Sim Association for Stock Car Auto Racers

SETUP GUIDE

NASCAR 2002 Chassis Setup Guide

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In an effort to clear up some of the confusion over all the setup options included within NASCAR 2002, I decided to put this guide together to help you better understand what, why, & how adjustments are made in the sim. Just about all the available setup options that you can adjust on a real WC car can be adjusted in the sim. With so many different combinations of possibilities it leaves us with literally thousands of possible chassis combinations to choose from. For the novice sim racer, all these setup options can seem overwhelming & confusing without the knowledge of what all these adjustments are or do.

By understanding the basics of what each component is & how it directly effects the car, you'll quickly discover what direction you should head when trying to adjust for that looseness exiting the corner under acceleration. This guide is very similar to the NASCAR 4 setup guide. Much of the same information translates over to NASCAR 2002 as well. This setup guide also has new information based on the changes that go along with the 2002 version of the sim. This guide covers much of the basics for the less experienced sim racer as well as a troubleshooting section that should help reduce your lap times.

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CHASSIS ADJUSTMENTS

How to use this guide
The information in this guide may change without notice. I've tried to make this guide simple to use & easy to understand. By clicking on the contents you will be taken directly to the info your looking for. Throughout this guide I will use the abbreviations RF,RR,LF,&LR. These stand for right front, right rear, left front, & left rear respectively. Whenever I bring up the left or side of the car I'm talking about the drivers side. The right side of the car is the passenger side. All left & right references are viewed from the drivers position. By holding your mouse over a setup option for a few seconds in the sim, you will be given a brief description of how that adjustment works or what it affects. Right clicking an option brings up the description right away.

One last thing I must mention before turning the wrenches. It is important to understand that for every adjustment you attempt, it may not produce the desired results right away as mentioned below. You may have other chassis adjustments that are not quite right masking the problems your trying to adjust for. Because of this factor, you may not see as drastic a change in your adjustments after just one change. You may have to readjust another chassis component to so call "free" up your original adjustment. If you feel your setup is close, yet seems to be lacking that one minor adjustment, it may be more involved that just adjusting one more component. You may have to "undo" another few adjustments elsewhere then go back to your original adjustment to get it just right. For every action you take, there will be a counteraction that may not appear at first to be in the best interest of your setup. There may be times when you may have to take two steps back to gain one step forward. Because of this, chassis adjustments can become frustrating to figure out. It isn't easy, as many WC teams find out on any given Sunday. Perseverance & patience are required when playing this chassis setup game.

Where To Begin
Before attempting any chassis adjustments it is important for you as a driver to know & understand what your car is doing on the track. The only way to understand how your car is reacting is through seat time. The more laps you turn, or practice you get; the better off you will be in deciding what your trouble points are on the track.

Learn how to hit the same line lap after lap with the default setups packaged with NASCAR 2002 before attempting any other adjustments. The biggest mistake rookie drivers make, are trying to adjust a chassis for what they believe is an ill handling car. I get so many emails from drivers that think the default easy, intermediate or fast setups that come with the sim are terrible because they cannot drive them. You must become comfortable with these default setups before you should even look into tinkering with any adjustments in the garage. Begin with the easy setup, then graduate to the intermediate setup and lastly the fast setup. Only when you can run clean consistent laps with the easy setup, should you move up to the intermediate setup. The same goes with the intermediate setup before graduating to the fast. Only when you can run competitively with the fast setup against the AI at 97% without spinning out, should you attempt to make any adjustments in the garage. There are nothing wrong with the default setups in NASCAR 2002. If you cannot drive them properly it is because you simply do not have enough seat time and or experience.

I can't stress enough the importance of adjusting only ONE component at a time. Making more than one change is nonproductive because you won't be able to determine what change made the car better or worse. Be sure to have plenty of paper & pencil on hand. It is critical to take notes after every adjustment you make. With all the adjustments available to make, it's real easy to forget what adjustment you made 3 practice sessions ago. Record keeping is important. If you do go the wrong way with an adjustment you can always set it back to where it was before making the change by simply referring back to your notes. By tracking & logging information, it also allows you to refer back to them to see how you progressed to cure your handling problem. These notes could be useful for setups at tracks with similar configurations which can turn out to be a real time saver. By keeping track of adjustments, you will be able to refer back to your notes to see what worked & what didn't. This will help you decide what to adjust if a similar situation arises at another track.

Weather changes are another reason that record keeping becomes a must. The changes in the handling of your car in various weather conditions seems a lot more pronounced that previous releases. What works fine at 70 degrees & no wind may not be worth a damn at 90 degrees with a 20 mph wind. This is especially true for gearing and tape. In general, you'll want to loosen the car up some as the temperatures go up and tighten the chassis some as it gets colder. Keeping good records will ease your efforts & time over the long run.

