO BRAZIL. SAO PAULO

Autodromo Jose Carlos Pace, Interlagos,
Sao Paulo, Brazil



A circuit that demands a great deal from the transmission with numerous gear changes. The long left-hander can also make it exhausting for the drivers who have to fight the strain on their neck muscles. It's important to be quick on the two long 200 mph straights, so cars are set up with **very little downforce**.

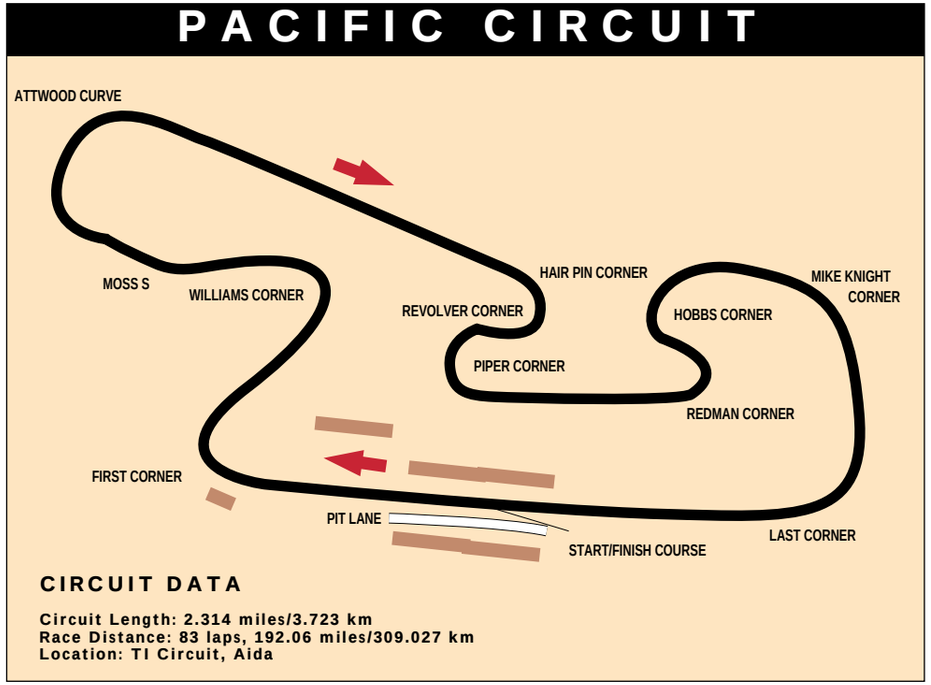
However, this makes the inner sections of the track more difficult to drive as the wheels lose grip and the car feels jumpy and erratic.

From the pits straight, go flat out in 6th gear at 200 mph. Then, sweep left and right for **Curva 1** and **Curva de Sol** to wind up for the long **Curva 2** left-hander to accelerate past **Reta Oposta** in 6th at 190 mph. This is followed by two slight left-handers after **Curva 3** and you can storm through the 4th gear **Feradura**. From here, you need to get into a good rhythm to take you through a series of slow winding bends: **Laranji** (2nd at 55 mph), **Pinheirinho**, **Bico do Pato** (2nd, 55 mph) and **Merghulo**. **Curva 4**, taken in 2nd or 3rd, is next, a bumpy, slow left-hander. This bend is important in that, taken properly, it can put you in a good position to approach the long left-hander that leads to the pit straight: **Arquibancadas**. This is a good place to line yourself up for an overtaking manoeuvre.

Length of Circuit:	*2.688 miles / 4.325 km*
Number of Laps:	*71*
Total Distance:	*190.848 miles/ 307.075 km*
Fastest Lap (Qualifying):	*1m.15.962 sec (Senna)*
Fastest Lap (Race):	*1m.18.455 sec (Schumacher)*

PACIFIC GRAND PRIX.
TI AIDA

TI Circuit Aida, Okayama, Japan



A clockwise track set deep in Japan's mountain region and more familiar to motorbike racers, 1994 was the first time Aida was used as a Grand Prix Circuit. In practice many of the drivers complained that the circuit was very slow and slippery making the car delicate to handle. In addition, the track was seen as too narrow with a lack of any straight lines making it almost impossible to overtake. Add Downforce to cope with the slippery nature of the track; you will lose straight line but it's important you maintain position in the slowest parts of the course.

From the grid accelerate to about 140 mph in 5th, then brake hard into the **First Corner** right hander taken at 40-45 mph in 3rd gear. You might have time to hit 90 mph as you approach **Williams Corner**, a 90 degree left-hander which you should take in 3rd at about 40 - 50 mph. Then it's up to the **Moss S** - a left-right 'S' bend that can be clipped at 80 mph. Before you have time to adjust, you'll be on **Attwood** a looping right-hander which you could line up for any overtaking action as you race flat out 6th into the **Hair Pin Corner** a very tight right-hander that you'd be wise to take slowly. Then comes the slowest part of the track a sequence of tight and frustrating bends that'll keep you in 3rd. 4th and 5th (for a very short period) - **Revolver Corner** a tight left-hander, then **Piper Corner**, another left-hander, into a short straight but brake hard for the slow **Redman Corner** (25 mph in 2nd). Next loop right into **Hobbs Corner,** accelerate out into the sweeping right-hander at 80 mph, but slow down and get into position for **Last Corner**. Come out of this well and you'll have a good chance to overtake flat out in 6th across the pits straight.

Length of Circuit:	*2.314 miles / 3.723 km*
Number of Laps:	*83*
Total Distance:	*192.060 miles/ 309.027 km*
Fastest Lap (Qualifying):	*1m.10.218 sec (Senna)*
Fastest Lap (Race):	*1m.14.023 sec (Schumacher)*

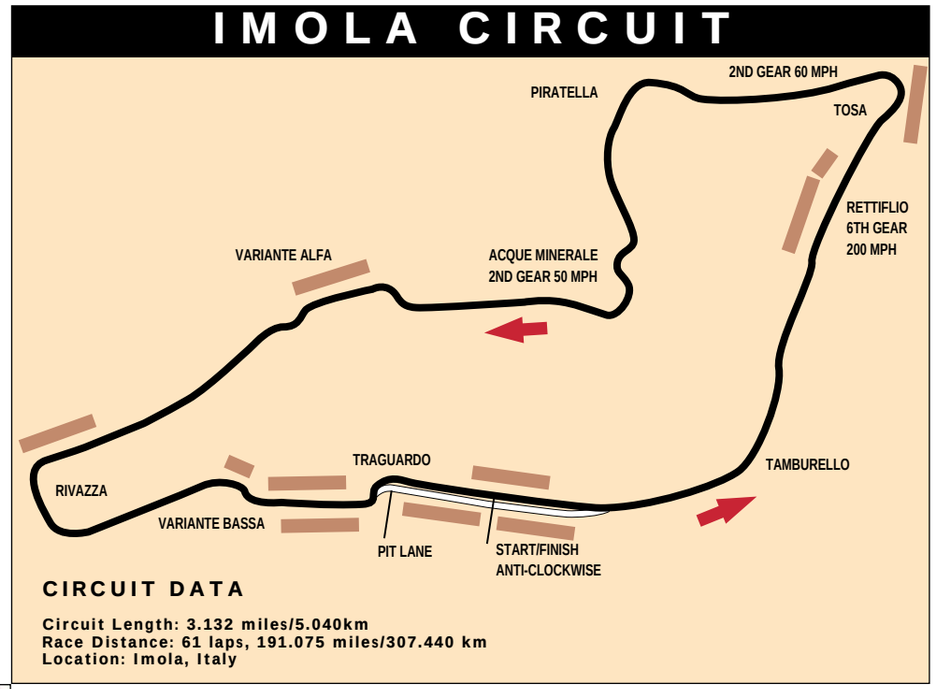
Gerhard Berger accelerates out of Tosa up the hill towards Piratella in the San Marino Grand Prix.

GRAN PREMIO DI SAN MARINO. IMOLA

Autodromo Enzo & Dino Ferrari, Imola, Italy

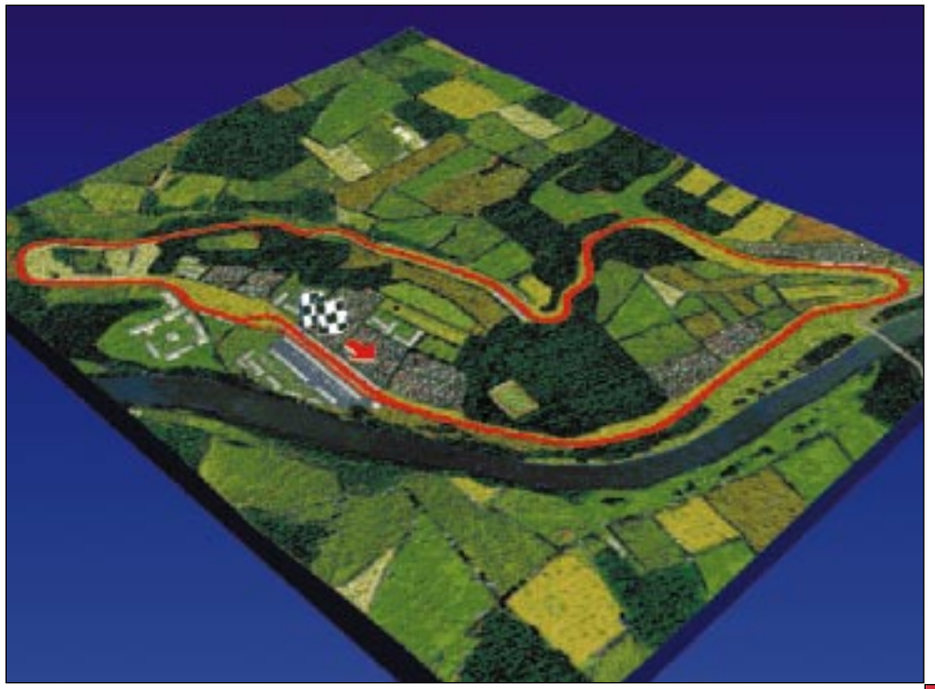
A bumpy, bruising anti-clockwise circuit where cars run **little wing** and are often struggling for grip or clipping the kerb.

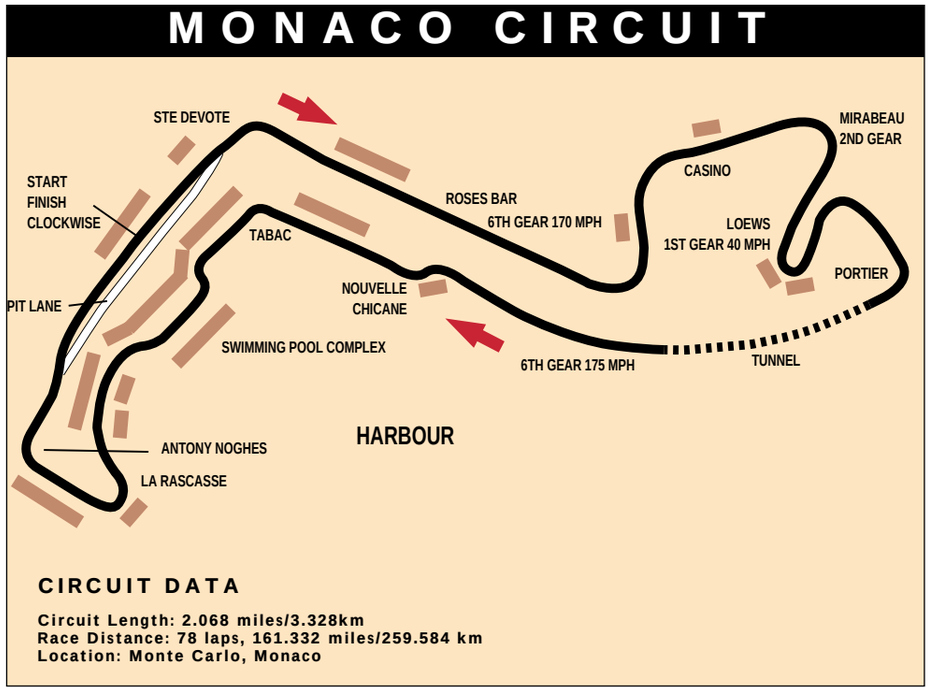
From the starting grid, you roar towards **Tamburello**, a long fast 6th gear left-hander, that pushes you into speeds in excess of 170 mph. Accelerating into **Rettifiolo**, the cars may hit 200 mph before they break hard for **Tosa**, an off-camber tight left-hander (2nd at 60 mph). Here, you may be presented with a chance of hitting the brakes late and overtaking - but it's not easy! Double-back up the hill to a fast left at **Piratella**, flat out in 4th, then change up into 5th just as you leave the bend. Next, down the hill into the long left-hander towards the **Acque Minerale** chicane. The approach is off-camber and blind; you have no view of the 'S' until you are in it - in 2nd at 50 mph. Here, there is a tendency to bounce from one side of the track to the other and you can easily spin-off on this corner.



Now, flat-out throught the small chicane at **Variante Alfa**, in and out in 3rd, and down towards two bumpy left-handers: **Rivazza** (requires hard braking from 6th to 2nd). Back in 5th gear, you approach **Variante Bassa,** a right hand switchback that leaves you blind to the position of the apex. Finally, you can weave through **Traguardo** - a left-right chicane that pushes you into the pit straight.

Length of Circuit:	*3.132 miles / 5.040 km*
Number of Laps:	*61*
Total Distance:	*191.075/ 307.44 km*
Fastest Lap (Qualifying):	*1m.21.548 sec (Senna)*
Fastest Lap (Race):	*1m.24.438 sec (Schumacher)*



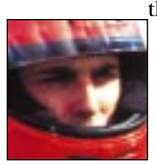


GRAND PRIX DE MONACO. MONTE-CARLO

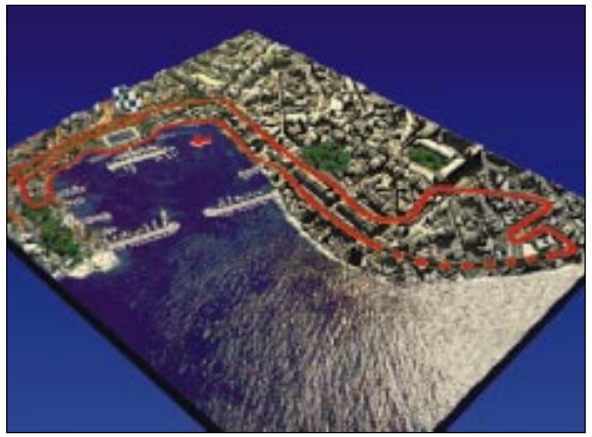
Circuit de Monaco, Monaco

The qualifying laps for this circuit are very important because it's very difficult to pass anybody here unless they make a driving error or crash. The cars must be set for **maximum downforce**.

After the mayhem of the first bend at **Sainte Devote**, where everyone tries to squeeze through, you pass **Rose's Bar** flat out in 6th at 170 mph - a great uphill straight, full of dips, bumps and manhole covers that make the car judder and thump. Then to **Casino**, hard through the left-hander (in 3rd) and quickly right downhill, off-camber, almost brushing the barrier as the road gets narrower, slippery and very bumpy. **Mirabeau** next, approached downhill in 5th, dropping to 2nd to take the simple but tight bend. Accelerate sharply then brake practically to a standstill for **Loews**. This is a 1st gear, 40 mph, hairpin that needs maximum lock. Often, there is a procession of cars here and if you're not in the first six, then you have to wait your turn. Accelerate gently through **Portier** (2nd) then flat out into the **Lowens Tunnel** (6th). Roar out in 6th at about 175 mph, stay well out to the right and line up for the **Nouvelle Chicane**.



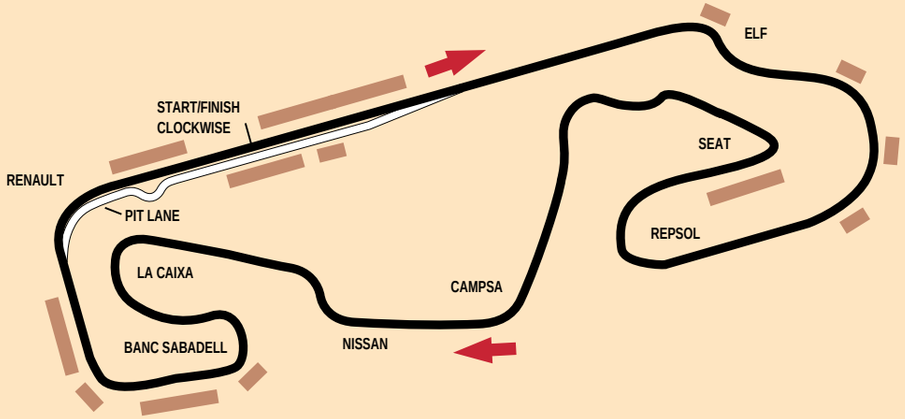
Take this fast in 2nd, (left-right zig-zag). This narrow section needs to be driven with the utmost precision - one touch of the kerb and you're out of the race. Out of the chicane, flat out in 5th, the road widens and you head for **Tabac** and the **Swimming Pool Complex** in 3rd. Accelerate briefly, brake hard and almost touch the barriers with the right wheels. **La Rascasse** next, then in 2nd for **Antony Noghes**, accelerate out of the bend (3rd) then roar through the gears and flat-out in 6th towards the finishing straight.



Length of Circuit:	*2.068 miles / 3.328 km*
Number of Laps:	*78*
Total Distance:	*161.332 miles/ 259.584 km*
Fastest Lap (Qualifying):	*1m.18.560 sec (Schumacher)*
Fastest Lap (Race):	*1m.21.078 sec (Schumacher)*

Sparks fly from Oliver Panis' Ligier, in the Monaco Grand Prix, as he roars out of the Lowens tunnel in sixth gear at a speed of 180 mph. The tunnel is now very well lit and does not affect the driver's vision as they hit daylight.

BARCELONA CIRCUIT



CIRCUIT DATA

Circuit Length: 2.950 miles/4.747km
Race Distance: 65 laps, 191.768 miles/308.555 km
Location: Barcelona, Spain

GRAN PREMIO DE ESPANA. BARCELONA

Circuito de Catalunya, Santano, Barcelona, Spain

A circuit that has a wide range of corners from slow, 2nd gear to fast 4th/5th gear, and which includes a very long 200 mph overtaking straight. In shape it is very similar to Estoril but the surface here is much smoother. Drivers will have to compromise between the downforce needed for the many bends and the speed required for the pit straight. Most will opt for **little downforce** and try to nurse their cars through the infield section.

From the start, accelerate through the gears, flat out in 6th heading for **Elf,** a slow left-hander. If you are not in the lead, this gives you a good opportunity to overtake under braking. Then, it's a slight left before a long sweeping 4th gear right-hander that you leave in 5th and speed up for the short straight to **Repsol**; a corner which turns back on itself but whose angle progressively widens. Next, a short burst of speed into **Seat**, brake, drop to 2nd at 45mph, accelerate, then slight left, slight right before taking **Wurth** in fourth and roaring off to **Campsa**, a fast, 3rd/4th gear right-hander.

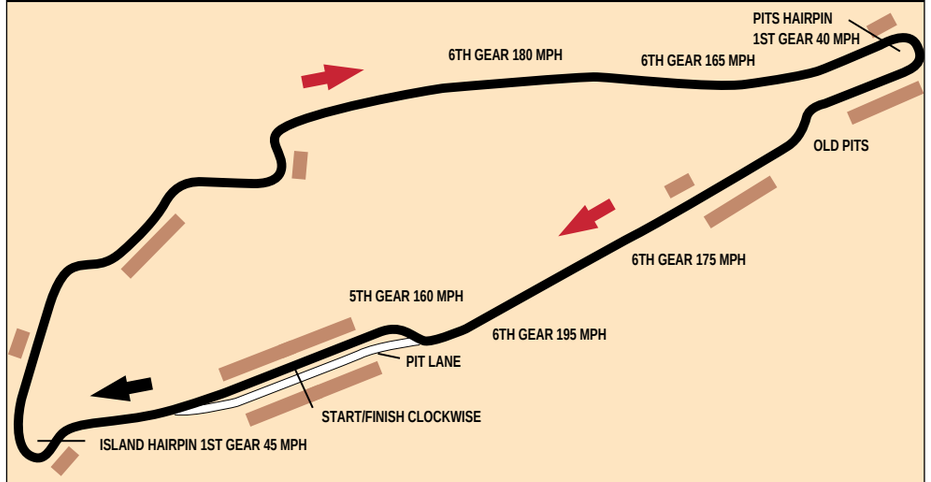
After that, it's right and left through **Nissan** and flat out, up to **La Caixa**. This is another corner that starts tight and opens out. Steer in, get on line early and as the corner widens, move to the outside of the track. There is no time to put your foot down before you reach the **Banc Sabadell**, a long constant radius bend.

Next, comes the approach to the straight. Sweep right, foot down, then right again. Take **Renault** in 3rd, change to 4th and charge out in 5th before hitting 6th, flat out, past the finishing line.