I've included two setup sheets with this guide to help track your chassis adjustments. One is a chassis setup sheet for you to track all of your chassis settings. The second is a tire temperature sheet for logging tire temperature after practice sessions. Simply print as many of these sheets as you like to help aid in your record management.

One of the more overlooked aspects of chassis setup is the driver himself. More so than ever it's critical for drivers to run the same line over & over when practicing & adjusting. If you're entering the track low in turn 1 & the car is loose, don't make an adjustment then start entering the same corner in the middle. This again is nonproductive & you won't know if it's your line into the corner that has helped or made your condition worse or if it's the adjustment itself. Driver consistency is very important when trying to determine how a car is reacting throughout a corner. Smooth & gradual throttle, brake, & steering inputs are required. Gone are the days of barreling into a corner, slamming on the brakes, & cranking the wheel hard left.

As a driver it's very easy to mislead yourself into believing how your car is reacting through a corner. If your loose going into a corner then push in the middle & once again get loose exiting, it could very well be your driving habits. I see many drivers getting loose into the corners. When this situation occurs, the obvious reaction is to brake & turn into the spin in hopes of catching the back of the car. If you do manage to correct it, chances are you'll have a push in the middle as the car sets & grabs from you turning right in an effort to save it from corner entry. Now in an effort to get back low into the racing-groove, you jerk the wheel hard left applying throttle causing yourself to be loose. You may think your setup is all out to lunch when the fact of the matter is that it's you causing two thirds of the problem all because your loose entering the turn. You may still have cornering problems in the middle & exiting, but because of your looseness going in, you yourself could be making the rest of the corner a problem when in fact it really isn't.

Because of this, it is important to divide each corner into 3 sections. The entry, middle, & exit. Each section of the turn will be effected by how you negotiated the previous section. Corner entry is where you begin your chassis adjustments. If you can't get into a corner, don't bother adjusting for the rest of the corner. Don't mislead yourself into believing the car is doing something that it isn't. In the above example you must take care of the loose condition entering the corner before you setup for the rest of the corner. Once your happy with the setup entering the corner, work on how the car feels in the middle. Only after you have a neutral handling car entering the corner & through the middle do you attempt to work on adjustments exiting the turn. Many times by simply curing your corner entry problems, you'll cure your middle or exiting problems. This is because you won't be making corrections to either loosen or tighten up the car based on corner entry problems.

If you can always remember to divide each corner into sections, & work on entry before worrying about the rest of the corner, it should go along way towards simplifying the whole setup process. Be consistent & smooth with your driving inputs.

CHASSIS ADJUSTMENTS

Camber

Camber is the inward or outward tilt of the wheel at the top of the tire. Negative camber is the tilt of the top of the tire towards the center of the vehicle. Positive camber is the tilt of the top of the tire away from the center of the vehicle. Camber adjustments are utilized to help maintain the maximum grip allowable from the surface of the tire through the corners of the track. Proper camber adjustments are critical is achieving maximum cornering speeds. When camber is set correctly it allows the entire surface of the tire to adhere to the track maximizing the use of the contact patch when taking a corner at high speed.

Proper camber adjustments are achieved by reading tire temperatures. Read the section on Tire Temperatures for the proper way to decipher what your tires/camber are telling you. In a WC car you are allowed camber adjustments on all 4 tires. In NASCAR 2002 we are allowed a wide range of adjustment for the front tires. +5 is the most positive camber allowed, while -5 is the most negative camber allowed. In the rear we are only allowed adjustments of +1.8 through -1.8.

On all tracks except road courses you'll want to run with negative camber on the right front & positive camber on the left front. Running camber as such will create part of the pull to left that will help the car get through the corner easier. The more excessive the cambers the greater the pull can be. Running excessive amounts of camber will cause premature tire wear due to the fact that the tires aren't running on the full contact patch of the racing tire.

As a general rule, the flatter or slower the track the more camber you'll need on both front tires. More positive camber on the left front & more negative camber on the right front would be required at a track like Martinsville over a high speed high banked track like Talladega. Another factor in determining camber is body roll. The more the car "rolls" over through a corner the more negative camber you will need in the RF. Body roll is determined by how stiff your springs & or sway bars are. The stiffer the springs, the less body roll. The less body roll, the less amount of negative camber required in the RF.

Rear camber is not as critical as front camber due to the fact that the rear end is solid axle. The same theory holds true though as you might want negative camber on the RR & positive camber on the LR on an oval track. On a flatter track you may not need any camber in the rear. Stagger built into the Goodyear tires will naturally create some negative camber in the RR & positive in the LR as is.

When competing on a road course like Watkins Glen or Sears Point or any track where your making both left & right handed turns you'll need to "square" up your camber or make it equally negative on both sides.

When all is said & done, knowing how to read & understand tire temperatures will be the determining factor in how much camber to set in your wheels. In fact it's the only way to properly adjust for correct amounts of camber. Since you must constantly monitor tire temperatures you will always be readjusting camber (at least in the front). Just when you think you have your tire temperatures & camber perfect, you'll change a spring or tire psi to find more speed, or the weather will be different forcing you to make some adjustments elsewhere. All that hard work you spent on achieving those perfect temperatures will have to be thrown out the window & the whole process begins once again.

Keep in mind that adjusting one part of the car & not readjusting camber could be throwing off your original adjustment. Let's just say for example that you didn't take tire temperatures after changing the RF spring & running another 20 laps. Your times are slower after the spring change & you give up on that spring change because it made you slower. Maybe it wasn't the spring change that made you slower it was your camber being off that made you slower. Readjust the camber after running 20 laps with that spring change then decide if that was really the wrong way to go. Did you go faster after making the spring change? No. Did you go faster after making the spring change & camber change? Ah there ya go <g>. Take constant notes of each & every adjustment you make. If it doesn't work, you'll at least know how to set it back to where is was before you started.

Here is a synopsis of how cambers effect the handling of the chassis:

- More negative RF camber allows the car to turn into a corner quicker & will loosen up the chassis.
- Less negative RF camber takes away some of the pull to the left. The car won't turn in as quick into a corner & will tend to tighten the chassis.
- More negative LF camber will reduce the pull to the left while tightening the chassis from the middle out.
- More positive LF camber will increase the pull to the left & allow the car to turn into a corner quicker loosening the chassis.
- More positive camber in the RR will loosen the car from the middle out.
- More negative camber in the LR will loosen the chassis entering a corner.

Caster
Caster is the leaning forward or back of the tire at the top of the wheel. Do not confuse this with camber which is the inward or outward tilt of the wheel at the top. Positive caster is when the wheel is tilted back toward the rear of the vehicle. Negative caster is when the wheel is tilted forward toward the front of the vehicle.

Caster is used to provide directional steering stability. When thinking of caster, think of a tool box, TV stand, chair, or anything else that has 4 wheels on it that swivel to help you move it across the floor. When you push an object like this across the floor you'll notice that the wheels will swivel back allowing you to push forward with ease. This is positive caster. Now take those 4 swivel wheels & turn them forward 180 degrees. This is negative caster. I'm sure you know how difficult it is to push something with the wheels in this forward or negative position. Besides being difficult to push, it also has a tendency to take off in an unwanted direction until the casters spin in a positive direction. For the same reasons we want our chair to slide across the floor with ease, we want our race car to do the same. When setting your chassis you'll want to tip the top of the wheels back adding positive caster to provide you with that straight ahead directional stability. There are NO circumstances where negative caster is preferred, even though the adjustment range within NASCAR 2002 is from -2.0 through +6.0.

Proper caster adjustments will vary with each track & individual driver as well as the steering device you maybe using. (i.e. force feedback) The more positive caster the more feedback you will feel as a driver. More caster can also provide a more difficult steering effort, especially with a force feedback wheel. More positive caster will also give you a better feel for the car. More caster will allow you to make better decisions on the track about how the car is handling.

So why not crank the caster positive as far as it will go? Because too much positive caster also has it's drawbacks. When you turn a car left with positive caster the LF rises while the RF drops. This changes the weight on all 4 corners of the car. In effect you're taking cross weight out of the car the more you turn the wheel. The more positive the caster, the more cross weight there is being removed. The more cross weight you remove the looser the car will get.

In general, you'll want to run higher positive caster settings on a short track with tight corners, over a larger track with long, wide sweeping corners & long straight-aways. +4 to +5 on the RF isn't uncommon for a track like Martinsville. For Michigan or California a setting of +2 or +3 would be preferred. Higher caster settings allow you to ‘catch’ power slides on exit a little bit easier as well.

Another element that must be considered is the caster split or caster stagger as I like to call it. Caster stagger is simply using different settings on the LF wheel than the RF. When caster settings are different, your steering will tend to pull toward the side with the least amount of caster. On tracks where your only turning left, you would want a higher positive caster setting on the RF than the LF. This more positive caster on the RF will make the car pull to the left entering the turns, which is the preferred setup for entering the corners. The higher the caster stagger you run the easier the car will turn itself into the corner. Higher stagger will also take some feel out of the car & also force you to hold your wheel to the right down a straightaway.

Caster stagger will also affect braking. If you run too much stagger at tracks that require heavy braking such as Martinsville or the road courses, you may have to add brake bias. Although a better trade-off would be just to even up the caster allowing you to brake harder without causing the car to pull to the side with the least amount of caster.