Length of Circuit:	*2.950miles/ 4.747km*
Number of Laps:	*65*
Total Distance:	*191.768miles/ 308.555km*
Lap Record (Qualifying):	*1m.21.908sec (Schumacher)*
Lap Record (Race):	*1m.25.155sec (Hill)*

Jean Alesi in the Ferrari negotiates the 'Beirut' chicane at the Spanish Grand Prix. This temporary tyre chicane was installed, after the disasters of the previous races, to slow down the cars as they approached Nissan and La Caixa.

MONTREAL CIRCUIT



CIRCUIT DATA

Circuit Length: 2.753 miles/4.430km
Race Distance: 69 laps, 189.975 miles/305.670 km
Location: Circuit Gilles Villeneuve, Montreal, Canada

GRAND PRIX DU CANADA. MONTREAL

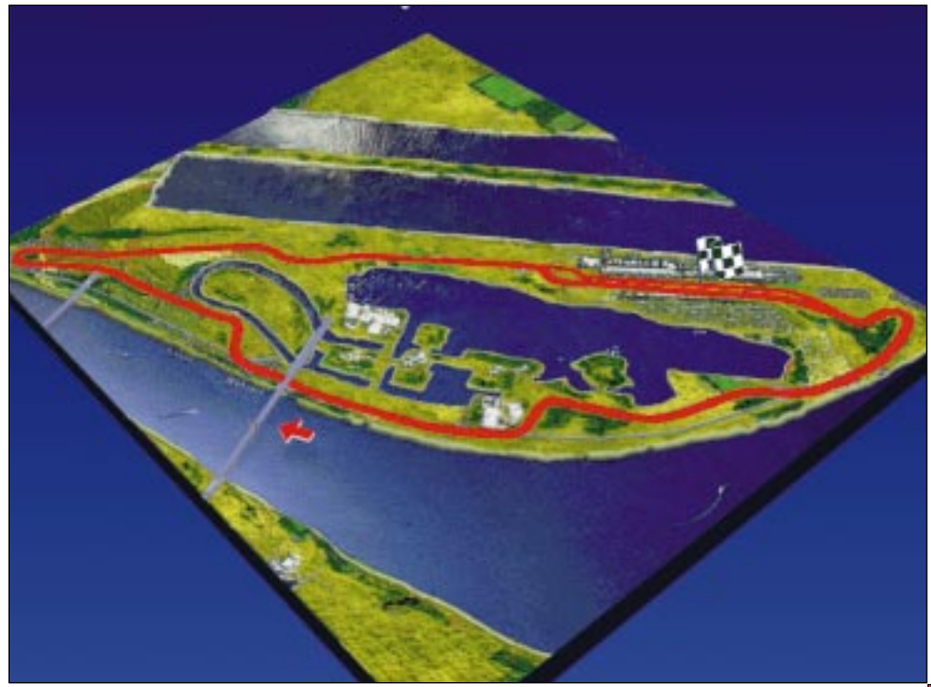
Circuit Gilles Villeneuve, Montreal, Quebec, Canada

A fast circuit that needs a succession of hard-braking and accelerating. Drivers tend to **reduce downforce** to get straight speed to maximum, but this makes the slower sections much more difficult and emphasises the uneven surface of the circuit.

From the start, proceed into the slow left/right **Island Hairpin** (1st or 2nd gear), taken at 45 mph. Out of this, with a lot of wheelspin there is just enough time to get into 5th at 160 mph before the long, extended 'S' bend. Then it's flat out in 6th - 180 mph along the back straight, slowing down to 160 mph before slamming on the brakes for the 1st - 2nd gear **Pits Hairpin** at 40 mph. It's very important to get a good fast exit out of this bend, then right-left, through what is thought to be the most dangerous part of the circuit with high concrete walls on either side of the track. Past **Old Pits** and into 6th, then accelerate through the straight at 175-195 mph. This is the fastest part of the circuit and leads to one of the least favourite corners - down to 5th, 160 mph, a quick left-right. It's easy to clip the kerb and spin-off here, either on entry or on the apex. But if you come out of it well, you are set up for a charge down the finishing straight.

Length of Circuit:	*2.753miles/ 4.430km*
Number of Laps:	*69*
Total Distance:	*189.975 miles/ 305.670km*
Lap Record (Qualifying):	*1m.26.178sec (Schumacher)*
Lap Record (Race):	*1m.28.927sec (Schumacher)*

After Damon Hill made, in his own words, "My second best start of the season", at the French Grand Prix, Michel Schumacher caused a sensation by overtaking him before the first corner. Here we see the drivers approaching the first bend with the Benneton leading the pack.

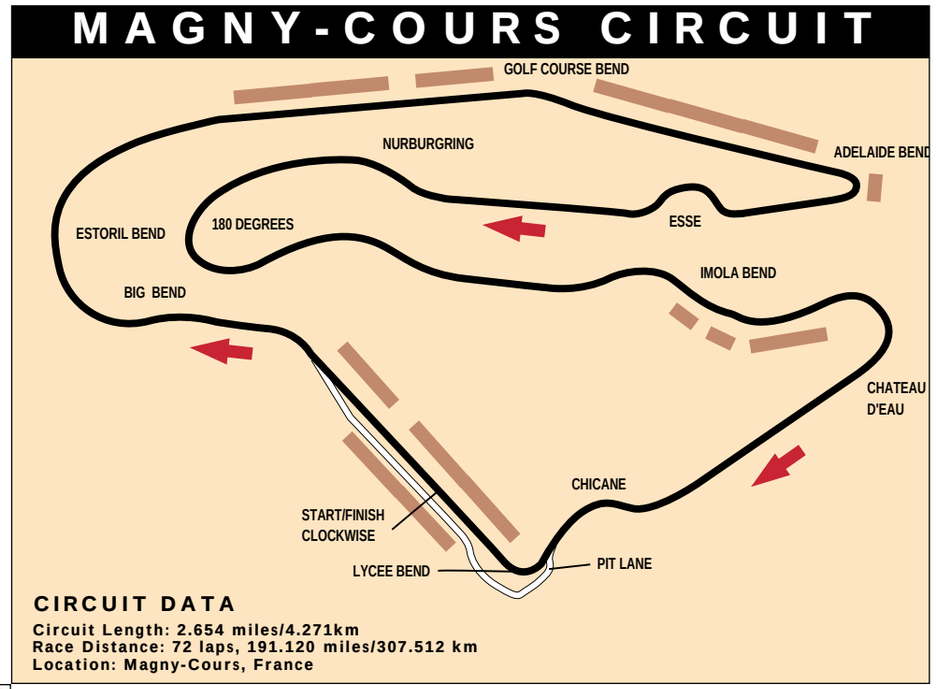


GRAND PRIX DE FRANCE. MAGNY-COURS

Circuit de Nevers, Magny-Cours, France

Smooth and challenging, doubling back on itself, with fast 4th-5th gear corners and first gear hairpins as well as a long top-speed straight, Magny-Cours has been built to appeal to Formula One spectators and TV crews alike. The circuit has several constant radius corners but the cars are set up to carry **less downforce**. The five fast straights mean that acceleration and top-speed are more important than the fraction of a second to be gained at corners when carrying more downforce.

After the pits straight, you roar into a fast left-hander which changes into a slow left-hander at **Big Bend** then turns into a long sweeping right-hander: **Estoril Bend**. Taken in 4th or 5th, this propels you into the long back straight, past the **Golf Course Bend**, in top at 190mph. After the fastest point, brake hard for the first gear hairpin at **Adelaide Bend** and turn into the infield part of the course. Swing into the 2nd or 3rd gear **Esse** then a short straight before **Nurburgring**, a slight right, then a sweeping left which turns into a double-apex 180 degree bend that throws you into another short straight almost parallel with the previous one.



Next, a 5th gear left-hander, **Imola**, which leads into the fast 4th gear bend at **Chateau d'Eau**, then another short straight, under the bridge and into the **Chicane** before you take a good line sharp right into the **Lycee Bend**, then flat out across the finishing line.

Length of Circuit:	*2.654miles/ 4.271km*
Number of Laps:	*72*
Total Distance:	*191.120miles/ 307.51km*
Lap Record (Qualifying):	*1m.16.282sec (Hill)*
Lap Record (Race):	*1m.19.678sec (Hill)*

BRITISH GRAND PRIX. SILVERSTONE

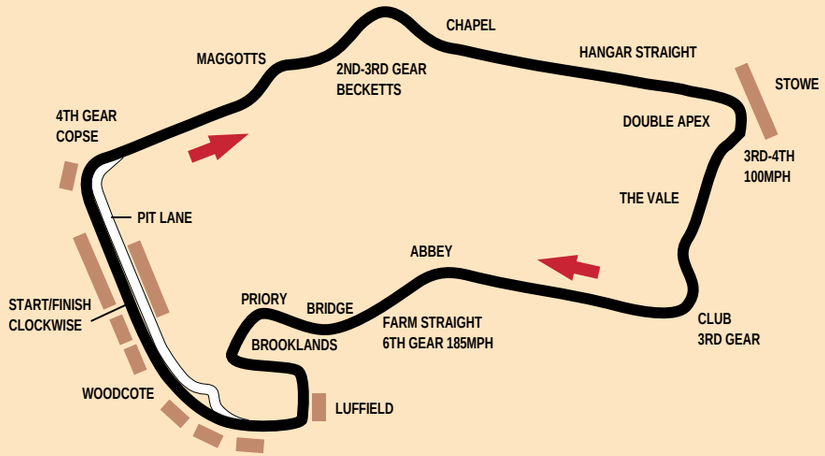
Silverstone Circuit, Silverstone, Towcester, Northamptonshire, UK

The circuit had been altered for the 1994 Championship because it was considered too dangerous. A bend such as **Club Corner** taken in sixth at 185mph with no run off track was particularly hazardous.

Copse is a 4th gear corner that pushes you into a fast straight leading to **Maggotts**, where you swing into the S shaped **Becketts** in 2nd or 3rd. This slows the cars down and provides a better spectacle for the crowd.

Then the cars roar away from **Chapel** along the **Hangar Straight**, under the bridge, towards the double apex right-hander **Stowe**; taken in 3rd or 4th at 100mph. After the **Vale** complex you have to take **Club**, a 3rd gear left-hander that throws you into the **Abbey** straight, a favourite overtaking stretch. In 6th, at 185 mph, sweep into the **Farm Straight** and a fast right under **Bridge** towards **Priory** and **Brooklands**. Two 2nd or 3rd gear left-handers followed by two right-handers ending at **Luffield**, then it's flat out along the fast **Woodcote** and through the finishing straight.

SILVERSTONE CIRCUIT



CIRCUIT DATA

Circuit Length: 3.202 miles/5.153km
Race Distance: 60 laps, 192.000 miles/309.180km
Location: Northamptonshire, Great Britain

1994 SAFETY CHANGES

Copse, Priory, Woodcote were made tighter to slow down cars. **Stowe** became a 90 degree turn. A left-right chicane was added to **Abbey** to slow the drivers approaching **Bridge** and the pit entrance was moved away from the track wall.

Length of Circuit:	*3.202miles/ 5.153km*
Number of Laps:	*60*
Total Distance:	*192miles/ 309.180km*
Lap Record (Qualifying):	*1m.24.960sec (Hill)*
Lap Record (Race):	*1m.27.100sec (Hill)*

Pit crew swarm over Jean Alesi's Ferrari as they negotiate tyre change and refuelling at the British Grand Prix, Silverstone. Alesi finished in third but the day saw Damon Hill extend William's sequence of victories at the British Grand Prix to four in a row.

The competitors line up on the grid at Hockenheim in the German Grand Prix, giving the world's photographers their last chance to take pre-race pictures.

GROSSER PREIS VON DEUTSCHLAND. HOCKENHEIM

Hockenheimring, Hockenheim, Heidelberg, Germany

There are three chicanes on the circuit, one fast and two that have to be taken slowly. The rest of the course is a series of straights. This means that to have good top speed almost all downforce is taken off, and the cars are a horror to drive with no grip, and twitchy on any bend.

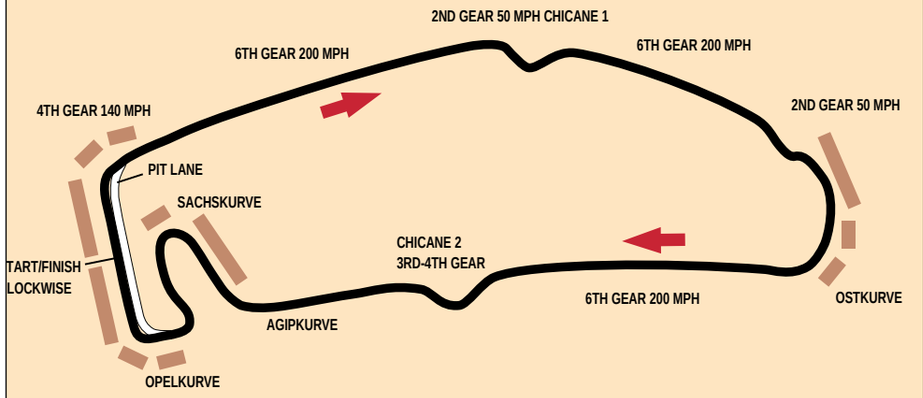
From the start you take a 4th gear right-hander at 140mph, then put your foot down 'till you hit 6th at 200mph for the fastest part of the course. Brake hard for **Chicane 1** which hooks sharp right and can be taken in second at 50 mph, but if you drive a bad line you may be forced to drop to bottom gear. Up through the gears again, flat out, 200 mph for the sweeping right-hander then brake again for another chicane which you take in 2nd at 50mph. Come out of that and roar into **Ostkurve**, one of the fastest bends of any championship course; take it in 6th, 200mph. Slow down for **Chicane 2**, drop to 4th or 3rd, then flat out for the rest of the straight until **Agipkurve**. This is the most difficult part of the circuit and tends to wear out tyres prematurely.

Approaching **Sachskurve**, slip to 4th, line the car into the right-hander, foot down, sweep round, then 2nd gear to take the hairpin, speed up, line up the car for the tight right-hander, brake lightly and roar out of **Opelkurve** in third towards the finishing straight.

Hockenheimring is a good overtaking circuit but the slow chicanes require brutal braking, and brakes tend to cool off on the long straights making them less efficient. Most drivers find it difficult to establish a satisfactory rhythm on this course.

Length of Circuit:	*4.227miles/ 6.802km*
Number of Laps:	*45*
Total Distance:	*190.236miles/ 306.90km*
Lap Record (Qualifying):	*1m.43.582sec (Berger)*
Lap Record (Race):	*1m.46.211sec (Coulthard)*

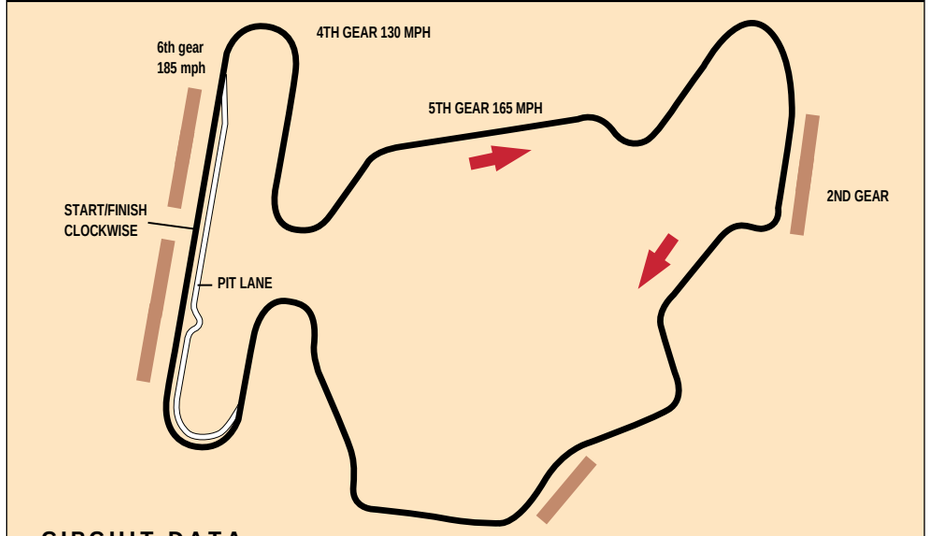
HOCKENHEIM CIRCUIT



CIRCUIT DATA

Circuit Length: 4.227 miles/6.802km
Race Distance: 45 laps, 190.236 miles/306.090 km
Location: Heidelberg, Germany

HUNGARORING CIRCUIT



CIRCUIT DATA

Circuit Length: 2.466 miles/3.968km
Race Distance: 77 laps, 189.851 miles/305.536 km
Location: Hungaroring, Budapest, Hungary

MAGYAR NAGYDIJ - HUNGARIAN GRAND PRIX. BUDAPEST

Hungaroring, Budapest, Hungary

A tough but relatively slow circuit with a large number of corners and few straights. It's difficult to overtake on this course and you have to be quite patient, waiting for the right moment. Cars are usually set up for **more downforce** to gain the advantage of good grip on the numerous bends.

Roaring away from the start, downhill, flat out in 6th at 185mph, the pit straight is the main overtaking point on the course. Then through the first of several constant radius corners at 130mph in 4th, a short back straight, then a double-apex left-hander leading to a long sweeping right. Accelerate to 165mph in 5th, sweep left then go into another double-apex bend. Slow down for the 2nd gear chicane, then drive hard into a whole series of fast corners before the constant radius **Pit Lane** bend throws you out into the long finishing straight.

The twisting up and down nature of the track means that average speeds are quite low, about 105-110mph, and tyres wear out quickly as the drivers lose patience and try to exit corners faster than the tyres will allow. Most teams find that drivers come in for a tyre change much earlier than planned, if only to get away from the queues that develop on this circuit.

Length of Circuit:	*2.466miles/ 3.968km*
Number of Laps:	*77*
Total Distance:	*189.851miles/ 305.536km*
Lap Time (Qualifying):	*1m.18.258sec (Schumacher)*
Lap Time (Race):	*1m.20.881sec (Schumacher)*

Katayama, Barrichello and Irvine collide on the second corner of the first lap at the Hungarian Grand Prix. The accident meant that Eddie Irvine had not completed the first lap in his last four Grand Prix!

GRAND PRIX DE BELGIQUE. SPA-FRANCORCHAMPS

Circuit de Spa-Francorchamps, Stavelot, Belgium

Fast, challenging and exhilarating, Spa is a favourite circuit among Grand Prix drivers. It successfully combines fast 6th and 5th gear corners with good 1st gear hairpins and 2nd gear chicanes. Generally cars are set up with **little downforce**.

From the start line, there is a short space of time before the cars reach the 1st gear, 45mph **La Source** hairpin, the scene of many opening-lap shunts, as 26 cars brake from 160mph to 45mph while trying desperately to overtake each other. Then, it's a race up through the gears, downhill in 6th at 180mph, you drop into the **Eau Rouge** dip, a slight left, then sweep right uphill past **Raidillon**. This is one driving line you cannot afford to get wrong - one error and you're off the circuit!

Speed up through **Kemmel** and into the long straight, flat out at 195mph, weave through **Les Combes** and then take **Malmedy** in second. This is a tricky 180 degree corner, downhill and off-camber. **Pouhon** is next; an extremely difficult left-hander that starts off in 6th, then drops to 5th at 150mph.

Through **Les Fagnes** and **Stavelot** you take a series of fast corners that lead you to the long sweeping right and left towards **Blanchimont,** then brake hard for the **Bus Stop Chicane**. For most drivers the **Bus Stop** is the least favourite corner. To be quick you have to run over the shallow kerbs, which is always a risk.

Length of Circuit:	*4.313miles/ 6.940km*
Number of Laps:	*44*
Total Distance:	*189.747miles/ 305.360km*
Lap Time (Qualifying):	*2m.21.163sec (Barrichello)*
Lap Time (Race):	*1m.57.117sec (Hill)*

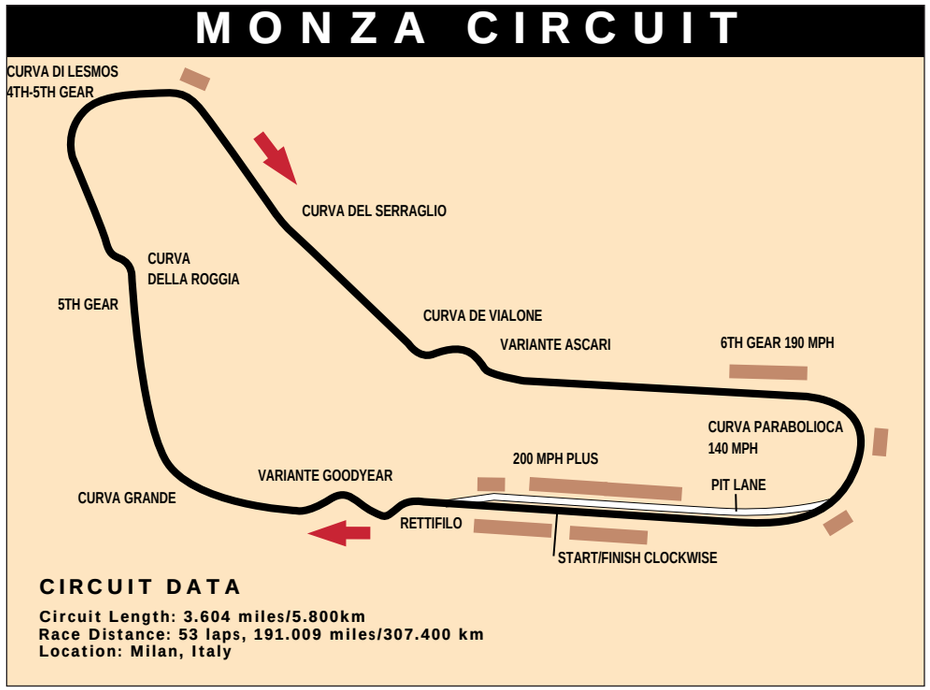
The weather is always a big factor at Spa-Francorchamps and it is invariably wet which results in small, hazardous streams crossing the circuit, making drivers adjust their driving line.

SPA-FRANCORCHAMPS CIRCUIT

CIRCUIT DATA

Circuit Length: 4.313 miles/6.940km
Race Distance: 44 laps, 189.747 miles/305.360 km
Location: Spa-Francorchamps, Belgium

Rubens Barrichello, in the Jordan, leads at the start of the Belgian Grand Prix. The race was to end in controversy when Schumacher's winning car was judged illegal. The Benetton's skidblock, introduced earlier in the season to reduce downforce, was 1.6mm thinner than the legal after-race thickness



GRAN PREMIO D'ITALIA. MONZA

Autodromo Nazionale di Monza, Milan, Italy

Monza is always full of screaming, hysterical crowds being marshalled by even more hysterical officials. The drivers absorb the atmosphere and are spurred on to perform to their utmost, especially if they are driving an Italian car.

The cars run **little wing** to take advantage of the very fast start/finish straight, **Rettifilo**, which is crossed at speeds in excess of 200mph. The track has been modified to make it safer, including the introduction of the 2nd gear **Variante Goodyear**, a chicane that leads into the famous 5th gear **Curva Grande**.

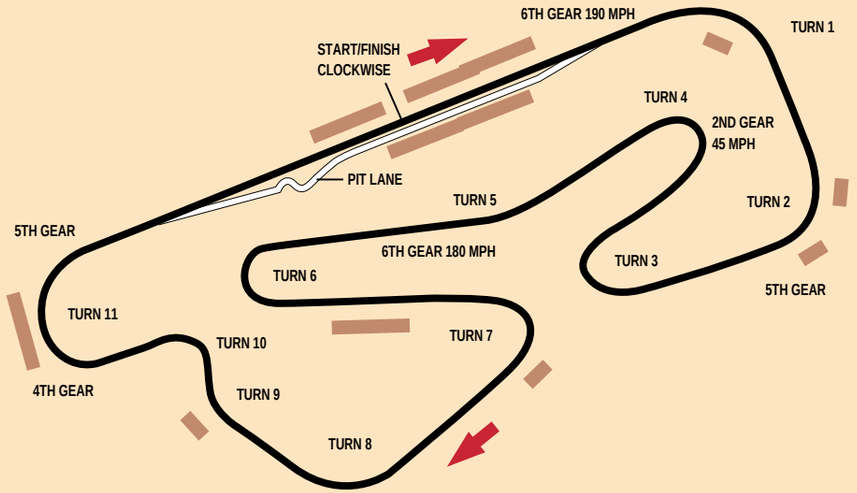
Flat out towards **Lesmos** in fifth there is another 2nd gear chicane: **Curva della Roggia**, before the double right-hander **Curva di Lesmos** corner. You take the first part in 4th gear, then power up to take the second part flat-out. These corners have to be taken just right; any slight error will slow you down considerably and put you in a bad position for the 180mph back straight, **Curva del Serraglio**.

Then it's a tricky 3rd gear chicane **Variante Ascari**. Come out of this in 5th and charge down **Rettifilo Centro** at 190mph in top and brake hard for the famous **Curva Parabolica**, a fast, 180 degree right-hander that's taken in 4th at 140mph. Accelerate to 160mph out of the bend, then storm through the finishing line with your foot down in 6th.

Length of Circuit:	*3.604miles/ 5.80km*
Number of Laps:	*53*
Total Distance:	*191.009miles/ 307.400km*
Lap Time (Qualifying):	*1m.23.844sec (Alesi)*
Lap Time (Race):	*1m.25.930sec (Hill)*

Competitors jostle for position at the start of the Portuguese Grand Prix. Gerhard Berger leads from pole position in his Ferrari. His commanding lead was lost when his gearbox pump broke after 7 laps.

ESTORIL CIRCUIT



CIRCUIT DATA

Circuit Length: 2.703 miles/4.350km
Race Distance: 71 laps, 191.951 miles/308.850 km
Location: Autodromo do Estoril, Portugal

GRANDE PREMIO DE PORTUGAL. ESTORIL

Autodromo do Estoril, Estoril, Portugal

Estoril is a tough, tiring circuit with several long, constant radius corners and some very bumpy straights. If the car is starting from near the front of the grid then it's wise to run **a lot of downforce** to cope with the long bends, but if you are starting low down in the order then you must use **less downforce**, otherwise you'll find it very difficult to overtake.

The start/finish line is in the middle of the circuit's longest straight. Cars accelerate to 190mph in 6th before **Turn 1**, trying to overtake each other, before braking into the 4th gear corner. **Turn 2** is another sweeping right-hander, then it's up to 5th for the short straight. Brake hard for **Turn 3,** the **Martini Bridge Bend**, a tight double-apex right-hander. It's important to drive a good line through the infield at Estoril, avoiding the kerbs and the sandy, greasy edges.

Turn 4 is almost a mirror image of the previous corner. Take the left-hander in 2nd at 45mph, then race up through the gears, swing through the slight right-hander, **Turn 5**, then flat out in 6th at 180mph. This is probably the best place to overtake on the whole circuit.

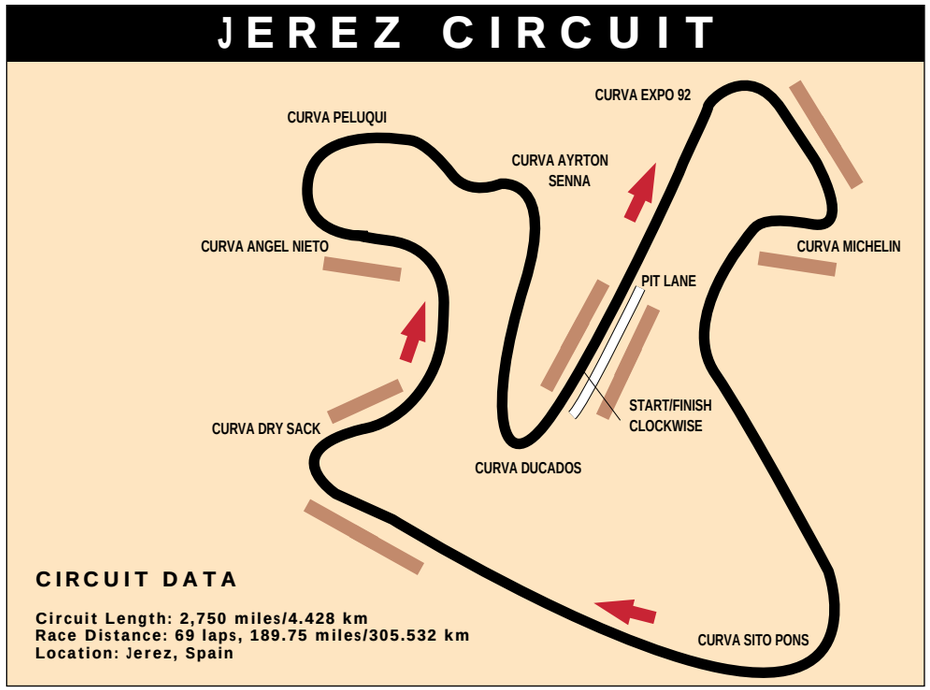
Through **Turn 6**, a corner that begins tight then opens out, foot down for a short straight and into the long series of fast bends, **Turns 7-8-9-10**.

It's important to maintain a good rhythm through these bends. Keep concentrating - change up, change down, brake hard.

The final corner before the pit straight, **Turn 11**, is a real challenge for any Formula One driver. It's a long, constant radius sweeping bend that you enter in 4th and leave in 5th, accelerating all the way, ready to get in position to overtake.

Estoril is a circuit that's not only hard on gears and brakes but also tough on tyres; the long sweeping bends often mean that many drivers return to the pits earlier than planned as the heat and rough surface take their toll.

Length of Circuit:	*2.703miles/ 4.350km*
Number of Laps:	*71*
Total Distance:	*191.951miles/ 308.850km*
Lap Time (Qualifying):	*1m.20.608sec (Berger)*
Lap Time (Race):	*1m.22.446sec (Coulthard)*



GRAND PRIX OF EUROPE - JEREZ

Circuito de Jerez,

Jerez de la Frontera, Spain

A good grid position is very important on this tight, narrow circuit that encompasses lots of twists and turns. Beware, you will find it extremely difficult to overtake, particularly if the driver in front decides to shut the door on you. If you're at the front of the grid run **more downforce** - you'll need it to keep up with the twists and turns. If you've got a bad grid position you've got no option but to take off downforce - or you'll never keep up or overtake.

From the pits straight, go flat out in 6th at 180 mph then brake hard into the **Expo 92** bend: a 3rd gear right-hander. Change up briefly before negotiating **Michelin** - a tight right-hander taken at 60 mph in 2nd.

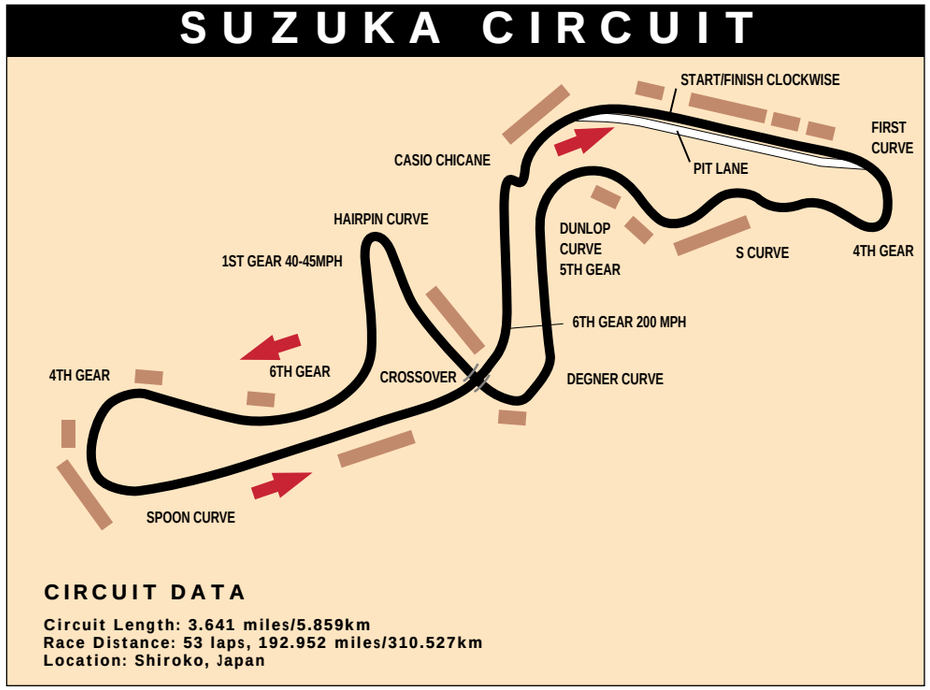
Sweep out of **Michelin**, changing up to 5th to take **Turn Three** - a left-hand 150 mph curve that will exert strong G force. Now, down to **Sito Pons** a fast right hander that allows you to accelerate from 130 to 150 mph to hit the long, overtaking straight and go flat out. The speed of the straight means that you will approach **Dry Sack**, a tight right hander, at 185 mph braking down to 60 mph (2nd or 3rd). Speeding up, you'll next head for **Turn Six** a 120 mph left hander tackled in 4th. **Turn Seven** is a continuation of the loop, another left hander that you should hit at 130 mph and leave at about 85 mph, changing down from 5th to 3rd. Now get ready for two tight right hand bends **Angel Nieto** and **Peluqui** approached at about 85 mph. Accelerate through a short straight to the **Ayrton Senna Chicane** - a right-left combination taken only in 2nd gear - perhaps the slowest part of the circuit. Then race through the gears to 6th at 180 mph, before slowing down for **Ducados** in 2nd - a tight left-hander that leads back to the start line straight.

Length of Circuit:	*2.751miles/ 4.428km*
Number of Laps:	*69*
Total Distance:	*189.75miles/ 305.532km*
Lap Time (Qualifying):	*1m.22.762sec (Schumacher)*
Lap Time (Race):	*1m.25.040sec (Schumacher)*

Grand Prix wouldn't be complete without a touch of glamour. Grid Girls parade national flags along the pit straight at the pre-race build up of the European Grand Prix in Jerez, Spain.

FUJI TV JAPANESE GRAND PRIX. SUZUKA

Suzuka Circuit, Mie-ken, Japan



An interesting, undulating course and the only figure of eight in the Grand Prix. Tough, 6th gear corners combine with first gear hairpins to make tyre stops essential. **Little downforce** is set because of the three long straights, and the cars generally feel sluggish in the corners.

The pits straight is a 6th gear, 190 mph charge where it is perfectly possible to overtake, then it's down to 5th for the **First Curve**. You drift the car to the left side of the track, down to fourth and race out of the corner.

Next, you come to a series of 4th gear bends (**The S Curve**). Driving as tight a line as possible through these, you leave **Dunlop Curve** with your foot down in 5th, going uphill and blind for the oncoming left-hander. The car feels light as you roar

over the bumpy crest and come down hard for the two right handers **Degner Curve** and **Crossover**. You now pass under the circuit and approach at a slow 40mph for the first gear **Hairpin Curve**. This corner can play havoc with your rear tyres if you try to exit too quickly and overspin the back wheels. Now line up the car for the long double apex left hander. Enter in 4th but slow down for the second part of **Spoon Curve** for it's quite easy to spin off here.

Next, you get to one of the fastest straights, 6th gear, 180mph, sweeping left with both hands on the wheel. Ease your car carefully through the slow **Casio Chicane** then storm through, flat out past the finishing straight.

Length of Circuit:	*3.641miles/ 5.859km*
Number of Laps:	*53*
Total Distance:	*192.952miles/ 310.527km*
Lap Time (Qualifying):	*1m.37.209sec (Schumacher)*
Lap Time (Race):	*1m.56.597sec (Hill)*

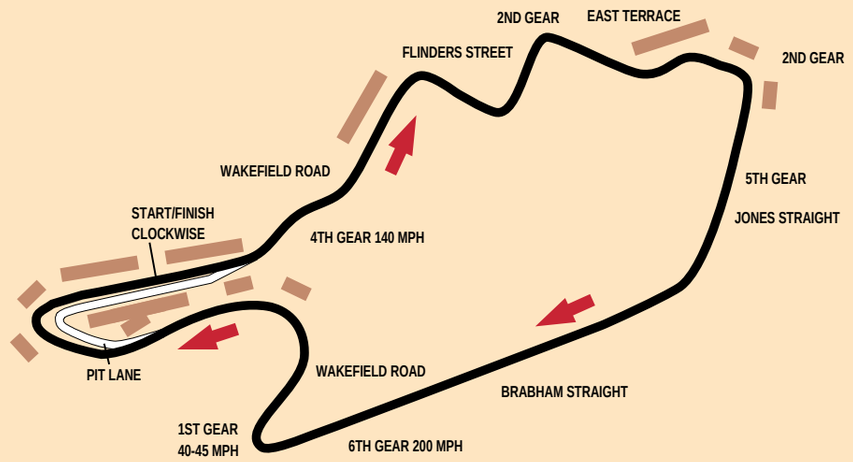
AUSTRALIAN GRAND PRIX. ADELAIDE

Adelaide Grand Prix Circuit, Norwood, South Australia

A hard, unforgiving street circuit that requires numerous gear changes and is very tough on brakes and tyres. The last Grand Prix venue of the Championship season and always very exciting as teams try to finish the year off with a win. Adelaide has been responsible for deciding the outcome of several championships, the most famous being Nigel Mansell's blowout in 1986. Again, there is a need to **compromise with downforce**; you'll need a lot for the 90 degree bends but you will also need the speed for the Jones and Brabham straights.

After the start, you come to a fast, 4th gear chicane at **Wakefield Road**, take this at about 140mph then flat out towards the **Flinders Street Complex**. The road is very bumpy here and the occasional manhole cover will knock the breath out of you. Brake hard for a difficult 2nd gear, 90 degree right-hander, then left 90 degrees, and right 90 degrees. Through **East Terrace** and a fast off-camber left hander, drop down to 2nd and steer a good line to hit **Jones Straight** in 5th. Foot down, then a slight right and into **Brabham Straight,** under the two bridges flat out, 200mph in sixth.

ADELAIDE CIRCUIT



CIRCUIT DATA

Circuit Length: 2.349 miles/3.780km
Race Distance: 81 laps, 190.292 miles/306.180 km
Location: Adelaide, Australia

Next, you step hard on the brakes to take a tricky, 1st gear, 40mph hairpin and speed up, into 3rd for a deceptive tightening corner. Stay wide as long as possible, hit the apex late, brake, change down, take a line on the outside and follow the curve of the bend to give you the smoothest possible exit angle. Past **Pits** and right through **Racecourse**. Brake hard, change down into 2nd for a good fast exit into the finishing straight.

Length of Circuit:	*2.349miles/ 3.780km*
Number of Laps:	*81*
Total Distance:	*190.292miles/ 306.180km*
Lap Time (Qualifying):	*1m.16.179sec (Mansell)*
Best Lap Time (Race):	*1m.17.140sec (Schumacher)*

The data logger records car performance information which can be graphed and analysed, in the **Performance Analysis Menu**. This information can be useful when adjusting car set-ups. The information can also be used to compare performance over different laps. This can help you improve your driving technique. You can also compare your performance with the performance of a friend.

Data recordings start when the car exits the pit-lane. A lap of logged data is registered when the car either crosses the start/finish line or re-enters the pit-lane. All registered laps are available after they have been fetched from the data logger. You are also able to convert saved hot laps into data logged data (i.e. performance analysis files).

The data logger records the following information:

Speed
Steering demand
RPM
Throttle
Brake
Gear
Ride height (for each wheel)
Suspension travel (for each wheel)
Wheelspin (for each wheel)

Speed

The speed trace enables you to analyse your speed at any point in the lap.

It can be particularly useful when comparing laps, especially where one has a split time better than the other. Used in combination with steer, brake, throttle, RPM and gear, you can discover which driving techniques produce the best results.

If you are adjusting the car set-up, the speed trace can show on which section of the circuit, the car is fastest. It can also show where the fastest corners are. All of this information should assist you in improving the car set-up and performance.

Steering demand

The steering demand indicates the point at which you turned into a corner.

Upwards deviations indicate turns to the left while downward deviations indicate turns to the right.

RPM

The RPM shows how you made use of the engine in relation to the gears..

You can also see when rev limiting occurs, i.e. when the revs are at their highest and the speed curve becomes flat instead of climbing.

Throttle

The throttle can be of interest when comparing laps to see which level of throttle through a corner produces the best result.

The throttle value can be useful particularly when assessing the wheelspin.

Wheelspin can occur when the car is travelling at low speeds, or is in a low gear and there is a large throttle demand. If the inside rear wheel goes “light”, when travelling around a corner, then traction may be lost and you may wonder whether too much throttle was applied as opposed to there being a need to soften the rear suspension.

One sign that a set-up change has been successful is if the throttle traces, of a “before” and “after” lap, demonstrate that you were able to get on the throttle earlier, or had a higher level of throttle through a bend.

Brake

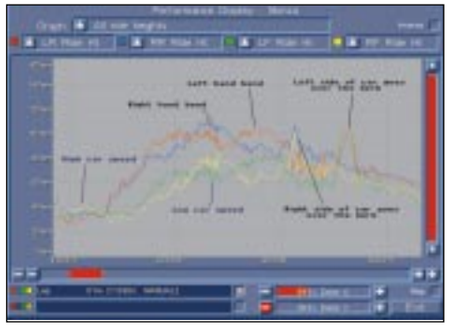
The brake can be of interest when comparing laps to see which braking points produce the best result.

One sign that a set-up change has been successful is if the brake traces, of a “before” and “after” lap, demonstrate that you were able to brake later for a bend.

Gear

The gear display shows when gear changes occur. These can sometimes explain spikes in other traces as the forces on the car temporarily change.

Ride heights (for each wheel)



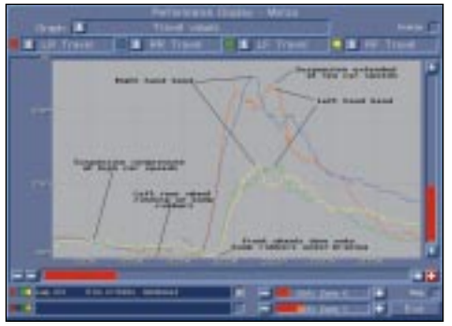
The ride height measures the distance between the car floor and the ground.