Caster stagger is NOT the only adjustment that will give you that pull to the left. Many other factors must also be considered. Camber settings, weight balance, tire stagger, tire psi, & track banking also plays an important role. Many newcomers will be uncomfortable with the pull to the left & many may even think that there wheel won't calibrate properly. This pull to the left is normal & is the preferred setup to assist drivers when entering the corners with ease. Most caster stagger settings will be between 2 & 3 degrees. In other words, if you ran 1 degree positive on the LF, you would run positive 3 or 4 on the RF. In general, tracks that are small & have tight corners will require a higher caster split to help you turn into a corner better.

Simulating the pull that a stock car gets in a game is going to yield different results for different types of controllers. To add to this variation, the Linearity setting you choose in setting up your controller, in combination with the steering ratio you choose within the setup is going to contribute in making the pull feel different from user to user. On any given controller, setup the Linearity towards the Non Linear side (say 10%) You will notice the need to use a lot more counter steering on the straight than somebody using 90% Linearity with the exact same setup.

Do you see real drivers using counter steering down the straights? No, because they can center the wheel on the steering shaft. Is the pull still there for them? Yes. You can get your controller to center on the straights by how you calibrate it, get rid of it entirely if you like. Will you still feel the pull? No, why? because the pull you're feeling is from the tension on the springs, bungee, or whatever your controller uses to center itself. Your controller isn't hooked up to the suspension of a stock car, so you're not going to be able to feel the dynamic pull that the suspension creates. Furthermore, your steering wheel doesn't have the range of motion as a real car. At best you're probably getting from 240 to 270 degrees of motion, and much less on a Joystick (maybe 90 degrees if you're lucky?) A real car has what, maybe 3 to 4 full rotations from lock to lock? With this in mind the game has to have Steering Ratio values that can compensate for the lack of true lock-to-lock movement. The differences in degrees of lock to lock motion between a joystick and a wheel is why the Linearity setting makes such a big difference, it has to in order to make all types of controllers usable. You just need to find the setting that is comfortable to you.

One thing to remember in NASCAR Racing 2002, a setting of 32:1 is going to require MORE steering movement than a setting of 15:1, which would be more sensitive to steering input.

Caster synopsis:

- More positive caster will loosen the chassis the more the wheel is turned through a corner.
- More positive caster will allow you to catch slides on exit a little easier.
- Caster adjustments are better felt through a force feedback wheel.
- The car will pull to the side with the lower amount of positive caster.
- The higher the caster stagger, the easier the car will turn into a corner.
- The higher the caster stagger, the easier the car will break loose braking into a corner.
- The higher the caster stagger, the less steering effort required. This will tend to give you a loose feeling upon corner entry.

Differential Ratio

The differential is a gear assembly in the rear end whose purpose is to distribute torque to the rear wheels for traction. In NASCAR 4 we have the ability to change these gears allowing us to run different ratios for different size tracks. This adjustment can be accessed by clicking the drivetrain/aero tab on the garage screen.

The ratio expresses the number of turns required by the pinion (which is attached to the output shaft of the transmission) to turn the drive axle one revolution, i.e. 2.857 means the pinion must turn 2.86 times to turn the drive axle once. A higher number (6.556) means a lower (or shorter) gear. Short gearing gives quicker acceleration, but because the engine must turn faster, fuel mileage and top speed are lower. Tall gears give smoother acceleration and higher top speed, at the expense of quick acceleration.

We are allowed to choose from no less than 49 different ratios with an adjustment range from as low as 2.857 to as high as 6.556. The differential ratio you will need is different for every track you compete at & is the most common gear changed on a WC race car. When you change the differential ratio, you change all the final drive ratios together proportionally.

On short tracks you will want to choose a higher differential ratio because quicker acceleration will be a must at tracks where speeds are not as high. At superspeedways you'll want a smaller ratio for top speed since quick acceleration is not necessary on a track where you're at full throttle most of the time. The most important factor when considering what ratio to use is that you don't choose a ratio that is too high. Too high a differential ratio will result in running higher rpms. If, by the time you reach the end of a straightaway, you're running higher than 9000 rpms. you risk having your rev limiter kick in. This will result in a loss of torque & thus a loss of speed. The rev limiter is used to prevent us from running too high an rpm, which could result in a blown engine. You must watch your tach when changing gear ratios. If you're running too high an rpm you will also notice it through the sound of your engine as a "missing" sound.

As you adjust other chassis components, you will most likely find yourself having to change your differential ratio. As you find more speed through the corners, you'll eventually find yourself on the throttle quicker. Since you're on the throttle sooner you will be running a higher rpm towards the end of a straightaway. This is likely going to force you to make a differential change.

Differential synopsis:

- The higher the ratio/number (6.556) the higher the rpms. Provides quicker acceleration, but slower top speeds.
- The lower the ratio/number (2.857) the lower the rpms. Provides slower acceleration, but higher top speeds.