When the car is travelling on a straight the two rear wheel traces should be virtually identical to each other. The two front wheel traces should also be virtually identical to each other. Then, for example, if the car goes around a right hand corner the left hand side of the car floor drops and the right hand side of the car floor rises. This results in the two rear traces moving apart from each other, and similarly with the front traces.

It is possible to examine how low the car gets as it travels around the circuit. It is normally good practice to ensure that the car is as low as possible without the plank rubbing on the ground. By examining the ride height of the car you can judge what adjustments, if any, you could make. For example, if the ride height is 25 mm above the ground at its lowest point (probably a fast straight) then, considering there is a 10mm plank under the floor, this means you could lower the ride height by 15 mm before the plank would start to rub on the ground. This is a slight simplification, but the principle is important. The plank is located in the middle of the car and not at the front. This means that the plank may be off the ground if the front is less than 10 mm off the ground. This is due to the pitch angle of the car (i.e. the pitch angle may be higher at the back of the car than at the front). The same is true for roll angle. One side of the car can dip lower than 10 mm. Ultimately inspection of the plank will produce the final verdict. However you can make sensible judgements using the trace.

Note: When the car is moving, the optimum undercar downforce results from setting the ride height as low as possible. It is important however, that the rear ride height is set a certain height above the front ride height.

Suspension travel (for each wheel)



Suspension travel is useful for set-up level 2 in that it helps to identify how many packers you need to keep the plank off the ground. The trace actually represents suspension movement relative to any packers you have fitted. This means that the trace relative to the bottom of the chart actually shows the available remaining travel of the suspension. Therefore, if you find the point on the circuit with the lowest ride height (using the ride height trace) and then check the available suspension travel at the same part of the lap, then this will indicate the depth of *additional* packers required to remove the remaining suspension travel. So, in effect, at that part of the lap the car is on the bump rubbers.

Once those packers have been inserted if you reduce the ride height by, for example, 3 mm, then an additional 3mm of packing is required to keep the plank off the ground at the worst part of the lap (i.e. where the ride height is lowest). Inspection of the plank indicates the actual wear but the traces allow you to make sensible judgements. If the wheel is gripping without slipping, then this velocity is the road speed of the wheel.

Wheelspin (for each wheel)

The wheel circumference velocity is shown in the trace. If the wheel is gripping, without slipping, then this velocity is the road speed of the wheel. You can see how, when the car goes around a bend, the outside wheels have further to go and so have a higher speed than the inside wheels. Wheelspin is shown on the trace by sharp upward spikes. Wheels locking due to braking or scrub, are shown by a sharp downward spike. This trace can be useful when assessing traction on a bumpy circuit, or in corners generally. It may indicate a need to soften the suspension at the rear of the car.

APPENDIX C
Car Set-up Procedure Guide

The Sauber team at the Pacific Grand Prix in Japan. The experience and ingenuity of mechanics, designers, research and development personnel, and the skill of drivers are all needed to create a successful Grand Prix team.

You can improve your chances of qualifying on pole position and winning races by optimising the set up of your car.

In general you will always be looking for best laptimes as an indicator of the best settings.

The following step by step guide to setting up the car should help you achieve these best laptimes.

CAR SETUP STANDARD MENU

NB: Setting up the car is an exercise in compromise - everything affects everything else! Remember, if you try something and it doesn't work, you still have a positive result because trying the opposite will very often cause the desired effect.

You may need to consult the **Glossary** (see Appendix M) to gain a clearer understanding of some of the technical terms used in this section.

1. Select an initial set-up with slight understeer.

Grand Prix 2 provides you with this for each track.

REAR WING

Question: Does the circuit have high, low or medium downforce priority ?

E.g. Monaco needs high downforce because of the many corners and few straights. Hockenheim needs low downforce because of the long straights and few corners, and Suzuka needs medium downforce because of the mix of long corners and fast straights.

Examine track layout diagrams and try out a few laps to get a feel for each circuit.

If you decide on low downforce then...

2.a) Reduce the rear wing setting to reach high speeds on straights.

If you reduce the rear wing setting by a large amount, reduce the front wing setting by an equal amount to avoid large balance changes. Use the Speed trace on the Performance Analysis Graph to determine the fastest straight on the circuit. Use the speedometer to determine the fastest speed on the straight. If the rev limit is reached in 6th gear then go to step 4a and lengthen the gear ratio. If the car oversteers in fast bends then go to step 3 and lower the front wing. Eventually, lack of cornering performance outweighs any straight line speed advantage. This will become apparent by trial and error and when your lap times slow down. The top speed of the car will have increased so you will need to brake earlier for corners.

If you decide on high downforce then...

2. b) Increase the rear wing setting to reach high speeds in corners.

Use the Speed trace, on the Performance Analysis Graph, to compare your speeds through the corners with different wing settings. Also use the speedometer to determine the fastest speeds through the corners. If you have no acceleration in 6th gear, go to step 4b and shorten the gear ratio. If the car understeers in fast bends then go to step 3 and increase the front wing setting. Eventually a lack of straight line performance will outweigh any cornering speed advantage. This will become apparent by trial and error and when your lap times slow down.

If you decide on medium downforce then...

2. c) Adjust the rear wing setting to find the best overall compromise between 2a and 2b.

Do this along with steps 3 and 4. Use the Speed trace, on the Performance Analysis Graph, to study the circuit. Use the split times, to compare laps with differing car set-ups. The best adjustment is found by trial and error and by comparing your lap times.

FRONT WING

3. Adjust the front wing setting for desired balance in high speed corners.

This adjustment should be made in tandem with step 2a, 2b or 2c.

NB: The body, wheels and rear wing are responsible for aerodynamic drag.

The front wing does not additionally contribute to drag because of the nature of the airflow over an F1 car. Thus the front wing is only used to control the aerodynamic balance of the car. However, more front wing can interfere with airflow over the rear wing resulting in reduced rear downforce. Remember that compensating for this with more rear wing will increase drag, or that compensating with more steering demand will increase tyre wear.

GEAR RATIOS

4. Adjust the gear ratios in the following circumstances;

a) if reaching the rev limit in 6th gear, lengthen the 6th gear ratio.

b) if there is a lack of acceleration in 6th gear, shorten the 6th gear ratio.

Use the Speed trace, on the Performance Analysis Graph, to determine the fastest straight on the circuit. Use the speedometer to determine the fastest speed on the straight. It may be necessary to adjust 3rd, 4th and 5th gears to prevent a large gap in the gear ratios. This adjustment should be made in tandem with step 2a, 2b or 2c.

Heinz-Harald Fritzen's Sauber in the team paddock at the Brazilian Grand Prix. Close attention is paid by mechanics and designers to every aspect of a car's performance. Cars must be set-up with the driver in position. A slight alteration in weight can make all the difference.

BRAKE BALANCE

Adjust the brake balance to avoid understeer /oversteer when braking at turn-in.

If the car understeers when braking, adjust brake balance towards the rear of the car. If the car oversteers when braking, adjust brake balance towards the front of the car. Both of the above conditions can result in braking distances on the straights being too long. Continue to make adjustments until the preferred balance is achieved.

CAR SETUP ADVANCED LEVEL 1 MENU

Advanced Level 1 introduces the setup options of springs, dampers, ride height and anti-roll bars. In general, the stiffer a wheel's suspension is, compared to the other wheels, the more load it will attract during manoeuvres. The more heavily loaded a tyre is, the less efficient its grip becomes. Thus a stiff front leads to understeer, and a stiff rear leads to oversteer.

When the car is travelling in a straight line, only the springs support the weight of the car. In the middle of a long corner when there is a non-zero angle of car body roll, the anti-roll bars also help to support the car (the larger the angle of roll, or the stiffer the anti-roll bar, the greater the support provided). The dampers can also help to support the car, but this aspect of their use is only described in Advanced level 2.

Dampers are necessary to dissipate any energy that is stored in the springs as they compress and expand (e.g. when going over bumps). Generally stiffer springs require more damping. It is usual for the left and right hand values of these setup devices to be equal (giving a condition of lateral symmetry). However on certain tracks which have a bias in the number of left or right hand corners, you could try different setup values on the left and right side of the car (lateral asymmetry).

In an attempt to slow cars down, a 1994 Formula 1 rule change requires the teams to fit a 10mm thick wooden plank to the underside of the car. No more than 1mm plank wear (due to rubbing on the ground) is allowed during the race and this ensures that the ride height is not so low, thus reducing the values of under car downforce. The Advanced Level 1 menu allows you to inspect the plank, but in *Grand Prix 2*, rather than being disqualified for excessive plank wear you will find that there is an extra drag penalty (once the legal limit has been exceeded) as the plank runs along the ground.

Springs

6. a) Fit softer springs to improve your performance over bumps.

NB: Spring adjustments are made to smooth out the ride over bumps.

Each circuit has a unique surface 'bumpiness' profile. The 'bumpiness' can only be discovered by driving around the circuit. Make small adjustments in tandem with steps 8 and 11. If the car understeers on bumps then soften the front springs. If the car oversteers on bumps then soften the rear springs. If the car loses traction on bumps, then soften the rear springs. Use the Wheel Spin trace, on the Performance Analysis Graph, to determine any loss of traction. If softening the springs makes the plank rub along the ground, you may need to increase the ride height (see step 7). Use the Ride Height trace on the performance analysis graph, to determine any ride height variations. Continue making adjustments until ride height variations become smoother. Maximum suspension travel will now have been finalised. Softer springs will lead to more weight being shifted to the front wheels during braking. This leads to a loss of braking power due to the front tyres locking. Therefore, you will need to shift the brake balance, by a small amount, towards the rear of the car.

6. b) On a relatively smooth circuit you should stiffen the springs to facilitate a reduction in ride height because:

Ride height needs to be relatively large with soft springs.

Stiffer springs give rise to smaller suspension travels.

Smaller suspension travels allow reduction in ride height.

Reducing the ride height will increase undercar downforce.

Be careful not to lose traction by stiffening the rear too much. Compare the Speed trace on the Performance Analysis Graph to determine in which area loss of acceleration occurs.

Ride height

7. Adjustment of ride height.

Note: The ride height values relate to the car when stationary. When the car is in motion, downforce and bumps will vary the ride height.

Ride height must be high enough to keep the plank off the ground as the springs compress. Ride height settings need to be higher if the springs are softer. Reducing ride height will increase undercar downforce. However, when the car is in motion, there is an optimum, relative ride height between the front ride height and the rear ride height. At this optimum ride height the rear ride height will be higher than the front ride height.

Note: Downforce gained from lower ride height has no drag penalty. Therefore, reducing ride height all round is more desirable than increasing wing settings. Reducing ride height will increase plank wear rate if the car gets too low. Use the Ride Height trace, on the Performance Analysis Graph, to determine what ride height you are achieving around the circuit.

Dampers

8. Adjust dampers to improve performance over bumps.

NB: Damper adjustments are made to help keep the tyres on the track.

Make small adjustments in tandem with 6 a). If the car understeers on bumps, soften the front dampers. If the car oversteers on bumps, soften the rear dampers. Continue to make adjustments until the car ceases to skate/step out. If you are losing traction on bumps, soften the rear dampers.

NB: Making the dampers too soft will cause sloppy handling.

Anti-roll bars

9. Adjust anti-roll bars for balance in slow and medium corners.

Anti-roll bars are only effective when the car has roll angle. Pick a long corner to ensure damper effects have finished. If the car understeers in corners, soften the front anti-roll bars, or stiffen the rear anti-roll bars. If the car oversteers in corners, stiffen the front anti-roll bars, or soften the rear anti-roll bars. Continue to make adjustments until the preferred balance has been achieved. You may have to go back to step 3 since the anti-roll bars also work in fast corners.

Note: Softer settings all round will improve cornering grip/traction and reduce tyre wear. Stiffer settings all round will improve sloppy handling and allow lower ride heights without the plank rubbing on one side.

Tyre wear

10. Soften the suspension all round, if necessary, to prevent excessive tyre wear.

Use the tyre wear display to assess the amount of tyre wear.

CAR SETUP ADVANCED LEVEL 2 MENU

The setup features provided by the Car Setup Advanced Level 2 Menu are an extension of those used in Advanced Level 1. The additional setup devices being introduced are 4 way adjustable dampers and packers. In Advanced Level 1 we saw that springs support the car on straights and that they are helped by anti-roll bars in corners (at non-zero roll angles). Besides absorbing energy from the springs, dampers also help to support the car but only when the car is actually rolling i.e. it has roll velocity. Consequently, the support contribution from the dampers is only noticeable at entry to and exit from corners. This is useful if the driver wishes to have a different balance at the turn-in to, or exit from, a corner than at the apex (determined by the front/rear spring and anti-roll bar stiffness balance). The transient effect of the dampers will last longer if their settings are stiffer.

As you may have found in Advanced Level 1 setup, the only way to keep the plank off the ground when the springs are compressed under downforce is to raise the ride height of the car. The disadvantage of this is that there may be a loss of under car downforce. A further disadvantage is that the car rolls and pitches more as a result of the higher centre of gravity and is therefore less responsive to sudden changes in direction or sudden braking. The balance of the car is also affected due to an exaggeration of any front / rear bias in the setup. Setting the car up to Advanced level 2 will allow you to overcome these disadvantages.

4 Way adjustable dampers

The dampers on an F1 car are designed to have different stiffnesses when the wheel is moving up and towards the body (bump) and when it is moving down and away from the body (rebound). The bump direction, as its name suggests is meant principally to cope with bumpy road surfaces. The rebound direction is used to control car balance at entry to and exit from corners. Rebound damper forces are typically 2/3 times the strength of bump damper forces of the same setting. Therefore, although as a car rolls into a corner the outside wheels go into bump and the inside wheels go into rebound, the rebound tends to provide the dominant damping. Both the bump and rebound directions have high and low speed adjustments. The low speed adjustment sets the car handling characteristic of the damper and the high speed adjustment allows further adjustment of the damper's effect over surface bumps.

11. a) Soften bump dampers to improve performance over bumps.

Note: Bump damper adjustments are made to help keep the tyres on the track.

Make small adjustments in tandem with 6 a). If the car understeers on bumps, soften the front bump dampers. If the car oversteers on bumps then soften the rear bump dampers. Set the slow bump first and then the fast bump. Continue to make adjustments until the car ceases to skate/step out. If losing traction on bumps, soften rear dampers

Note: Making the dampers too soft will cause sloppy handling.

11. b) Adjust the rebound dampers to obtain desired balance during steering transients.

Note: Rebound damper settings affect car balance during steering transients, i.e. at entry to and exit from a corner (when car has roll velocity).

If car understeers during transients, soften the front rebound damper (or stiffen the rear). If the car oversteers during transients, soften the rear rebound damper (or stiffen the front). Steering transients last longer if the rebound dampers are relatively stiff. Be careful not to lose traction by stiffening the rear too much. Compare the Speed trace, on the Performance Analysis Graph, to determine area with loss of acceleration. Use the wheelspin trace, on the Performance Analysis Graph, to determine the area in which loss of traction occurs. Set the slow rebound first and then the fast rebound. Terminate the adjustment when the preferred balance has been achieved.

Packers

Advanced level 2 makes it possible to run the car on a set of bump stops (or bump rubbers) to limit the downward movement of the body. Consequently, for a given spring stiffness, the ride height can be substantially reduced to gain downforce, without the plank rubbing on the ground. The method adopted for controlling at what ride height the bump stops come into play is to fit packers (spacers) into the spring/damper unit so that the bump rubbers are reached prematurely, thus limiting suspension travel.

This section forms an extension of the Ride Height section in the Advanced Level 1 menu. Lowering the car will result in less roll and pitch as the centre of gravity is lowered. That will affect cornering and brake balance, which must be optimised afterwards.

Question: Do you wish to run for periods on the bump rubbers?

NB: Running on bump rubbers allows reduction in ride height. Running on bump rubbers allows softer springs to be used for bumpy tracks. Bump rubbers are used to limit allowable suspension travel. Packers are used to vary the position of the bump rubbers. Bump rubber suspensions only become usable at high speeds. When in use, the bump rubbers are the only active part of the suspension. Bump rubbers are very much stiffer than springs, bars and dampers. However, the additional stiffness does not generally affect handling because the tyres are so heavily loaded by the time the bump rubbers come into play.

Answer: Yes - to intentionally use the bump rubbers as suspension.

12. a) Fit packers to facilitate a reduction in ride height. An overall reduction in ride height will increase the under car downforce. The optimum ride height occurs when the rear ride height is a certain amount higher than the front ride height. A reduction in ride height does not affect suspension travel. Consequently, for the same spring rate the car may ground at high speeds. Use Speed trace, on the Performance Analysis Graph, to determine the fastest straight on the circuit. Start by lowering the ride height until the car grounds at high speed (use the plank wear display to verify that grounding has occurred). Then, fit packers to restrict the suspension travel and keep the car off the ground. You can use the Suspension Travel trace, on the Performance Analysis Graph, to determine when the bump rubbers are in play and how many packers to use (see **Appendix B: Data Logging Guide**). Carry on until the suspension travel is too restricted (in corners or over bumps).

NB: If the track is bumpy, the ride height may end up relatively high.

Answer: Yes - to intentionally use the bump rubbers as suspension but not in high speed corners.

12. b) Adjust the ride height to prevent running on bump rubbers in high speed corners. When the car slows down to enter a corner the ride height increases. This ride height increase will ideally bring the car off the bump rubbers. If not, then increase the ride height and remove the redundant packers. Use the Suspension Travel trace, on the Performance Analysis Graph, to determine how many packers to fit (see **Appendix B: Data Logging Guide**). Terminate the adjustment when you are no longer running on bump rubbers.

Answer: No - to intentionally avoid running on bump rubbers.

12. c) Increase the ride height to prevent excessive use of bump rubbers. As above, but increase ride height further and remove redundant packers. Use the Suspension Travel trace, on the Performance Analysis Graph, to determine the frequency of bump stop contact. Terminate adjustment when you are no longer running on bump rubbers.

NB: If new ride height is excessive, you should consider fitting stiffer springs.

Mechanics set up Barrichello's Jordan on the grid at Monaco. During set-up the driver must remain, fully kitted up, seated in the cockpit and the fuel tanks must be half full.

APPENDIX D
Car Set-up Reference Guide

Action	Effect on Car Balance	Other effects
Springs: *Set to maximize traction, cornering grip and vertical car movement*		
Stiffen the front	More understeer in corners	Additional traction, especially when exiting corners. Less cornering grip on bumpy surfaces. Additional front tyre wear. Handling more responsive. Less dive under braking.
Stiffen the rear	More oversteer in corners	Traction loss, especially when exiting corners. Less cornering and traction grip on bumpy surfaces Additional rear tyre wear. Handling more responsive.
Stiffen all round		Can achieve lower ride heights and so more downforce. Less cornering and traction grip on bumpy surfaces. Additional tyre wear all round. Handling more responsive.
Soften the front	More oversteer in corners	Traction loss, especially when exiting corners. Additional cornering grip on bumpy surfaces. Less front tyre wear. Handling less responsive. May be forced to increase front ride height. More dive under braking.
Soften the rear	More understeer in corner	Additional traction, especially when exiting corners. Additional cornering grip on bumpy surfaces. Less rear tyre wear. Handling less responsive. May be forced to increase rear ride height .
Soften all round		Improved traction and cornering grip on bumpy surfaces. Additional cornering grip on bumpy surfaces. Reduced tyre wear all round. Handling less responsive. May be forced to increase ride height.

Ride height (Static): *Set to maximize downforce and minimize plank wear*		
Reduce at front	More oversteer in fast corners because of more front under-car downforce	More front biased undercar downforce. More chance of plank wear at front. May restrict use of soft front springs on bumpy surfaces (Level 1). May force the use of additional front packers (level 2).
Reduce at rear	More understeer in fast corners because of more rear under-car downforce	More rear biased undercar downforce. Increase or decrease in total undercar downforce. More chance of plank wear at rear. May restrict use of soft rear springs on bumpy surfaces or for extra traction (Level 1. May force the use of additional rear packers (level 2).
Reduce all round		More chance of plank wear all round. May restrict use of soft springs all round (Level 1). May force the use additional packers all round (level 2). More undercar downforce all round. NB: downforce gained from lower ride height has no drag penalty therefore.. reducing ride height all round is more desirable than increasing wing settings.
Increase at front	More understeer in fast corners because of less front under-car downforce	Less front biased undercar downforce. Less chance of plank wear at front. May allow use of softer springs to improve performance over bumps. May allow removal of front packers to increase suspension travel over bumps (Level 2).
Increase at rear	More oversteer in fast corners because of less rear under-car downforce	Less rear biased undercar downforce. Increase or decrease in total undercar downforce. Less chance of plank wear at rear. May allow use of softer springs to improve performance over bumps and traction out of corners. May allow removal of rear packers to increase suspension travel over bumps (Level 2).
Increase all round		Less chance of plank wear all round. May allow use of softer springs to improve performance over bumps. May allow removal of packers all round to increase suspension travel over bumps (Level 2). Less undercar downforce all round.

Anti-roll bars: *Only effective when car has non-zero roll angle*		
Stiffen at front	More understeer in corners	Less cornering grip on bumpy surfaces. Additional front tyre wear. Handling more responsive.
Stiffen at rear	More oversteer in corners	Traction loss, especially when exiting corners. Less cornering grip on bumpy surfaces. Additional rear tyre wear. Handling more responsive.
Stiffen, front and rear		Less cornering and traction grip on bumpy surfaces. Additional tyre wear all round. Handling more responsive.
Soften at front	More oversteer in corners	Gain cornering grip on bumpy surfaces. Reduced front tyre wear. Handling less responsive.
Soften at rear	More understeer in corners	Gain cornering grip on bumpy surfaces. Traction gain, especially when exiting corners. Reduced rear tyre wear. Handling less responsive.
Soften, front and rear		May need increased ride height or extra. packers to avoid plank wear at the sides. Gain cornering and traction grip on bumpy surfaces. Reduced tyre wear. Handling less responsive.
Wings: *Only effective when car has forward velocity*		
Increase at front	More oversteer in fast corners	Increase aerodynamic downforce on front wheels. No additional aerodynamic drag, but may reduce effectiveness of rear wing. Increase cornering speed in fast corners. May need increased front ride height or extra front packers to avoid plank wear (Level 2). May need to stiffen front springs to avoid plank wear.
Increase at rear	More understeer in fast corners	Increase aerodynamic downforce on rear wheels. Increase aerodynamic drag. Reduced top speed on straights. May need to shorten 6th gear ratio. Increase cornering speed in fast corners. May need increased rear ride height or extra. rear packers to avoid plank wear (Level 2). May need to stiffen rear springs to avoid plank wear.
Increase, front and rear		Increase aerodynamic downforce on wheels all round. Increase aerodynamic drag. Reduced top speed on straights. May need to shorten 6th gear ratio. Increase cornering speed in fast corners. May need increased ride height or extra packers to avoid plank wear (Level 2). May need to stiffen springs to avoid plank wear.
Decrease at front		More understeer in fast corners. Decrease aerodynamic downforce on front wheels. No reduction in aerodynamic drag, but may increase effectiveness of rear wing. Decrease cornering speed in fast corners. May allow decreased front ride height or removal of packers for extra front undercar downforce (Level 2). May allow softer front springs for more cornering grip on bumpy surfaces.
Decrease at rear	More oversteer in fast corners	Decrease aerodynamic downforce on rear wheels. Decrease aerodynamic drag. Increase top speed on straights. May need to lengthen 6th gear ratio. Decrease cornering speed in fast corners. May allow decreased rear ride height or removal of packers for extra rear undercar downforce (Level 2). May allow softer rear springs for more cornering and traction grip on bumpy surfaces.
Decrease front and rear		Decrease aerodynamic downforce on wheels all round. Decrease aerodynamic drag. Increase top speed on straights. May need to lengthen 6th gear ratio. Decrease cornering speed in fast corners. May allow decreased ride height or removal of packers for extra undercar downforce (Level 2). May allow softer springs all round for more cornering and traction grip on bumpy surfaces.

Gear Ratios

Lengthen 6th gear		Decrease acceleration in 6th gear. May need to change other gears to prevent large gaps in ratios.
Shorten 6th gear		May find rev. limiting in 6th gear. May need to change other gears to prevent too much overlap in ratios.

Packers: *Used to vary the limit downward suspension travel (Level 2)*

Increase number at front	More understeer	Increase front ride height. Less front biased under car downforce. Run on front bump rubbers more often May restrict benefit of soft front springs on bumpy surfaces. Allows front ride height to be reduced with no extra plank wear.
Increase number at rear	More oversteer	Increase rear ride height. Less rear biased under car downforce. Increase or decrease in total undercar downforce. Run on rear bump rubbers more often. May restrict benefit of soft rear springs over bumpy surfaces. Allows rear ride height to be reduced with no extra plank wear.
Increase number front and rear	Increase ride height all round	Less under car downforce. Run on bump rubbers more often. May restrict benefit of soft springs on bumpy surfaces. Allows ride height to be reduced with no extra plank wear.
Reduce number at front	More oversteer	Reduce front ride height. More front biased under car downforce. May need to stiffen front springs to avoid plank wear. May need increased front ride height to avoid plank wear. Allows extra benefit of soft front springs over bumpy surfaces.
Reduce number at rear	More understeer	Reduce rear ride height. More rear biased under car downforce. Increase or decrease in total undercar downforce. May need to stiffen rear springs to avoid plank wear. May need increased rear ride height to avoid plank wear. Allows extra benefit of soft rear springs over bumpy surfaces.
Reduce number front and rear		Reduce ride height all round. More under car downforce. May need to stiffen springs to avoid plank wear. May need increased ride height to avoid plank wear. Allows extra benefit of soft springs over bumpy surfaces.

Bump Dampers: *Dissipates spring energy and is mostly effective when car is on bumpy surfaces*

Stiffen at front	More understeer in bumpy corners	Additional front tyre wear
Stiffen at rear	More oversteer in bumpy corners	Less traction grip on bumpy surfaces Additional rear tyre wear
Stiffen, front and rear		Less traction grip on bumpy surfaces Additional tyre wear all round Twitchy handling over bumps
Soften at front	More oversteer in bumpy corners	Reduced front tyre wear
Soften at rear	More understeer in bumpy corners	More traction grip on bumpy surfaces Reduced rear tyre wear
Soften, front and rear		More traction grip on bumpy surfaces Reduced tyre wear all round

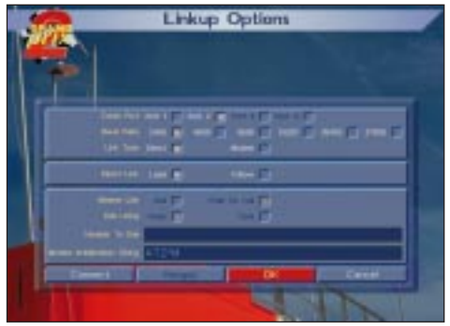
Rebound Dampers: *Dissipates spring energy and dominates over bump dampers when car has roll or pitch velocity*

Stiffen at front	More understeer during turn entry and exit	Additional front tyre wear.
Stiffen at rear	More oversteer during turn entry and exit	Less traction grip during turn exit. Additional rear tyre wear.
Stiffen, front and rear		Tendency towards more responsive handling. Body motions slowed down; pitch and roll. Body roll takes longer; full anti-roll bar forces delayed . Quicker load transfer - corner balance . determined more by damper stiffnesses. Becomes difficult to differentiate from springs that are too stiff.
Soften at front	More oversteer during turn entry and exit	Reduced front tyre wear.
Soften at rear	More understeer during turn entry and exit	More traction grip during turn exit. Reduced rear tyre wear.
Soften, front and rear		Tendency towards unresponsive handling. Body motions speeded up; pitch and roll. Body roll completed sooner; full anti-roll bar forces sooner. Slower load transfer - corner balance . determined more by springs and bars.

Brake Balance: *Only effective when braking*

Move towards the front	Understeer under braking at turn-in	Fronts can lock-up giving lower overall brake force. Braking distance lengthened.
Move towards the rear	Oversteer under braking at turn in	Rears can lock-up giving lower . overall brake force. Braking distance lengthened.

WHAT IS LINKED PLAY?



Linking allows you to play on two machines simultaneously. The two machines are connected either via standard Hayes compatible modems using a phone link (called a modem link) or directly via a special cable called a null-modem cable (a direct link).

HOW TO LINK UP THE MACHINES

First connect up the necessary cables. In order to use the link you will need to connect the modem or the null modem cable to one of the serial ports on the back of the machine. Most PCs have 2 serial ports, labelled COM1 and COM2. Either port will do, but if you are using a serial mouse, you should leave that port alone and select the other com port.

Having connected the cable, load up the game on both machines. Now from the **Main Menu**, go to the **Options Menu** and select the **Linkup Menu.** You should see the full screen Link Menu which controls how the link operates.

THE LINK MENU

The Comm Ports

At the top of the link menu are 4 buttons for the communication, or comm ports. Unless your machine has been expanded, only ports 1 and 2 will be available and ports 3 and 4 will be greyed out. Select the com port you wish to use by selecting the relevant button at the top of the link menu.

The Baud Rate

At the top of the link menu are 6 buttons labelled 2400, 4800, 9600, 19200, 38400 and 57600. These control the baud rate, which is a measure of how fast data is sent down the serial cable. A fixed amount of data is sent down the cable for each frame of the simulation, so if you wish to play with faster frame rates (for smoother animation and control) you will need a higher baud rate. The downside is that higher baud rates are more error prone, especially with longer or unshielded cables, and that while most modems will communicate with the computer at higher rates, the modem-to-modem connection down the phone lines may not be fast enough (in this case you will see higher than usual occupancy rates in the game).

Link Type

Below the baud rate buttons are two buttons to select the link type. Choose Direct for a null-modem cable between two machines, or Modem if you are playing across the phone lines.

Direct Link Lead/Follow

While the link is active, one machine takes control of the menus on both computers and is said to 'Lead'. The other machine is said to 'Follow'. For a direct link the machine that does the dialling (and pays the phone bill) is automatically the leader.

Modem Link Dial/ Wait for Call

If you are linked by modem over the phone line then one machine must dial up the other, and the other machine must be ready and waiting for a call. You should pre-arrange this (perhaps with a voice call) before trying to start up the link. These buttons control how the machine will behave for a modem link.

Dial Using

This tells the modem to use one of the two dialling methods employed by phone companies. Pulse dialling is much slower than tone dialling. Therefore, tone dialling is recommended if your phone exchange supports it.

Modem number to dial

You should type in the phone number to dial on the machine that will initiate the call. The string will be passed direct to the modem so, if your modem supports it, you can use "," to add delays to the dial etc. All the linkup selections are included in your Options file so it's useful to save options before linking.

Modem initialisation string

In order for the game to work smoothly via a modem connection, the modem must be set-up in a particular way. In order to keep the simulation running in real time, it requires the modem to pass the data through immediately and not buffer or compress it as it would be needed for a file transfer. Also the game performs its own error checking based on a packet system, so it's recommended that you turn the modem error checking off, as this can also delay data passage. Unfortunately, there is no standard set of commands to do this across all Hayes compatible machines. We have included sample initialisation strings for some makes below, but if your modem is not included, you may need to look up codes in your modem manual.

In summary, we recommend that you

1. Turn the compressor off.

2. Turn error checking/control off.

On a more technical note, it's recommended (though not essential) that you start the initialisation with the ATZ command to reset the modem. This ensures that it's in a standard state at the beginning and will make linking more reliable. If you need to insert control characters in the modem initialisation string, then the sequence ^ + letter will do it. For example, ^M will send a carriage return. There is no need to insert a ^M at the end of the string as an ASCII 13 is automatically appended.

For example:

Modem type
Sample initialisation string

Courier HST
ATZ&M0&K0

Twincom 144/DF
ATZ&Q6

Connect/Hangup/OK/Exit

Once both machines are set up, you should click on Connect on both computers. If you are connecting via a modem, then you should see the computer initialise the modem and show either 'Dialling' or 'Wait for call'. Once a connection is established, the machines should show 'Starting Link' to the dialler and 'Waiting for link' at the other end. After about a second these messages should clear and the button 'Link is active' appear.

For a direct link, one machine should show 'Starting Link' immediately and the other 'Waiting for Link'. Again, after about a second these messages should clear and the 'Link is active' button appear.

What to do if things go wrong

a. For a direct link.

If the machines are showing 'Starting Link' and 'Waiting for link' but nothing else is happening, you should check:

That you have selected the correct com port on each machine.

That they are both operating at the same baud rate.

If this appears okay and still nothing is happening, you may have an incorrectly wired cable. If you are not sure about the cable, you should check it out with a comms package.

b. For a Modem Link.

If the modem is not responding, check the connections and check that the modem initialisation string is correct. Any error in the string will not get an OK reply from the modem. As a check, try a simple ATZ for the string and see if the modem goes on to dial or wait for a call.

If the modems dial but do not connect.

This is the trickiest problem. Many modems have subtle differences, and modems from differing manufacturers can have problems with varying protocols. If possible, check that you can connect with a similar modem. After that it's down to checking through the modem's manuals.

After the link is connected

After a connection is established, you should see the message, 'Link Active', with either, 'This machine has control', or, 'The other machine has control'. While in the menus the system is controlled from one machine, with the other echoing its movements. The machine with control has the normal red highlight on the menus and is said to 'Lead', whereas the other will show a beige highlight and is said to 'Follow'.

The machine designated to 'Follow' is excluded from certain actions e.g. Control Method set-up, Printer Setup and general loading and saving (but not game saves) and will display a 'Please Wait' message if the Leader moves into these areas on the menus. Also certain menus will behave slightly differently; Driver Select, for example, now shows both machines' drivers and allows either to change their selections.

While in Linked menus there are 3 special hotkeys:

Ctrl+M (Hold the control key and press m)

On either machine will pop up a message box over the current menu and allow you to send up to forty characters of text to the other machine. Type your message of text and press Return, the link will then wait for the other machine to clear the message before moving back to the original menu.

Ctrl+R (Hold the control key and press r)

This hotkey is only active on the machine that has control of the menus. When the hot key is present, control passes to the other machine.

Ctrl+H (Hold the control key and press h)

This hotkey is active on both machines and brings up a menu box allowing you to hang up the link. You should always end the link either here, or by clicking on Hangup in the linkup menu and not by simply switching one machine off (the other machine would then be left trying to regain contact).

Ctrl+I (Hold the control key and press I)

This functions as normal, bringing up an information box on both machines. This is also available when not linked.

Ctrl+J (Hold the control key and press j)

This will toggle joystick control in the menus if the joystick has been calibrated. This is available when not linked.

These hotkeys are available on almost every menu, but note that they are disabled in the File Selector.

EXTRA OPTIONS WHILE LINKED

After linking you may find that some of your option strings have changed, especially if the other machine has control. Many of the option settings are copied across from the 'Load' machine. If you close the link, you will be given the option of re-loading your game state file.

Also, after linking, some menus change. Driver Select now has selection options for either machine and the Drive Options menu shows both players' chosen car and grid position for quickraces. There is an extra option available in the Quick Race menu when two machines are linked - a two player Quick Race. This allows a normal Quick Race, but with only the two players and no computer controlled cars.

LOADING AND SAVING

While in linked mode, any game saves must be made on BOTH machines. Screen prompts will guide you through the procedure and the filename chosen by the 'Leader' is automatically passed through to the other machine. It's recommended that you use the same filename on each machine to save confusion, but this is not essential.

OTHER MENUS

Some menus, notably the control method menus and the use of the printer menu can be accessed only by the machine in control. To reach the menu on the other machine the 'Leader' should release control ((press Ctrl+r) from the **Main** or **Options Menu**). After the second machine has finished, it can release control again, back to the original 'Leader'. Also some options are not allowed while linked; load names, load track records and save options are disallowed.

MULTI-PLAYER MODE

To implement Multi-Player Mode you must select more than one driver from the Choose Driver/Team Menu.

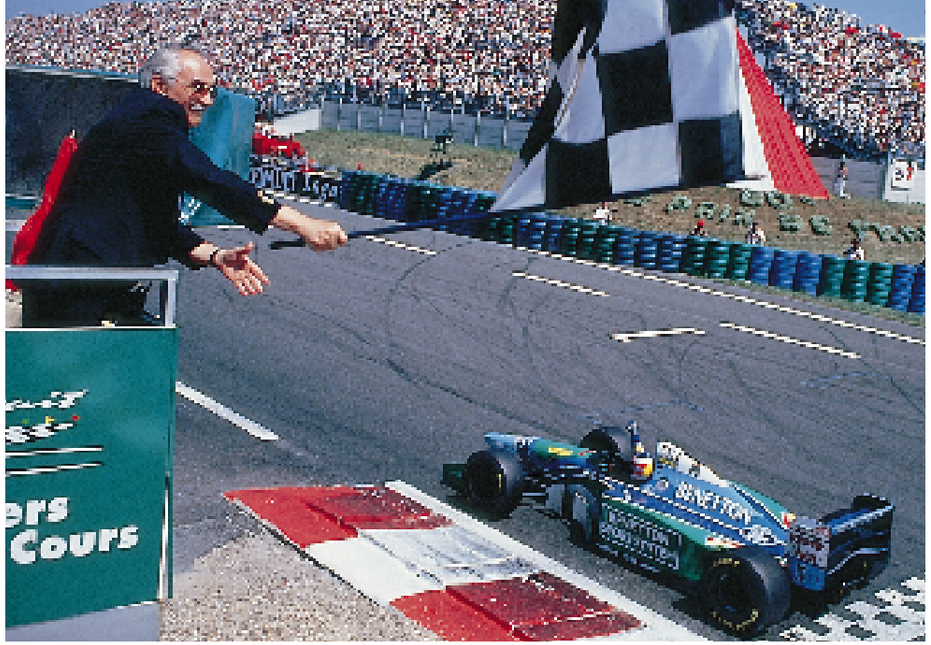
The programme will allocate equal time slots to each driver. For example, if two players wish to compete in a ten lap race, they each select a driver from the Choose Driver/Team Menu. The computer then chooses one player to drive first and drives the other car as well as all the remaining cars on the grid.

A 'programme manager' will allocate equal time for each driver and give a warning of the changeover. The single LED on the right of the steering wheel will flash amber for 10 seconds to warn the current player of the impending change over. The light will flash red for a further 5 seconds to warn the current player that the change over is imminent. After this period control of the car will return to computer before the change over is implemented. The camera view then changes to the next player's car, which is being controlled by the computer. Another 5 second passes before control passes to the next player. The LED will turn green to indicate that the player is now in control of the car. The option to pause and replay could be used during this period if the new player wishes to see more of his car's recent action.

The players can control the number of changeovers which occur during the race by specifying the number of turns per player in the Drive Options Menu.

Remember to set-up enough laps for each person to get a good drive.

In qualifying mode changeovers occur when a players return to the pits. The session ends automatically once the session period is complete and all players have used the same number of tyre sets. ESC can be used to force an exit. Remember, only the fastest 26 will qualify - but players will always qualify in preference to computer controlled cars.

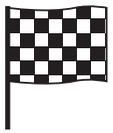


The clerk of the course waves the chequered flag, symbolising the end of the race, as Schumacher's Benneton storms to victory in the French Grand Prix.

RACE MARSHAL'S FLAGS

Starting Flag

This is usually the national flag of the country hosting the Grand Prix but it must not be similar to any other flag used by the marshals. The starting signal must be given by lowering the flag.



Finishing Flag

A black and white chequered flag waved at the cars on the finishing line.

Red Flag

Indicates that the race has been stopped by the Clerk of the Course. It is displayed motionless. All drivers must stop racing immediately and proceed to the pits.

Black and White Flag (divided diagonally into black and white halves)

Shown motionless with a white number on a blackboard. This is a warning to the driver of unsportsmanlike behaviour.

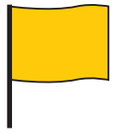
OBSERVATION POST FLAGS

Black Flag

Shown motionless, together with a white number on a black signalling board. Informs the driver of the car that he must stop at his pits on the next lap.

Black Flag with 40cm diameter Orange Disc

Shown with a white number on a black signalling board. Informs the driver that his car has mechanical problems, likely to endanger himself or others. Driver must stop at his pit on the next lap.



Yellow Flag

The signal of danger or a situation of danger. Slow down, prepare to stop. Keep your position and do not overtake until you see the Green Flag.

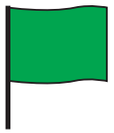
Yellow Flag with Red Stripes

Deterioration of adhesion. Tells the drivers that the grip on the track surface has suddenly deteriorated in the area after the flag. This is usually the flag used when oil has been dropped on the track, a pool of water is causing aquaplaning or when there is a sudden change from a dry to a slippery surface.

OBSERVATION POST FLAGS

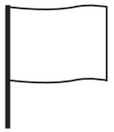
Red Flag

Stopping of the race (see above).



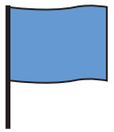
Green Flag

All clear. This is used at the end of a danger area controlled by the yellow flags.



White Flag

Slow-moving vehicle on the track. This tells the drivers that they are about to overtake a vehicle which is travelling on the track at a much slower speed than the competing cars.



Light Blue Flag

The overtaking signal. Waved, it informs the driver that he is going to be overtaken by one or more faster cars. Shown motionless means that the faster car is still some distance away.

The safety Car leads the racers around the track at the re-start of the San Marino Grand Prix. The marshal's yellow flag signals danger. Until the green flag appears drivers must proceed at a slow pace, holding their current positions.

not needed

THE RACING LINE

Andrea De Cesaris in the Sauber Mercedes exits a bend at the French Grand Prix. His racing line is close to perfect as he 'straightens out' the bend. At this point he will be accelerating into the approaching straight.

A racing car must take a bend or a series of bends at the maximum possible speed and reduce the shape of the corner to its minimum possible angle.

The best racing line can be seen as being made up of three distinct points on the bend.

A) the turn-in point, usually at the end of the braking area and the position when the car actually enters the corner.

B) the apex or the clipping point. This is the slowest part of the bend and the point where the car is nearest to the inside of the corner.

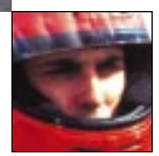
C) the exit point when the car is back on a straight line. This is usually the fastest part of the bend.