Final Drive Ratios
The final drive ratios can be viewed by clicking the drivetrain/aero tab on the garage screen. This is a non-adjustable option that is basically used for comparison purposes. The final drive ratio represents the number of engine revolutions to rear wheel revolutions. The final drive ratios can be viewed for all four gears. These 4 ratios change automatically whenever the differential ratio is changed & will change individually per gear whenever a transmission ratio is changed.

Like the differential & transmission ratios, the final drive ratios are read in the same manner. A higher number means a lower (or shorter) gear. Short gearing gives quicker acceleration, but because the engine must turn faster, fuel mileage and top speed are lower. Tall gears give smoother acceleration and higher top speed, at the expense of quick acceleration.

Your highest final drive ratio will be in 1st gear & should get smaller as you move through the gears. Your final drive ratio will be the same as your differential ratio. Unless your at a track that requires a lot of shifting, the final drive ratio will not be that important & is only used to compare how your ratios change through the gears after attempting a differential or single transmission ratio change.

Final Drive synopsis:

- The higher the ratio/number the higher the rpms. Provides quicker acceleration, but slower top speeds.
- The lower the ratio/number the lower the rpms. Provides slower acceleration, but higher top speeds.

Front Bias
The Front bias can be adjusted by clicking the weight bias tab on the garage screen. Front bias is the amount of weight on the front of the chassis as compared to the rear of the chassis. Front bias is determined by placing lead weight at various points as low as possible in the chassis. Sliding this weight forward gives you more front weight or bias. Sliding this weight towards the back of the car decreases front bias & increases rear weight or bias.

The most front bias were allowed is 54.2% (1950 lbs.) The least amount is 45.8% (1650 lbs.) Finding the correct amount of front bias depends on the track, banking, spring rates, frame heights & gearing. Generally speaking, the flatter the track, the more front bias required. The higher the banking the less front bias required. This is because the higher banked tracks require less braking which in turn means less weight is being transferred to the front of the vehicle. Less front bias or more rear bias would be preferred at a track like Talladega.

A slower track that requires shorter gear ratios, will also require less front bias. This is due to the problem of wheel spin that can occur during acceleration. You would rather have less front bias or more rear bias to help transfer weight to the rear quicker to avoid wheel spin. Just the opposite would be true when a higher gear ratio is required.

The more front bias you run the tighter the chassis will be, especially at mid turn & beyond. The less front bias you run the looser the chassis will be. A front bias of 50 - 51% would be a good starting point for many tracks. A track that is small & requires heavy braking may only require a front bias of 48 or 49%. Anything below 48% or higher than 51% isn't realistic in a real cup car, but can still be effective given different spring rates, sway bars & frame heights. Experimentation once again with all these variables will be the only way to correctly determine the proper front weight bias given the various circumstances.

Another factor that must be considered when dealing with front bias is Fuel. As fuel is burned, your rear weight distribution is lowered. You will lose approximately 1% of rear weight per every 5 gallons burned. This means that by the end of a full fuel run you'll lose over 4% rear weight. With less fuel & less rear weight, the car will have a tendency to tighten up as fuel diminishes. Although your not directly changing your front bias, you will be affecting the amount of weight that is being transferred as fuel is burned. This will result in an ever changing car as fuel dissipates.

Front Bias synopsis:

- More front bias will tighten the chassis.
- Less front bias will loosen the chassis.

Front Brake Bias

Many people believe that the brakes in a racecar are used for nothing more than slowing or stopping the car. Nothing could be further from the truth. Properly adjusted brakes can improve lap times by allowing you to get into a corner better. All WC drivers have an adjustment that allows them to control how much brake pressure is allocated towards the front & rear wheels. Front brake bias allows us that same exact adjustment.

When entering a corner 60 to 80% of the weight is transferred to the front of the car. The exact amount depends on the speed of the car, track, corner, & how much brake is applied upon entry. Because of these varying factors more or less front brake needs to be "dialed" into the car. Between the front & rear master cylinders is a balance bar that can be adjusted to allow more or less brake pressure to be applied towards the front when the brake pedal is pushed.

Within the sim we are allowed to set the front brake bias to as little as 50% to as high as 90%. Due to the rear brakes having larger calipers, at about 65%, the brake pressure is being applied equally to both the front & rear tires when the brake pedal is depressed. Since so much weight is being transferred to the front upon entry into a corner, a setting of 50% would probably be way to low. A setting of 67% or higher would be more desirable for a short track due to weight transfer.

The correct front brake bias setting depends on your driving style & how hard or how much you use your brakes getting into a corner. Since this will vary with each corner at each track, it is important to find the right balance as not to upset the chassis when you apply the brakes while cornering. It is important not to confuse a loose or tight condition upon entry with a front brake bias problem IF your problem doesn't occur when using the brakes. On the other hand, your chassis may not be tight or loose on entry, but because you have the incorrect front brake bias set into the chassis, you're creating a problem when using the brakes. It is real easy to mask or create an I'll handling car getting into a corner by making a front brake bias adjustment.

The more front brake bias (higher the number) you have set in the car the tighter the car will be on entry. The lower the number the looser the chassis will be. This tight or loose condition from front brake bias will only occur while your on the brakes entering the turn. If your loose entering a corner & are not using the brakes, then you do not have a front brake bias problem. Some may try to add front brake bias to tighten up the chassis going in, but unless your using the brakes going in, changing front brake bias will be useless. Plus the fact remains that you are only masking the problem of the loose condition by trying to compensate with a brake adjustment. You might want to adjust the chassis elsewhere to tighten the car up on entry.

So how do you know when you have the correct amount of front brake bias? I believe the correct brake bias is determined by how the chassis reacts when hitting the brakes hard going into a corner without locking them up. Enter a corner without jerking the wheel hard left & apply 3/4 brakes or as much as possible before lockup occurs. It is important not to steer any more than is necessary. Any added steering inputs can throw off your results due to the added weight transfer that occurs while turning. How did the chassis react? If your back end wants to come around on you, you have too much rear brake & need to add more front brake bias. If your car pushes towards the wall you have too much front brake & need more rear brake. When you can perform this test & the chassis holds a straight line you know you have the proper amount of front brake set into the chassis. You'll probably also want to make sure that you're not using any caster stagger during this test. Once you have the brake bias the way you want it, you can go back and work on the compromise between caster stagger needed for turn-in but not so much it causes you to use to much front brake bias.

Front Brake Bias synopsis:

- More front brake bias will tighten the chassis entering a corner under braking.
- Less front brake bias will loosen the chassis entering a corner under braking.

Front Roll Couple

Whenever you turn, there is going to be some body roll. Body roll has to be handled by the suspension system so the tires won't break traction. Since Cup cars use independent suspension, the front and rear of the chassis handle their share of body roll separately as it passes through the front and rear roll centers.

Roll couple percentage is how much body roll is distributed between the front and the rear suspension systems. Since we know the stiffest end of the car will slide first, roll couple provides a pretty good indication of whether the chassis is going to be loose or tight. If the front slides first, the chassis is tight and if the rear slides first the chassis is loose.

If you have an 80% roll couple, 80% of the transferred weight transfers between the left front and right front wheels while only 20% is being transferred at the rear.

Figuring out roll couple is a complex formula that includes roll rate, track width, spring rate, sway bar lengths and thickness, anti roll lever lengths and rates, and tire pressures. In NR2002S, all of this is done for you and the roll couple is determined by adjusting the front and rear springs and sway bars. Increasing the front springs and swaybars as well as decreasing the rear springs and swaybars will increase roll couple while doing exactly the opposite will decrease roll couple.

In general, front roll couple is somewhere between 70% and 80% for oval tracks. The higher the front percentage number, the more understeer (pushing) there is in a chassis. Conversely, the less front roll couple, the more oversteer (loose). The reason the front roll couple percentage is so much higher than the rear roll couple is because most of the weight transfer from inside to outside during cornering should be led by the front(or non driving) wheels.

There is also a direct correlation of weight distribution and roll couple. Typically, as you move weight forward in the car, the less amount of front roll couple is needed. As you move weight back more front roll couple would be needed. Adjusting roll couple should be done before adjusting wedge in regards to tightening or loosing the chassis. It is possible that taking out wedge could have a negative impact on right front tire wear as more dynamic weight may be distributed to the right front from the heavier load that was jacked (static negative wedge) to the left front and right rear.

Roll Couple synopsis:

- A typical roll couple percentage at the speedways would be in the lower 70% range moving towards 80% as the weight goes back for shorter tracks.
- Adjust roll couple before adjusting wedge to tighten or loosen the chassis.
- Increasing the front springs and swaybars and/or decreasing the rear spring and swaybars increases the front roll couple percentage.
- Decreasing the front springs and swaybars and/or increasing the rear springs and swaybars decreases the front roll couple percentage.

Front Sway Bar
A sway bar is also known as an anti-roll bar or stabilizer bar. The purpose of a sway bar is to control body roll through a corner. This is done with a bar that connects to both front lower a frames. Without getting to technical, a sway bar acts as a third spring to help balance out weight transfer during cornering. There are a number of ways to adjust sway bars, but within the sim we are only allowed to adjust them one way, & that is through the size of the sway bar itself.