Obviously, the best racing line also depends on the driver and the car. Is he trying to overtake another car into the corner? Is the corner before or after a fast straight? Is the track surface wet or oily? All these considerations come into play and the driver must adjust his line accordingly.

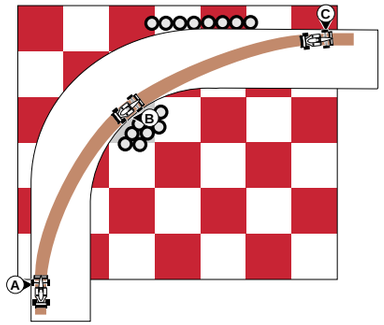
TYPICAL CORNERS AND BENDS

A driver must try to use all the available space on the track, even the 'rumble strip'- the run off area on the edge of the tarmac. In a typical corner, for example a right-hander, the driver arrives on the left side of the track, brakes, changes down, checks for his turning-in reference point then steers the car towards the clipping point on the inside of the bend. Once past, he eases back to the other side smoothly and exits the corner. Driver priority must be to get power back on as soon as possible to achieve maximum speed into the straight.

Andrea De Cesaris slows for a tight right hand turn, in his Sauber Mercedes, at the Canadian Grand Prix. Drivers must utilise every spare inch of the track and often mount the rumble strip.

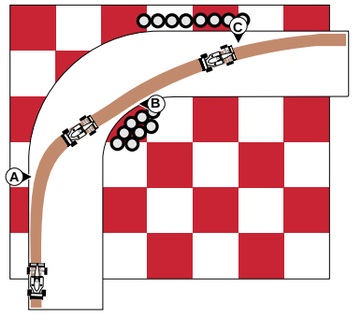


Fast Corner



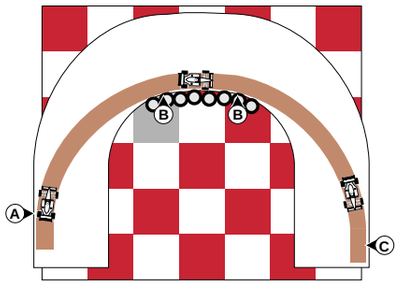
Most of the racing circuits have a corner of this sort that can be taken at speeds in excess of 140mph. The driver turns in at A, passes the apex at point B then keeps his line all the way through to exit point C. The driver makes no sudden turns on the wheel and the whole process should be very smooth.

90 Degree Turn



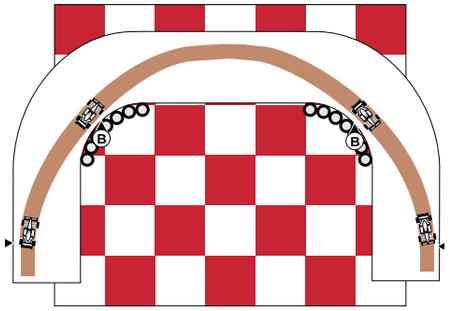
There are many different ways to turn into this type of corner depending on whether the driver is about to overtake, but the classic approach is to turn in late at A, pass the apex again late at B, and accelerate fast from that point to get a good clean exit at C.

The Constant-Radius Corner



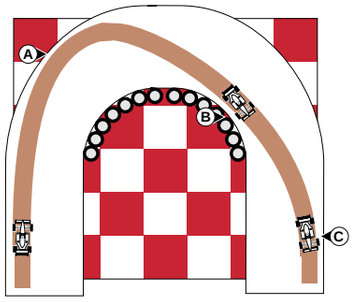
There is a very long apex on this type of corner so there is no gain in taking the entry point late. The driver turns in early at A then stays close to the contact points B and B as long as possible. As he leaves the apex, he crosses the track and touches his exit point at C.

Double-Apex Corner



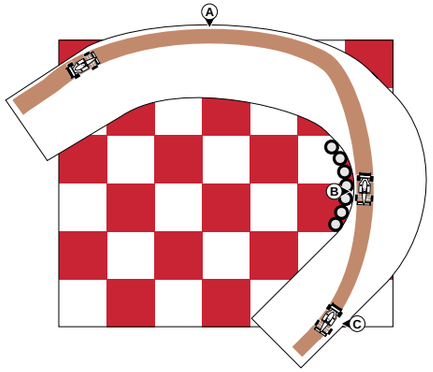
The key to negotiating this type of bend is to make one corner out of two. The driver aims for the ideal line and stays inside the track's width, effectively making the exit line of the first bend the entry line of the second. If the line is perfect then the driver does not have to correct his steering.

Hairpin



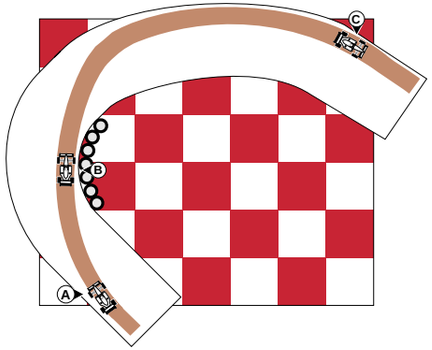
The aim here is to turn in late to create the widest possible angle so that after point A the bend can be treated like a fast corner. The sharp initial turn is vital to make the car as fast as possible out of the hairpin. When point B has been touched the driver can safely put his foot down before reaching point C.

The Tightening Corner



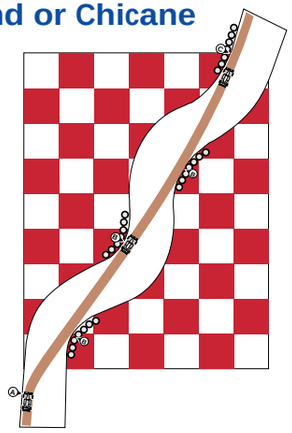
The car stays wide so that the driver can touch the apex extremely late at B, then brake, select a lower gear, cross the track following the curve of the bend and get a good clean exit at C.

The Opening Corner



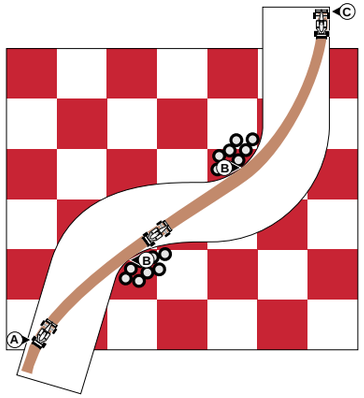
The driver turns in early at A, covers the short distance to the apex B then smoothly moves to the outside. This allows the last phase of the bend to be driven like a straight and the driver can accelerate quickly long before passing point C.

The 'S' Bend or Chicane



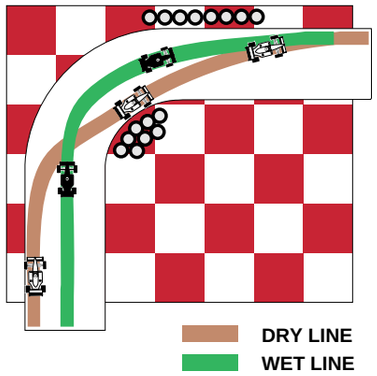
Ideally, a good racing line can straighten out some bends without the need for sudden turns. The driver turns in slightly at A approaching the first right-hander, then clips points B,B,B with hardly any modification before exiting at C.4

Tight Corner After a Fast Bend



Take a tight line into the fast right-hander but brake as the second point B approaches. The car must slow down to take the left-hander but this is not a problem, for the driver has gained speed in the first two-thirds of the series of bends.

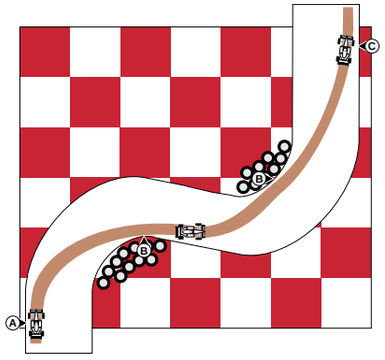
Cornering in Wet Weather



Taking the classic right-angle corner as an example, it's easy to compare the dry line with the wet line. The driver takes up position in the middle of the track, keeping off the outside line which is likely to be very slippery. The line he drives will be cleaner and give far better grip in the rain. The car is kept in the middle of the track as it passes the apex then steers for the outside line. The main aim of drivers in wet weather is to look for maximum grip.

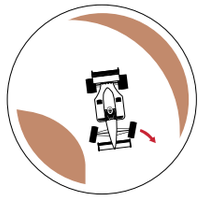
A Long Straight After Two Identical Corners

The important point about this series of bends is the approaching straight. The driver turns in late to the right-hander and hits the clipping point well into the bend. He then takes the fast left-hander as though the previous bend had not existed. Thus the first corner is taken slowly to give the car as much benefit as possible from the oncoming straight.



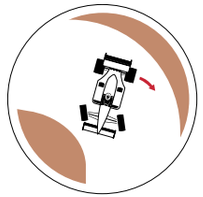
REACTION OF CAR THROUGH A CORNER

Understeer



An understeering car means that the rear wheels have better grip than the front wheels and so the car will not react fully to the driver turning the wheel. Since F1 cars are rear-wheel driven, the vehicle will begin to move towards the outside of the track. The driver in such a situation can do one of two things: ease up on the accelerator, making the driving wheels push less, giving the front wheels a better chance to grip; if the car still does not respond, brake lightly without locking the wheels. The car will slow down enough to give good grip to the front.

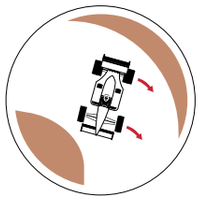
Oversteer



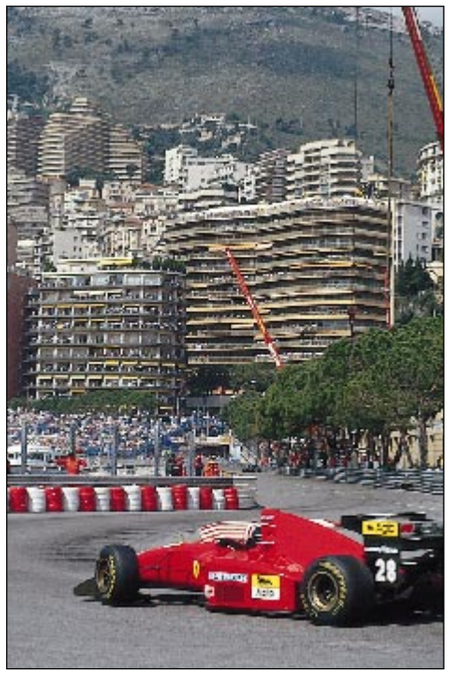
An oversteering car means that the front wheels have better grip than the rear wheels. This can possibly be because of too much power or because the car balance is poor. This tends to make the back end of the car slip out towards the outside of the corner. The consequence might be the car spinning off altogether!

To counter oversteer a driver can do one of two things: opposite lock on the steering wheel might just establish the car's balance; otherwise easing up on the accelerator will slow down the car and give the rear wheels a chance to grip. There are also certain times when drivers might accelerate, but knowing when to do this comes with experience.

NEUTRAL HANDLING



The ideal situation, as the sideways drift of the rear wheels is matched by those of the front. All four wheels slide in the same way. The driver sets up the car on entry to the corner, so the front wheels are straight and the driver doesn't have to steer.



The Monaco Grand Prix, Monte Carlo, built into the hills of the Mediterranean coast provides the most famous street circuit in the racing season. Gerhard Berger lines up his Ferrari prior to reaching the bend. Note the favoured racing line the car's tyres have made on the track.

MARKER POINTS

To set up the ideal racing line on a Formula One circuit you must find as many markers as possible to use as reference points. The individual tracks provide 300, 200, 100 metre boards before a bend but these are too general for most drivers; many rely on advertising boards, bumps in the track, certain trees or bushes for turn-in points, braking zones or accelerating areas.

In fact, the driver must know every square metre of the circuit and the markers, once memorised, allow the driver to think ahead, to anticipate the next corner.

Imagine you are accelerating through a fast straight. When you see the marker for the braking zone into a bend, your mind will be already thinking about the next marker for the turn-in point. As this is passed, you are thinking about the apex marker and finally the exit point. Think ahead. Look out for the next marker. Don't wait until you see it to react.

Parc Ferme officials carefully inspect every aspect of Schumacher's vehicle after the 1995 Spanish Grand Prix. Only they can touch the vehicle in the hours following a race. Engines may sometimes be sealed for inspection at a later date.

BRAKING

Ideal Braking

In Formula One the driver aims to keep his foot down on the accelerator as long as possible. When he gets to a corner, he will wait until the last moment before braking and then brake as hard as possible over the shortest possible distance. The only reason to brake should be to achieve the best speed for entering a bend and the only reason for removing your foot from the accelerator must be to 'jump' to the brake pedal. Ideally, there should be no compromises with braking.

Wheel Lock

Braking hard can present the F1 driver with another problem; that of locking wheels. It's possible to lock up one, two, or even all four wheels if you brake too hard in a given situation. A locked wheel is no good to anybody. The tyre wears out excessively on the locked patch and this creates a 'flat spot' which will feel like violent bumps when the wheel is turning again. The tyre will be out of balance and the car almost impossible to control. To avoid wheel lock, the driver must be sensitive enough to brake hard and to detect the first signs of lock-up.

CHANGING DOWN

Changing down into a lower gear must always accompany the act of braking. One without the other is not good Formula One driving. The aim is to brake to the ideal speed for the approaching corner then change down in order to be in the right gear for the moment you need to accelerate again. Changing down is done as you brake. Any earlier and the car will still be at full speed; any later and the driver has too much to do in mid-corner.

OVERTAKING

If you're not at the front of the grid in every race then chances are that you will need to overtake other cars at some point. Overtaking is not just a matter of more power in your engine. It usually boils down to three factors.

Can you take a corner better than a rival?

Can you exit a corner faster and enter a straight at a greater speed?

Or, can you brake later than a rival at the end of a straight?

To overtake successfully, especially against a determined rival, you must be aware of the driver ahead.

Where is he slowest?

Where does he brake earlier?

On what part of the circuit is he the least confident?

Eventually, you will have a good picture of his strengths and weaknesses. You must make his worst manoeuvre your best, wait for the right moment then make your challenge.

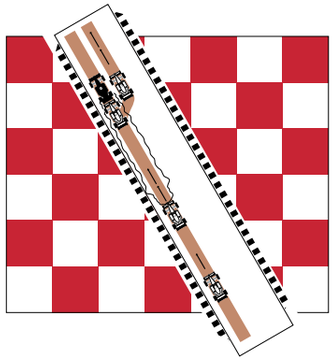
All the above assumes that the driver ahead will not make a mistake; but all drivers make mistakes during a two hour race, so take every opportunity offered to you and wait for that error!

Driving faster through a corner than a rival

Mark Blundell in the Tyrell holds the best line around a tight left-hander in the Portuguese Grand Prix. Oliver Panis in the Ligier is forced to drive wide.

The driver ahead is not confident through a certain corner. Choose your moment. Leave a space between the two cars so that he can't force you to slow down. Just enough room to let you attack the corner at the speed of your choosing. When you leave the corner you will have more speed than the other car. The faster exit speed gives you the advantage to overtake in the following straight.

Slipstreaming



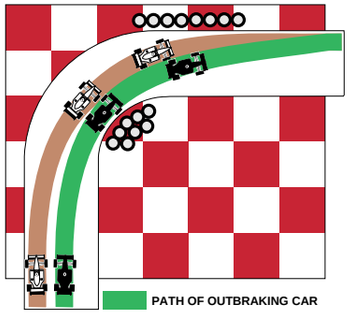
Slipstreaming is a phenomenon that occurs at speeds above 70mph. Catch a rival car on the beginning of a long straight and get very close behind him (within a few inches). Both of you are travelling at the same speed but you are in a small area, a few metres long, which is free of air turbulence. The car ahead is doing all the work while you gain mph. You can tell that you are successfully slipstreaming by the loss of turbulence and the gain in acceleration.

By now you're probably travelling at 140mph just inches behind the rival car.

You wait until the last possible moment then slip out to the side of the other car. Although you will now be subject to the same forces of turbulence, your speed gain during the sheltered period will give you the edge to move slightly ahead.

De Cesaris exits the Nouvelle chicane at Monaco. The cars behind him are in perfect position to take advantage of his slipstream in the approaching straight.

Outbraking a rival car



If a driver has managed to get a lead on a rival in the previous straight and is now on the inside line for the next corner, he must try to brake a little later into the bend, giving himself right of way. If the rival driver stays in contention, around the outside of the track, he is in danger of spinning off. It's important to 'close the door' after you exit the corner, especially if the rival car is trying to get level again. Take a strong position off the ideal line, in the centre of the track and make his overtaking attempt as difficult as possible.

DRIVING ERRORS

Overrevving

This is possibly the most common way a driver can ruin his engine and put himself out of the race. Changing down too early before braking sufficiently is quite common among inexperienced drivers. A driver must be a third of the way into the braking zone before changing down. It is quite tricky to get this right in short braking bends but in longer braking areas you can use markers for gear change points.

A second common way to overrev is by exiting a corner and not changing up at the right time; quite easy to do if you're busy controlling the car through a difficult bend. Fortunately modern Formula 1 cars are fitted with computer controlled rev limiters that prevent engine damage and bad gear changes.

LOSS OF CONTROL

The most common ways of losing control of your car in a race are:

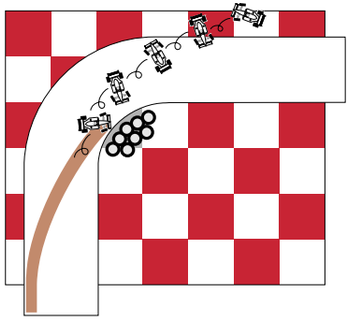
- going into a corner too fast, giving strong oversteer.
- accelerating out of a corner too fast.
- under braking when there is too much bias on the rear wheels.
- mechanical failure.
- oil, sand, dirt or grease on the track.

In all cases, as soon as the driver feels the loss of control, he must brake hard while keeping his revs up to prevent stalling. If possible, he must keep the car on the circuit, for once it touches the grass the spin will speed up tremendously.

Spinning off before reaching the apex of a corner will result in the car moving across the track to the outside of the bend. Generally, the inertia that it retains will send it off in an arc similar to the early shape of the corner.

Spinning off after the car has passed the apex of the corner will often give the driver a better chance of staying on the track, for although the car will be moving faster it is more likely to follow the exit profile of the curve.

If all else fails, and the driver knows that he is going to hit something, it's wise to protect himself as much as possible from the impact. He must lift his feet from the pedals, try and curl up as much as the cramped monocoque will allow, then at the last moment let go of the steering wheel to prevent his wrists from being broken.



Rubens Barrichello applies his brakes late and hard as he drives into a sharp corner in the Pacific Grand Prix at TI Aida. In this case the wheel locks briefly and the tyre rapidly wears out on the locked area to create a 'flat spot.

BRAKES

Brake performance in F1 cars is phenomenal; cars can decelerate from 200mph to full stop in under four seconds. They must be incredibly powerful, very low weight and have exceptionally high thermal resistance at temperatures in excess of 2000°C. Disc and brake pads are made from carbon fibre and their peak performance level is at about 350°C, so when they are first used they are slow to react and it's not until they have warmed up that they are totally efficient.

The brake system on F1 cars is split between the front and rear sets of wheels. This is partly done for safety reasons, in case of brake failure, and partly to balance the braking forces that come about during changes in weight distribution. The driver can adjust the brake balance from the cockpit to take into account such things as the change in weight as the fuel is used up.

The high temperatures achieved during fast deceleration means that cooling the brake system is crucial. This is achieved by carbon fibre cooling ducts which channel air on the brakes to prevent overheating. The size and number of ducts is variable and depends on the circuit conditions.

ENGINES

All engines for F1 cars are 3.5 litre (up to the 1994 season), normally aspirated, developing 600-700 b.h.p. There is no rev limit to the engines but generally, the more cylinders, the more power it will develop but with less torque. V12's (e.g. Ferrari) are more powerful but they are longer, heavier engines that use up more fuel. Engine performance in a modern F1 car is phenomenal: first gear will take the car to 80mph, the car will go from 0 to 150mph in just under 7 seconds, generating 1.3 g. Unfortunately, there is a downside to this fantastic performance; engines do not last and most are completely rebuilt after 300 miles.

The RS6 Renault engine used by the Williams team. This 790hp engine helped the team to 7 Grand Prix victories and 6 pole positions in 1994.

FUEL AND NEW RULES

Upto the Canadian Grand Prix 1994 F1 cars used special 102 octane fuel that gave the engine far more power than normal petrol. The teams used more powerful fuel for the qualifying laps than in the actual race when economy is more important and they want the lowest consumption possible to reduce the weight of the car. The average car consumes 1 litre for every 1,600 metres. New rules introduced for the season meant that teams would have to use standard pump fuel - the thinking behind this was to reduce engine power and make the less wealthy teams (who were using standard fuel anyway) more competitive.

Fuel consumption figures are very important to the racing teams and these are monitored carefully during practice. Information is gathered by the telemetry system and passed to the pits. Ideally, the car should finish the race with two or three litres left in the tank. If the rate of consumption is high then drivers can set the mixture control to a leaner setting. It's vital that they know how much fuel is left in the tank, down to the last drop.