Within NASCAR 2002 we are allowed a total of 12 different choices for the front sway bar. The sway bar is measured by the thickness or diameter of the bar. The thicker the bar the stiffer the bar. Here are the diameter choices of the bar:

0.000"	0
0.875"	7/8
0.938"	15/16
1.000"	1
1.063"	1 1/16
1.125"	1 1/8
1.188"	1 3/16
1.250"	1 1/4
1.313"	1 5/16
1.375"	1 3/8
1.438"	1/ 7/16
1.500"	1 1/2

By changing the diameter of the bar we are able to adjust the amount of roll couple or weight transfer that occurs at the front of the car. Generally speaking, the larger the bar the less the body roll up front. The less the body roll the tighter the car becomes. Therefore the smaller the bar, the more body roll & the looser the car becomes. Fine tuning with sway bars is an easy way to compensate for roll couple or body roll.

Front Sway Bar synopsis:

- The larger the bar the tighter the chassis.
- The smaller the bar the looser the chassis.

Front Toe Out
Front toe out is when the tires are farther apart in the front of the tire than the back. Toe in would be just the opposite. Front toe out is utilized to help prevent tire scrub while cornering. Within the sim we are allowed adjustments that range from -0.200 of toe in through 0.200 of toe out. Under no circumstances would you want a toe in condition. The majority of setups usually require a setting of less than 0.125 out. I wouldn't run anything less than .000 & no more than 0.175 out max. at any track within the sim.

As a general rule, the smaller the track & tighter the turns, the more toe out you may need. Larger radius tracks with long corners would require less toe out. More toe out will help the front end stick entering a corner. Running too much toe out will scrub off speed down the straightaway & create an Understeer condition. A car will run faster with the toe straight. By monitoring tire temperatures you can tell if you have a toe problem with the chassis. Excessive toe out would show higher temperatures on the insides of both front tires. Excessive toe in would show higher temperatures in the outsides of both front tires. Front toe in or out will cause the same feelings to a chassis as excessive amounts of camber & caster, albeit to a much lesser degree.

Front toe out isn't an adjustment that has to be changed or monitored as often as camber. Start with an adjustment of 0.050 & you will be close. Adjust the toe slightly only when the rest of the chassis is real close to being correct.

Front Toe Out synopsis:

- Excessive front toe out will make a car turn slower into a corner, & cause a tight condition.
- Excessive front toe in will make a car turn into a corner quicker, & may create a loose condition.

Fuel Level

Your WC race car comes equipped with a 22 gallon fuel cell. Your allowed to adjust the fuels levels from 1 gallon to 22 gallons for practice sessions only. All races as well as qualifying must begin with a full 22 gallons in the tank. Gone are the days of deciding how much fuel you want to add during a pit stop. We are now faced with 5 options. You are allowed to take on a splash of fuel as well as 1/2, 1, 1 1/2, or 2 cans. A splash of fuel will give you 2-3 gallons. 1/2 can gives you 5-6 gallons. 1 can equals 11-12 gallons, 1 1/2 cans will give you 17-18 gallons. 2 cans will fill your tank with 22 gallons. These options can be selected by hitting the left or right arrows on your keyboard after hitting F3. The less fuel your carrying the faster your car should be. This of course depends on tire condition.

The important thing to understand about fuel, is how it effects the handling of your car as it is burned. 1 gallon of fuel weighs 6.17 pounds. Multiply that times 22 gallons and you have an extra 135.74 pounds your carrying in the back of the car behind the rear axle during qualifying & at the beginning of a race. As fuel is burned, your rear weight distribution is lowered. You will lose approximately 1% of rear weight per every 5 gallons burned. This means that by the end of a full fuel run you'll lose over 4% rear weight. With less fuel & less rear weight, the car will have a tendency to tighten up as fuel diminishes. This is important to remember when taking on less fuel late in a race. If your setting your chassis based on using a full 22 gallons, you may think that by taking less fuel that you will be quicker. Depending on your setup that might not be the case.

The best solution is to practice your setup with different fuel levels to see how it performs. It's also possible to make a wedge or track bar adjustment in the pits to compensate for how your will react with less fuel.

Fuel Level synopsis:

- Less fuel equals faster speeds.
- The less fuel in the tank the tighter the chassis will become.
- Splash = 2-3 gallons, 1/2 can = 5-6 gallons, 1 can = 11-12 gallons, 1 1/2 cans = 17-18 gallons, 2 cans = full tank.

Grill Tape
The grill tape option is located under the drivetrain/aero tab within the garage menu. Grill tape is nothing more than duct tape. This tape is applied to the front bumper & air dam of the car covering the openings for air flow to the various components that are cooled through the force of air. These components include the radiator, oil/transmission coolers, & brakes. The only component were worried about is the radiator.

Within the sim we are allowed to run as little as no tape all the way up to 100% which covers every opening in the front grill. The amount of tape that can be added, can be done in 5% increments. The more tape you apply the hotter your engine will run. This will be reflected on your water temperature & oil gauges & or warning lights on your dash board. Running excessive amounts of tape for a long period of time will result in engine failure. So why put any tape at all on the the front end?