Marshals quickly extinguish a fire after Martin Brundle's McLaren blows up at the start of the British Grand Prix. Race officials are always aware of the risk of fire and the dangers to the drivers.

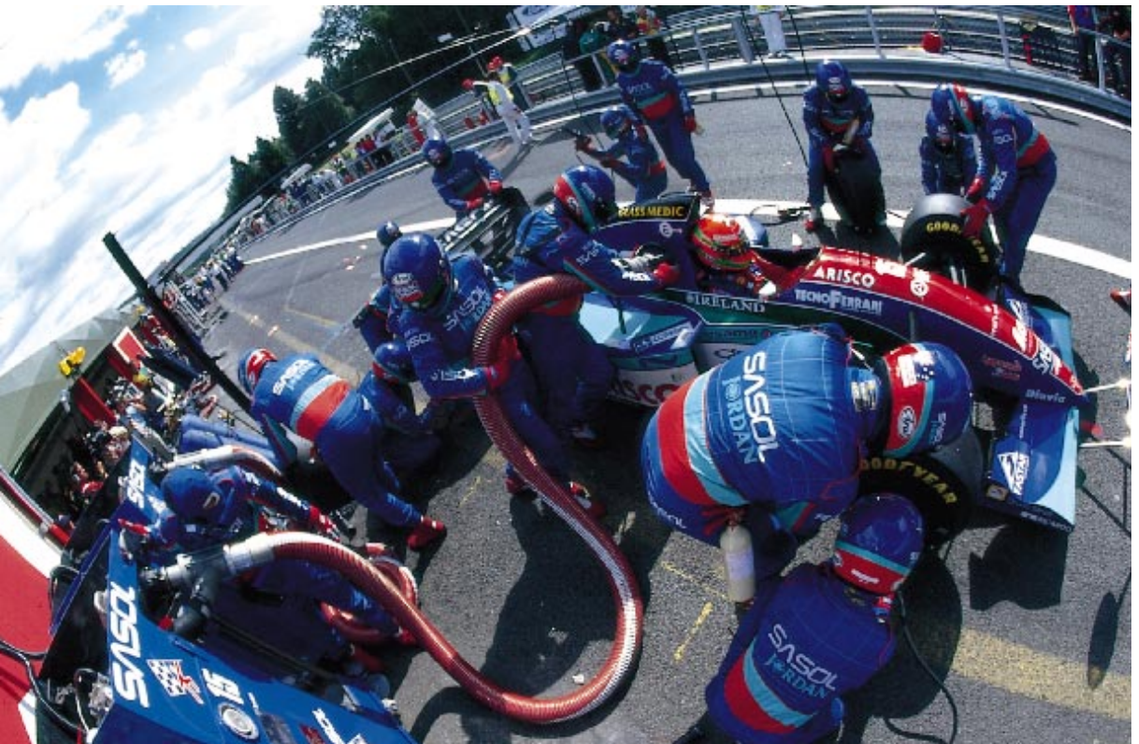
REFUELLING

Rules changed at the end of the 1993 season to allow cars to be refuelled during a race; a feature previously banned because of the danger of fire but re-introduced to add to the excitement of pitstops and race strategy. The FIA-supplied equipment is exactly the same for all teams, made by Intertechnique, the aircraft refuelling specialists. Charged with nitrogen, the system can pump 12 litres per second with pressure controlled by a valve. The rig itself is six feet high weighing 700 kg with thick steel walls. The hose has an inner and outer sleeve allowing the fuel along the inside and venting back up the outer. The tank vent is critical; otherwise the chassis would split under the incoming pressure.

GEARS

Semi-automatic systems are now standard: using short levers just behind the steering wheel (the right side for up, the left side for down). This means that the driver's hands stay on the wheel at all times, changes are much quicker. The ratios in the box are set up for each individual circuit depending on information received during practice. A cog is fitted based on the top speed needed in the fastest straight and the remainder adjusted downwards.

A new spectacle was introduced the previous season for the TV audience - refuelling. Each team's refuelling equipment is supplied through motor racing's governing body, the FIA. The refuelling system is cooled using nitrogen and can deliver 12 litres of fuel per second.



PIT BOARDS

These are used by the pit crew to tell the driver his position in the race, the number of laps left, how many seconds he is from the leader, how many seconds he is from the car behind and any other information they think helpful. Although F1 cars carry radios, teams prefer to have a surefire visual sign for the driver. For example if a pit board read:

P4 L23 -3.5 +7.0

the driver would know that he was in fourth position, with 23 laps to go, 3.5 seconds behind the third place car and 7 seconds in front of the fifth place car.

SUSPENSION.

F1 suspension has to be strong and rigid enough to stand up to the huge forces exerted by downforce. At 180 mph the car effectively quadruples in weight and, the faster a car goes the lower it drops, so it's vital that the car should have extremely stiff springs. At slower speeds however, before aerodynamics begin to play a major role, the cars need a softer spring in order to achieve mechanical grip. To overcome this problem, teams have developed variable rate springs, so that the faster a car goes the stiffer the suspension becomes.

TIMING AND OTHER DATA

In Formula One races a small radio transmitter is fixed onto each car which emits a unique signal back to an antenna buried in the track asphalt on the finish line. Data collected includes lap times, maximum lap speeds and speeds over certain specified sections of the circuit, as requested by individual teams. A print-out is produced for each car and is studied very carefully by the engineers, mechanics and drivers. Other data that can be collected includes: throttle position, exhaust gas analysis, the temperature of air pouring through the engine, pressure in clutch and brake lines, stress in suspension components, steering angle and g forces.

PIT STOPS

A good tyre change pit stop can take six seconds but a bad one can take double that time and mean the loss of a good position in the race. Usually, the big teams have three men to a wheel, two men to handle the jack and one man to hold the board to tell the driver to keep his brakes on. In 1994 refuelling was re-introduced to Formula One racing for the sole purpose of making the races more attractive to TV audiences - especially when one driver dominated in a season. The refuelling process upped the number of pit crew to 20.

The Williams pit crew changing Damon Hill's tyres at the Hungarian Grand Prix. The race ended in victory for Schumacher who saw his lead, over second place Hill, increase to 31 points.

Gerhard Berger in the pits during the qualifying stages of the Hungarian Grand Prix. Electric tyre blankets cover the tyres to bring them up to racing temperature.

A pit stop for anything else but tyres or fuel might only be worthwhile if a team is likely to gain points or, in the case of smaller teams, the possibility of finishing which may affect pre-qualification. Some drivers may be asked to come into the pits earlier than expected for tactical reasons if they are stuck in traffic and will benefit from returning to a clear track with new tyres.

The driver must not drive excessively fast in the pit lane, otherwise he will be fined heavily. He must position the car carefully to the exact point indicated by the pit crew, not an easy task when the pit lane is dirty, greasy and full of people. When the car is jacked up the driver keeps his foot on the brake, stays in neutral and keeps the engine revs up above 4000rpm to prevent stalling. As soon as the pit crew are ready, the car is jacked down, the 'Brakes On' board is taken away, the driver has already revved up to about 8000rpm, he slips into first and drives away carefully trying to avoid the other people in the pit lane. At the end of the pit lane stands a marshal with a light blue overtaking flag who will signal if a faster car is approaching on the track.

SAFETY REGULATIONS FOR THE PROTECTION OF THE DRIVER.

These are stringent rules specified by FIA.

The nose cone and the survival cell chassis must have undergone impact tests.

The fuel tank must be within the chassis width and behind the driver.

The driver's feet must rest behind the front axle line.

The driver's head must be below a line drawn from the main roll over bar to the dash hoop.

The driver must be strapped to a six point seat harness.

The driver must wear fireproof underwear, balaclava, gloves, three layer overall, boots and a helmet. These must have the capacity to give him 30 seconds protection in a blazing car.

F1 cars must have a fire extinguisher and power cut-off points accessible from inside and outside the car.

CAR RULES CHANGES 1994

The tragedy of Imola changed the face of Grand Prix. A host of new regulations were initiated to improve safety. Here Barrichello leaves the track as his car hits the kerb at Variante Bassa chicane. Luckily, he escaped serious injury.

The rules governing car specifications and the Formula One racing rules were changed several times throughout the 1994 season. As always, if any team, car or driver does not adhere to these rules they are penalised heavily. The new rules affect car design, with the emphasis on aerodynamics, driving aids (such as traction control) and structural safety.

Mika Hakinnen walks safely away from his McLaren after he and Damon Hill collided at Virage St Devote, Monaco. Race marshals prepare to winch the car off the tight street track.

REDUCING DOWNFORCE

The FIA introduced the 'Plank' as an aerodynamic restriction on all Formula One cars. The 10mm Plank is fixed along the base length of the car giving a one-third reduction in *downforce*. This forced all the teams to raise their cars to accommodate the plank, allowing more air to sweep under the cars, reducing grip and slowing them down.

More restrictions were made on the cars by limiting the size of the front and rear wings and the introduction of a 50mm stepped chassis, a safety measure that has been used in Indycar for some time.

ENGINE POWER

In 1994, engines were still rated at 3.5 litres (reduced from 3.5 litres to 3.0 litres in 1995). Mixed fuel became illegal in 1994 and the standard pump product has to be used by all teams. Fuel is one of the many things closely monitored by the FIA at all stages of racing.

FUEL TANK MINIMUM SIZE RESTRICTION LIFTED

1994 saw the 'minimum fuel tank size' lifted, allowing designers to produce a car with much better weight distribution. Although with smaller tanks, cars have to make at least one fuel stop per race, possibly three depending on the course and team strategy.

TRANSMISSION AND ELECTRONICS SYSTEMS RESTRICTIONS

Two other parts of the cars that were closely monitored by the FIA during 1994 were the transmission and the electronics systems. The cars now having reduced *downforce* meant that traction control was of utmost importance. In 1994 electronic traction control systems were outlawed, but 'fly-by-wire' methods of throttle control were still permissible.

COCKPIT SPECIFICATION CHANGES

The most noticeable structural change made to the cars in 1994 was the increase in size of the cockpit opening by 150 mm to 650 mm, with a minimum distance of 50mm between the steering wheel and the front of the cockpit. The height of the cockpit has also been raised by 150 mm. These two changes reduce the risk of drivers sustaining head and neck injuries in crashes.

CHASSIS CHANGES

Other changes to car specifications include a 750mm minimum distance from the front of the cockpit to the front wheel axle line. This means that the drivers pedals are behind the axle line. Also the length of the deformable structure in front of the driver's legs has doubled to 300mm, and the protective cone must be filled with an FIA approved impact absorbent material. These changes obviously make the cars much safer for the driver.

EFFECTS ON PERFORMANCE

All of these changes to the car structure have an effect on its performance, reducing its power, its traction and ultimately the speed the car can go. However, so long as all the teams adhere to the new specifications, the races should be closer, whilst being a lot safer for the drivers.

not needed

WILLIAMS-RENAULT

Address: Williams Grand Prix Engineering, Basil Hill Road, Didcot, Oxfordshire OX11 7HW. Great Britain.

Established: 1969

First Grand Prix: Argentina

General Director: Frank Williams

Technical Director: Patrick Head

Team Manager: David Williams

Employees: 200

Engine: Renault RS6 V10

Chassis: Williams FW16B

BENETTON-FORD

Address: Benetton Formula Ltd. Unit 9, Witney Trading Estate, Station Lane, Witney, Oxon OX8 6X2. Great Britain.

Established: 1970

First Grand Prix: Italy 1981

General Director: Alessandro Benetton

Technical Director: Ross Brawn

Team Manager: Flavio Briatore

Employees: 170

Engine: Ford Zetec R V8

Chassis: Benetton B194

TYRRELL-YAMAHA

Address: Tyrrell Racing Organisation Ltd. Long-Reach, Ockham, Woking, Surrey GU23 6PE. Great Britain.

Established: 1960

First Grand Prix: Canada 1970

General Director: Ken Tyrrell

Technical Director: Harvey Postlethwaite

Team Manager: Rupert Manwearing

Employees: 70

Engine: Yamaha OX10 AV10

Chassis: Tyrrell 022

Katayama in the Tyrell racing uphill towards Roses Bar at Monaco. Unfortunately he later spun off the track on the 38th lap.

MCLAREN- PEUGEOT

Address: McLaren International Ltd, Woking Business Park, Albert Drive, Woking, Surrey, GU21 5JY. Great Britain.

Established: 1963

First Grand Prix: Monaco 1966

General Director: Ron Dennis

Technical Director: Neil Oatley

Team Manager: Dave Ryan

Employees: 180

Engine: Peugeot A4 or A6

Chassis: McLaren MP 4/9

ARROWS-FORD

Address: Arrows Grand Prix Int. Ltd, 39, Barton Road, Water Eaten Industrial Estate, Bletchley, Milton Keynes, Bucks. MK2 3HW. Great Britain.

Established: 1977

First Grand Prix: Brazil 1978

General Director: Jackie Oliver

Technical Director: Alan Jenkins

Team Manager: John Wickham

Employees: 148

Chassis: Arrows FA 15

Engine: Ford HB V8

JORDAN-HART

Address: Jordan Grand Prix, Silverstone, Northants, NN12 8TJ Great Britain.

Established: 1981

First Grand Prix: USA 1991

General Director: Eddie Jordan

Technical Director: Gary Anderson

Team Manager: John Walton

Employees: 50

Chassis: Jordan 194

Engine: Hart 1035 V10

Rubens Barrichello in the Jordan Hart passes La Rascasse at the Monaco Grand Prix. Rubens was to retire on lap 27 with electrical problems.

LOTUS-MUGEN

Address: Team Lotus, Ketteringham Hall, Whymondham, Norfolk, NR18 9RS Great Britain.

Established: 1954

First Grand Prix: Monaco 1958

General Director: Peter Collins

Technical Director: Peter Wright

Team Manager: Trevor Foster

Employees: 40

Chassis: Lotus 107C

Engine: Mugen Honda ZA 5C V10

LARROUSSE-FORD

Address: Larrousse F1, Z.E. de Signes, 83870 Signes, Woking, France.

Established: 1987

First Grand Prix: San Marino 1987

General Director: Gerard Larrousse

Technical Director: Robin Herd, Michel Tetu

Team Manager: Gerard Larrousse

Employees: 45

Chassis: Larousse LH94

Engine: Ford HB VII V8

MINARDI-FORD

Address: Minardi Team SpA, Via Spallanzani 21 (Z.I), 48018 Farenza, Italy

Established: 1974

First Grand Prix: Brazil 1985

General Director: Gian Carlo Minardi

Technical Director: Aldo Costa

Team Manager: Gian Carlo Minardi

Employees: 75

Chassis: Minardi M194

Engine: Ford HB V8

LIGIER-RENAULT

Address: Ligier Sport SA, Technopole, 58470 Magny-Cours, France.

Established: 1969

First Grand Prix: Brazil 1976

General Director: Flavio Briatore

Technical Director: Frank Dernie

Team Manager: Cesare Fiorio

Employees: 150

Chassis: Ligier JS41

Engine: Renault RS 6 V10

FERRARI

Address: Ferrari SpR, Via Ascari 55, 41053 Maraello (MO), Italy

Established: 1929

First Grand Prix: Monaco 1950

General Director: Luca Di Montezemolo

Technical Directors: John Barnard, Claudio Lombardi, Valerio Bianchi

Team Manager: Jean Todt

Employees: 330

Chassis: Ferrari 412 TI

Engine: Ferrari E4A 94

SAUBER-MERCEDES BENZ

Address: PP Sauber AG, Wildbachstrasse 9, 8340 Hinwil, Switzerland.

Established: 1972

First Grand Prix: South Africa 1993

General Director: Peter Sauber

Technical Director: Andre de Cortanze

Team Manager: Carmen Ziegler

Employees: 75

Chassis: Sauber C13

Engine: Mercedes-Benz V10

SIMTEK-FORD

Address: Simtek Grand Prix Ltd, 8, Wates Way, Acre Estate, Wildmere Road, Banbury, Oxon. OX16 7TS. Great Britain.

Established: 1994

First Grand Prix: Brazil 1994

General Director: Nick Wirth

Technical Director: Nick Wirth

Team Manager: Charlie Moody

Employees: 35

Chassis: Simtek S941

Engine: Ford HB V8

PACIFIC-ILMOR

Address: Urses Pacific Grand Prix, Brunel Business Centre, Brunel Way, Thetford, Norfolk, IP24 1HP. Great Britain.

Established: 1992

First Grand Prix: Brazil 1994

General Director: Keith Wiggins

Technical Director: -

Team Manager: Ian Dawson

Employees: 35

Chassis: Ursus Pacific PRO1

Engine: Ilmor V10 F1

APPENDIX J
1994 Constructors' Championship

Position	Make	Points	Poles	Victories	Best Laps	Best Laps Lead	KM's in Lead
1	Williams Ford	118	6	7	7	294	1336
2	Benetton Ford	103	6	8	9	626	2727
3	Ferrari	71	3	1	0	102	592
4	McLaren Peugeot	42	0	0	0	13	64
5	Jordan Hart	28	1	0	0	3	13
6	Tyrell Yamaha	13	0	0	0	0	0
7	Ligier Renault	13	0	0	0	0	0
8	Sauber Mercedes	12	0	0	0	0	0
9	Arrows Ford	9	0	0	0	0	0
10	Minardi Ford	5	0	0	0	0	0
11	Larrouse Ford	2	0	0	0	0	0

APPENDIX K
1994 Participating Drivers

Williams-Renault

RACE NUMBER 0

- Name: HILL
- First Names: Damon Mark
- Nationality British
- Date of Birth: September 17, 1960
- Place of Birth: London GB

Over the last two seasons Damon Hill has proved that he is one of the most talented drivers in Formula One, only losing the Drivers' World Championship by one point. Damon was thrust into the Williams team leader position following Ayrton Senna's death at Imola, and he proved beyond a shadow of a doubt that he is capable of an exceptional performance.

RACE NUMBER 2

- Name: COULTHARD
- First Names: David
- Nationality: British
- Date of Birth: March 27, 1971
- Place of Birth: Twynholm GB

David Coulthard 'came from nowhere' at the beginning of the season, appointed to the team following Ayrton Senna's accident. The team's ex-test driver proved, after a single Grand Prix, that he was more than capable of handling the Williams-Renault FW16, and it was only bad luck that limited him to a season's total of 14 points.

Tyrrell-Yamaha

RACE NUMBER 3

- Name: KATAYAMA
- First Name: Ukyo
- Nationality: Japanese
- Date of Birth: May 29, 1963
- Place of Birth: Tokyo, Japan

The Japanese driver had some promising races with the Venturi-Larrousse team in 1992 but was out of the competition in 1993. In '94 he had a great season qualifying fifth at both Germany and Hungary but unfortunately suffered frequent engine failures, which prevented him scoring more than 5 points in the season.

RACE NUMBER 4

- Name: BLUNDELL
- First Name: Mark
- Nationality: British
- Date of Birth: April 8, 1966
- Place of Birth: Barnet, GB

In 1994 Mark Blundell has revealed his driving talents. His steady driving technique has allowed him to collect a total of 8 Championship points with three visits to the podium.

Benetton-Ford

RACE NUMBER 5

- Name: SCHUMACHER
- First Name: Michael
- Nationality: German
- Date of Birth: January 3, 1969
- Place of Birth: Hurth-Hermuhlheim , Germany

The 1994 World Champion, Michael Schumacher, surpassed all his team's expectations, taking the new Benetton-Ford to seven wins in eight races. Although a very close season, nothing can be taken away from the German; his ability for setting up his car and his race performances have shown he is one of the most capable drivers in Formula One.

RACE NUMBER 6

- Name: VERSTAPPEN
- First Name: Jos
- Nationality: Dutch
- Date of Birth: March 4, 1972
- Place of Birth: Montfort, Netherlands

Hired as a test driver, Verstappen was called in to replace JJ Lehto close to the beginning of the season. For his first season he performed admirably, especially in the wake of Schumacher and there are high hopes for the young driver next season.

McLaren-Peugeot

RACE NUMBER 7

- Name: HAKKINEN
- First Name: Mika, Pauli
- Nationality: Finnish
- Date of Birth: September 28, 1968
- Place of Birth: Heksinki, Finland

McLaren hired Hakkinen to replace the dismissed Andretti. Throughout the season the Fin proved to be a strong competitor; occasionally too strong, as he was suspended from a Grand Prix following two accidents. Even so, he still managed seven podium visits, six of which were for top three placings.

RACE NUMBER 8

- Name: BRUNDLE
- First Name: Martin John
- Nationality: British
- Date of Birth: June 1, 1959
- Place of Birth: King's Lynn, GB

Martin Brundle's style and skill are undeniable, although having been racing in Formula One for ten seasons (131 Grand Prix) he has never consistantly succeeded. His best results of the year were coming second to Schumacher at Monaco and third at Australia and he totalled 16 points for the season.

Arrows-Ford

RACE NUMBER 9

- Name: FITTIPALDI
- First Name: Christian
- Nationality: Brazilian
- Date of Birth: January 18, 1971
- Place of Birth: Sao Paulo, Brazi

1994 was the third racing season for the young Brazilian. Having left Minardi after two full seasons. Driving for the Footwork team based in Milton Keynes, England he picked up a total of 6 points and finished 14th.

RACE NUMBER 10

- Name: MORBIDELLI
- First Name: Gianni
- Nationality: Italian
- Date of Birth: January 13, 1968
- Place of Birth: Pesaro, Italy

Returning to Formula 1 for the 1994 season following a short period of absence racing in Italy, Morbidelli was in excellent shape at the beginning of the season. Performing brilliantly in qualifying, including sixth place on the grid at Brazil, he promised great things. Unfortunately due to mechanical problems and the infamous spin he finished in 22nd place with 3 points in the Championship.

Lotus-Mugen

RACE NUMBER 11

- Name: ZANARDI
- First Name: Alessandro Leone
- Nationality: Italian
- Date of Birth: October 26, 1966
- Place of Birth: Bologna, Italy

Returning to Formula One for the Spanish Grand Prix to take Pedro Lamy's place, following a serious accident. Zanardi drove for the rest of the season but was unable to score any points.

RACE NUMBER 12

- Name: HERBERT
- First Name: Johnny
- Nationality: British
- Date of Birth: June 27, 1964
- Place of Birth: Romford, GB

Johnny Herbert had a disrupted season in '94. Beginning the season with Lotus for the first thirteen races, the team he has been with since 1990. Then moving to Ligier-Renault for one race and then to their sister company Benetton-Ford to aid their bid for the Constructors Championship. Unfortunately, Herbert was unable to finish at either Japan or Adelaide.

Jordan-Hart

RACE NUMBER 14

- Name: BARRICHELLO
- First Name: Rubens Goncalves
- Nationality: Brazilian
- Date of Birth: May 23, 1972
- Place of Birth: Sao Paulo (Brazil)

Barrichello had an exceptional season in '94; only his second in Formula One. Finishing the season with a total of 19 points and in sixth place overall. Six finishes in the top six including a third place at the Pacific Grand Prix at Aida and fourth at Brazil, Britain, Italy, Portugal and Australia. He remains with Jordan for next season; who have high hopes for the young Brazilian.

RACE NUMBER15

- Name: IRVINE
- First Name: Eddie
- Nationality: British
- Date of Birth: November 10, 1965
- Place of Birth: Newtownards, N. Ireland

Having only driven for Jordan in the last two races of the 1993 season, 1994 was the beginning of his first full season. Unfortunately it didn't start too well, Irvine was blamed for the horrific crash at the Brazilian Grand Prix, and was ultimately banned for three races. However, following the ban he finished three times in the top six, showing that he has the capability to compete against the well-established drivers.

Eddie Irvine races through the pit straight in the French Grand Prix. The Jordan Hart engine performed excellently throughout the season, earning the team 5th place in the Constructors' Championship.

Larrousse-Ford

RACE NUMBER 19

- Name: BERETTA
- First Name: Olivier
- Nationality: Italian
- Date of Birth: November 23, 1969
- Place of Birth: Monte-Carlo

Beretta's first season in Formula One lasted just ten months. Only able to complete four of his ten races, (his best finish, a seventh place at Hockenheim, Germany) the young Italian left the Larrousse team voluntarily at the Belgian Grand Prix.

RACE NUMBER 20

- Name: COMAS
- First Name: Erik Gilbert
- Nationality: French
- Date of Birth: September 28, 1963
- Place of Birth: Romans, France

Comas like his team mate Beretta didn't complete the 1994 season. Unhappy with the performance of the Larrousse Ford and suffering several retirements throughout the season, he finished with a total of two sixth places and 2 points.

Minardi-Ford

RACE NUMBER 23

- Name: MARTINI
- First Name: Pierluigi
- Nationality: Italian
- Date of Birth: April 23, 1961
- Place of Birth: Lugo di Romagna, Italy

Performing well during the '94 season, Martini drove well despite the resrictions of his car. In the latter stages of the season Minardi's engineers spent more time fixing the car than developing it; possibly restricting their progress next season.

RACE NUMBER 24

- Name: ALBORETO
- First Name: Michele
- Nationality: Italian
- Date of Birth: December 23, 1956
- Place of Birth: Milan, Italy

Michele Alboreto completed the '94 season with one point for a sixth place at Monaco. Having only scored a total of seven points over the last four years, at the end of the season Alboreto was thinking of retiring from Formula One.

Ligier-Renault

RACE NUMBER 25

- Name: BERNARD
- First Name: Eric
- Nationality: French
- Date of Birth: August 24, 1964
- Place of Birth: Istres, France

Returning to Formula One following a two-year absence because of a horrific accident at Suzuka in 1991, Bernard made his highest ever finish at Hockenheim with a visit to the winner's podium. Unfortunately, Bernard will be racing for another team in '95, following Flavio Briatore's decision to bring Johnny Herbert to the Ligier team

RACE NUMBER 26

- Name: PANIS
- First Name: Olivier Denis
- Nationality: French
- Date of Birth: September 2, 1966
- Place of Birth: Lyon, France

Olivier Panis competed brilliantly in his first Formula One season, managing to complete 15 out of the 16 Grand Prixs. Panis proved that he had the skills of a world champion in the making; calm, consistantly quick and never making a mistake. There are high hopes for his performance next season.

Ferrari

RACE NUMBER 27

- Name: ALESI
- First Name: Jean
- Nationality: French
- Date of Birth: June 11, 1964
- Place of Birth: Avignon, Franc

1994 was Alesi's best season so far. Collecting pole position at Monza with some controlled, hair-raising driving, he finished with a total of four podium visits. He is still waiting for his first Grand Prix win, but Ferrari will need something very special for this to happen next season.

RACE NUMBER 28

- Name: BERGER
- First Name: Gerhard
- Nationality: Austrian
- Date of Birth: August 27, 1959
- Place of Birth: Worgi, Austria

Winning the team's first victory in four years at Hockenheim in '94, Berger showed that he was in good shape this season. He maintains a strong commitment to his career and Ferrari .

Sauber-Mercedes Benz

RACE NUMBER 29

- Name: de CESARIS
- First Name: Andrea
- Nationality: Italian
- Date of Birth: May 31, 1959
- Place of Birth: Rome, Italy

The fifteen year F1 veteran returned once again to replace Eddie Irvine at Jordan following the Imola and Monaco crashes. De Cesaris then replaced Karl Wendlinger after his accident but unfortunately was only able to score one point, at the French Grand Prix.

RACE NUMBER 30

- Name: FRENTZEN
- First Name: Heinz-Harald
- Nationality: German
- Date of Birth: May 18, 1967
- Place of Birth: Monchengladbach, Germany

Scoring two points in only his second Grand Prix and qualifying third at Japan, Frentzen's skills haven't gone unnoticed. He had been approached by several other teams but decided to remain with the new Sauber-Ford team. Great results are expected from this driver next season.

Simtek-Ford

RACE NUMBER 31

- Name: BRABHAM
- First Name: David
- Nationality: Australian
- Date of Birth: September 5, 1964
- Place of Birth: Wimbledon, GB

This season David Brabham was returning to Formula One for the first time since 1990. Previously, he drove for the Brabham team, but now has returned to join the Simtek-Ford team. Brabham proved to be a fast, safe driver, however unfortunately, Simtek as with all new teams have teething problems and Brabham had several retirements.

RACE NUMBER 32

- Name: GOUNON
- First Name: Jean-Marc
- Nationality: French
- Date of Birth: January 1, 1963
- Place of Birth: Aubenas

Gounon didn't begin to race for Simtek until the mid-part of the season due to car testing and modifications. Simtek wanted the Frenchman to race from the beginning of the season, but Gounon wanted to wait for a more competitive car.

Pacific-Ilmor

RACE NUMBER 33

- Name: BELMONDO
- First Name: Paul Alexandre
- Nationality: French
- Date of Birth: April 23, 1963
- Place of Birth: Paris, France

Belmondo has only been able to qualify for two Grand Prix in 1992: Monaco and Spain, and in the three seasons that he has been in Formula One he hasn't amassed any points. However Belmondo remains undetered and confident, content to keep competing in Formula One.

RACE NUMBER 34

- Name: GACHOT
- First Name: Bertrand
- Nationality: Belgian
- Date of Birth: December 22, 1962
- Place of Birth: Luxembourg

Returning from a one year absence, Betrand Gachot has joined the Pacific team. Even though non-qualifications were abundant, Gachot has found a team that has potential and that he is happy with. Next year should be a lot better for the Pacific team and its drivers.

[ ] - did not start season as original driver

Name	Team	Number	Races
Michael Schumacher	Benetton	5	1-11, 13-16
Damon Hill	Williams	0	All
Gerhard Berger	Ferrari	28	All
Mika Hakkinen	McLaren	7	1-9, 11-16
Jean Alesi	Ferrari	27	1, 4-16
Rubens Barrichello	Jordan	14	All
Martin Brundle	McLaren	8	All
[David Coulthard]	[Williams]	[2]	5-6, 8-13
Ayrton Senna	Williams	2	1-3
[Nigel Mansell]	[Williams]	[2]	7, 14-16
Jos Verstappen	Benetton	6	1-2, 7-14
Olivier Panis	Ligier	26	All
Martin Blundell	Tyrrell	4	All
Heinz-Harald Frentzen	Sauber	30	All
[N. Larini]	[Ferrari]	[27]	2-3
C Fittipaldi	Arrows	9	All
Eddie Irvine	Jordan	15	1, 5-16
Ukyo Katayama	Tyrrell	3	All
Eric Bernard	Ligier	25	1-13
[Eric Bernard]	[Lotus]	[12]	13
Karl Wendlinger	Sauber	29	1-4
[Andrea de Cesaris]	[Jordan]	[15]	3-4
[Andrea de Cesaris]	[Sauber]	[29]	6 -14
Pier-Luigi Martini	Minardi	23	All
Gianni Morbidelli	Arrows	10	All
Eric Comas	Larousse	20	1-15
Michael Alboreto	Minardi	24	All

[JJ Lehto]	[Benetton]	[6]	3-6, 12-13
[JJ Lehto]	[Sauber]	[29]	15-16
[P Adams]	[Lotus]	[11]	11, 13
[P Aliot]	[McLaren]	[7]	10
[P Aliot]	[Larousse]	[19]	11
P Belmondo	Pacific	33	All
O Beretta	Larousse	19	1-10
D Brabham	Simtek	31	All
[Y Dalmas]	[Larousse]	[19]	12-13
[J-D Delatraz]	[Larousse]	[20]	16
Bertrand Gachot	Pacific	34	All
[J-M Gounon]	[Simtek]	[32]	7-13
Johnny Herbert	Lotus	12	1-13
[Johnny Herbert]	[Ligier]	[25]	14
[Johnny Herbert]	[Benetton]	[6]	15-16
[T. Inoue]	[Simtek]	[32]	15
[F. Lagorce]	[Ligier]	[25]	15-16
P. Lamy	Lotus	11	1-4
[A. Montermini]	[Simtek]	[32]	5
[Hideki Noda]	[Larousse]	[19]	14-16
Roland Ratzenberger	Simtek	32	1-3
[M Salo]	[Lotus]	[12]	15-16
[D. Schiattarella]	[Simtek]	[32]	14,16
[A Suzuki]	[Jordan]	[15]	2
[A. Zanardi]	[Lotus]	[11]	5-9, 12, 14-16

APPENDIX L 1994 Season Point Results

Pos	Driver	Make	Bra	Pac	San	Mon	Spa	Can	Fre	Bri	Ger	Hun	Bel	Ita	Por	Eur	Jap	Aus	Total
1	Michael Schumacher	Benetton Ford	1	1	1	1	2	1	1	D	A	1	D	-	-	1	2	A	92
2	Damon Hill	Williams Renault	2	A	6	A	1	2	2	1	8	2	1	1	1	2	1	A	91
3	Gerhard Berger	Ferrari	A	2	A	3	A	4	3	A	1	12	A	2	A	5	A	2	41
4	Mika Hakkinen	McLaren Peugeot	A	A	3	A	A	A	A	3	A	-	2	3	3	3	7	12	26
5	Jean Alesi	Ferrari	3	-	-	5	4	3	A	2	A	A	A	A	A	10	3	6	24
6	Rubena Barrichello	Jordan Hart	4	3	-	A	A	8	A	4	A	A	A	4	4	12	A	4	19
7	Martin Brundle	McLaren Peugeot	A	A	8	2	11	A	A	A	A	4	A	5	6	A	A	3	16
8	David Coultard	Williams Renault	-	-	-	-	A	5	-	5	A	A	4	6	2	-	-	-	14
9	Nigel Mansell	Williams Renault	-	-	-	-	-	-	A	-	-	-	-	-	-	A	4	1	13
10	Jos Verstappen	Benetton Ford	A	A	-	-	-	-	A	8	A	3	3	A	5	A	-	-	10
11	Olivier Panis	Ligier Renault	11	9	11	9	7	13	A	12	2	6	7	10	9	9	11	5	9
12	Mark Blundell	Tyrrell Yamaha	A	A	9	A	3	11	10	A	A	5	5	A	A	13	A	A	8
13	Heinz-Harald Frentzen	Sauber Mercedes	A	5	7	-	A	A	4	7	A	A	A	A	A	6	6	7	7
14	Nicola Larini	Ferrari	-	A	2	-	-	-	-	-	-	-	-	-	-	-	-	-	6
15	Christian Fittipaldi	Arrows Ford	A	4	13	A	A	6	8	9	4	14	A	A	8	17	8	8	6
16	Eddie Irvine	Jordan Hart	A	-	-	-	6	A	A	A	A	A	13	A	7	4	5	A	6
17	Ukyo Katayama	Tyrell Yamaha	5	A	5	A	A	A	A	6	A	A	A	A	A	7	A	A	5
18	Eric Bernard	Ligier Renault	A	10	12	A	8	14	A	13	3	10	10	7	11	-	-	-	4
-	" "	Lotus Mugen	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-
-	Karl Wendlinger	Sauber Mercedes	6	A	4	-	-	-	-	-	-	-	-	-	-	-	-	-	4
-	Andrea DeCesaris	Jordan Hart	-	-	A	4	-	-	-	-	-	-	-	-	-	-	-	-	4
-	" "	Sauber Mercedes	-	-	-	-	-	A	6	A	A	A	A	A	A	A	-	-	-
-	Pierluigi Martini	Minardi Ford	8	A	A	A	5	10	5	10	A	A	8	A	13	15	A	9	4
22	Gianni Morbidelli	Arrows Ford	A	A	A	A	A	A	A	A	5	A	6	A	10	11	A	A	3
23	Eric Comas	Larrousse Ford	9	6	A	10	A	A	11	A	6	8	A	8	A	A	9	-	2
24	Michele Alboreto	Minardi Ford	A	A	A	6	A	12	A	A	A	7	9	A	14	14	A	A	1
-	JJ Lehto	Benetton Ford	-	-	A	7	A	7	-	-	-	-	-	9	A	-	-	-	1
-	" "	Sauber Mercedes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A	10	-

Abbreviations: (-) - Did not race. (D) - Disqualified. (A) - Abandoned, did not finish race.

Summary of Points: 1st: 10 Points. 2nd: 6 Points. 3rd: 4 Points. 4th: 3 Points. 5th: 2 Points. 6th: 1 Point

APPENDIX M Glossary

Active Suspension	Software controlled method of automatically pitching the suspension for specific bends.
Aerodynamics	The force that comes into play when the car has picked up speed. Wings mounted upside down give negative lift and hold the car down.
Angle of Slip	The angle between the direction of the wheels (front and rear) and the direction of travel.
Anti-Roll Bar	Forms part of the suspension assembly and helps to support the car when cornering, by resisting the tendency for the body to roll.
Apex or Clipping Point	The nearest point a car gets to the inside of a curve in an ideal racing line.
Balance	The degree to which a car has understeer or oversteer in a corner.
Brake Balance	The bias of braking power between the front and rear tyres.
Braking Distance	The distance between the point where braking starts and ends.
Bump Damper	An energy absorbing device, fitted between the wheel and car body, which resists upward movement by the wheel.
Camber	Slight upward curve to the centre of race track.
Camber Angle	Camber angle is designed to make a tyre work as effectively as possible when a car is going through a corner. Negative camber is applied so that when fully stressed a tyre will be as close to perpendicular as possible.
Castor Angle	Castor gives greater responsiveness and stability to the front wheels. The larger the castor angle, the heavier the steering and more stable the front end.
Centre of Gravity	The position within the car around which all the mass is gathered. The lower the centre of gravity, the greater the downforce.
Chicane	A sharp 'S' bend that reduces speeds by forcing drivers to drive through in single file.
Damper	Forms part of the suspension system and absorbs the energy that is produced when the spring is compressing or extending. Damper force increases with speed (heave, roll and pitch velocity).

Downforce	The force which pushes the car downward allowing the vehicle to 'grip' the road surface.
Drag	Resistance to forward motion of the car. Can be caused by aerodynamic resistance or mechanical resistance.
Electronic Control Box	Contains, among other information, the Driver aids software and settings, (traction control, active suspension etc.) The Electronic Control Boxes are frequently inspected by the FIA following a race to test for illegal driving aids being used by constructors.
FIA	Federation Internationale de l'Automobile. The motor racing sport's governing body.
Getting a Tow	Another term for 'slipstreaming', gaining speed by sitting behind a rival car prior to overtaking.
Ground Effect	Now outlawed by FIA but in the period 1980 to 1982 virtually all cars were built in this way. The car had an underbody shaped like an inverted wing which almost sucked the car on to the track and gave tremendous grip.
Increase the Lock	For some tight hairpins, such as Loews in Monaco, the car steering lock is increased to take the bends faster albeit to the detriment of the tyres.
Logged data chart	Graphical method of displaying information which has been recorded during a lap. Also known as Performance Analysis.
Outbrake	To brake very late into a corner when dicing with a rival car.
Oversteer	Oversteer is characterised by the rear end of the car losing grip, giving the car a tendency to spin.
Packers	Packers form part of the suspension assembly and adjust the position at which the bump rubbers become loaded.
Paddock	The parking area behind the pits where all the equipment, trucks and spare cars are kept by the teams.
Parc Fermé	The area where cars are isolated after a race finishes. Only officials may touch the vehicles for an hour after the finish. Some engines may be 'sealed' for later inspection.

Plank, The	A 10mm plank running down the length of the underside of all F1 cars. This addition following the '94 Imola Grand Prix, means that the ride height of the car must be sufficient to avoid the plank 'grounding'. This results in less downforce and therefore lower speeds, particularly round dangerous corners.
Points System	The points awarded for finishing a Grand Prix are as follows: 1st = 10 points, 2nd = 6 points, 3rd = 4 points, 4th = 3 points, 5th = 2 points and 6th = 1 point.
Rebound damper	An energy absorbing device fitted between wheel and car body which resists downward movement by the wheel.
Refuelling	Refuelling is an essential part of race strategy. The less fuel a car holds, the faster it can travel, but this will result in the need for more time-consuming pit stops to refuel.
Responsive handling	The car responds quickly to steering, acceleration and braking inputs from the driver, allowing very accurate manoeuvres.
Rev limiter	A device which limits the RPM of the engine to a preset value. This is used in the pit lane to keep the car speed within the pit lane speed limit.
Ride height	The height of the car floor, above the ground, measured from the wheels.
Rumble Strip	The bobbly, coloured strip on the edge of the track which serves as a warning to the driver to transgress no further.
Run Off Track	A stretch of track close to a dangerous section of the circuit, that gives the driver an escape route if things go wrong, e.g. the driver loses control of the car.
Shunt	A knock from the car behind you.
Skidblock	See Plank, The.
Springs	The springs form part of the suspension assembly and are the main means of supporting the car.
Stewards Decision	In the event of a breach of FIA rules, a stewards enquiry is normally called. The party in question is called before the 'Steward of the Meeting' who issues a 'Stewards Decision' with accompanying fine/disciplinary action, if relevant.

Super Licence	A licence required by all drivers, competitors and officials participating in a Formula One Championship.
Suspension travel	The distance through which the moving parts of the suspension travel in relation to the fixed parts.
Telemetry System	Multi-function system that measures all aspects of car and driver performance.
Tifosi	Italian Fans.
Time Penalties	Should the stewards choose to impose a time penalty the offending driver must, in normal circumstances, proceed to the designated area and remain there until a specified time period has passed, after which the driver may rejoin the race.
Torque	The amount of thrust driving through from the engine to the wheels.
Traction	The ability of the rear tyres to grip the track surface and cause the car to accelerate.
Traction Control	An electronically-controlled clutch allowing the car to accelerate as fast as possible without losing traction and the wheels spinning. This system was outlawed in the '94 season.
Turn-in	The point on the track where the driver starts to steer the car into a corner.
Tyre Blankets	Special electric blankets placed over tyres just before a start to keep them up to racing temperature.
Understeer	Understeer is characterised by the front end of the car losing grip. This gives the rear of the car a tendency to carry straight on, through a corner.
Wings	Devices fitted to the front and rear of the car which produce aerodynamic downforce. This allows faster cornering speeds. The rear wing also produces significant aerodynamic drag.

Grand Prix 2 Credits

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