Taping off the openings in the front of the car reduce drag & increases speed. Instead of air going through the car, air is being forced around the car. This places more downforce on the front end. More downforce will make the front of the car turn into the corner quicker. Excessive amounts of tape can cause too much downforce making the rear of the car lite creating a loose condition. Weather is another factor you must consider when deciding how much grill tape to use. It stands to reason the hotter the day, the higher your water temperature will be. Therefore with the warmer weather you'll find yourself having to run less grill tape to allow more air flow through the front of the car. In other words, running the same amount of grill tape on the same track in 50 degree weather may cause an overheating or engine failure problem with the weather being 85 degrees. Be sure to keep an eye on your gauges, or you may find yourself pitting to remove some of that tape.

The secret here is to find the best trade off between speed & handling. Try to get away with as much tape as possible on superspeedways without causing excessive water temperature. More tape will decrease lap times. If you discover you can get away with running more tape, but become to loose, adjust for the looseness elsewhere.

Grill Tape synopsis:

- Higher tape % will increase speeds.
- Higher tape % equals higher water temperatures.
- Higher tape % will loosen the chassis.
- The hotter the weather the less tape you can use.
- Tape causes aerodynamic changes that have very little affect at speeds less than 140 MPH.

Left Bias
The left bias can be adjusted by clicking the weight bias tab on the garage screen. Left bias simply means how much weight is on the left side of the car compared to the right side. Between all the weight adjustments allowed, this one is the easiest to figure out.

When you enter a corner on an oval track, you hit the brakes & turn left. Weight will naturally go forward & to the right upon corner entry. Because of this you'll want to start with weight percentages greater on the left side & towards the rear. When you start with more weight to the left & rear, your hoping to balance the weight equally when you enter the corner once weight is transferred. If you could run your car, with the weight being equal at all 4 corners entering a turn, then you would run faster than anyone else in the corners. With perfect weight distribution you would have perfect tire temperatures. Perfect tire temperatures equals the maximum traction you could attain. This is what were all trying to accomplish with every single adjustment we make on a racecar.

Finding the overall correct weight distribution isn't easy & varies with every track. As heavy as WC cars are, left side bias on an oval is simple to deal with. Always keep as much weight as possible towards the left side of the chassis. Within NASCAR 2002 we are allowed left bias adjustments from 54.2% left side weight, to 45.8%. Whenever your dealing ONLY with left hand turns, always keep the left side weight at 54.2%. More left side weight allows you to take left hand turns at a higher speed.

The only reason you would want to adjust the left side bias is when you're dealing with both left & right hand turns. These obviously would be the road courses. You'd probably want to run an even left bias of 50% at these tracks. Although at a track where there are more right hand turns than left, you may favor a higher right side percentage. This will allow you to get through those right handers a little more quickly, but at the sacrifice of losing speed going through the left handers. This still could be advantageous if there are few more turns going right than left.

Left Bias synopsis:

- Higher left side bias will help turn the car left into a corner & loosen a chassis when making left hand turns.
- Higher right side bias will cause the car to Understeer when making a left hand turn.

Rear Sway Bar
The purpose of the rear sway bar is the same as the front sway bar except it controls body roll at the rear of the car. The rear sway bar connects in the back between both rear lower trailing arms. As with the front sway bar, the rear is adjusted by changing the diameter of the bar.

The rear sway bar range of adjustments are as low as 0.000" to a max of 1.000". This differs by a half inch over the front sway bar, yet the rear offers no less than 26 adjustments in 25 hundredth increments. The larger the bar the stiffer the rear becomes. But by making the rear stiffer, it has just the opposite effect that occurs at the front. A larger rear sway bar will actually loosen the car up due to the fact that the way the weight is being transferred at the rear, is just the opposite of the the way the weight gets transferred at the front of the vehicle.

Rear Sway Bar synopsis:

- The larger the bar the looser the chassis.
- The smaller the bar the tighter the chassis.

Ride Height
The chassis ride height is simply the distance measured in inches from the bottom of the frame rails to the ground. This measurement is taken at all 4 corners of the car where the frame rails are lowest to the ground. Usually just behind the front wheels & just in front of the rear wheels. Ride height is adjusted by turning down or up on load bolts located at each corner of the car on top of each spring. NASCAR has limits as to the minimum ground clearance allowed. Ideally you would want to run

your chassis as low as possible. The lower your ride height, the lower your center of gravity. The lower the center of gravity, the lower the overall weight is to the ground. The lower the weight the less weight transfer will occur while cornering.

There are a number of criteria that must be considered when adjusting ride height. Those include chassis clearance, spring rates, camber change, front & rear roll centers, & rear steer. The front roll center & rear steer isn't an option for us to adjust within NASCAR 2002. These adjustments are built into the chassis itself. Rear roll center can be taken care of by adjusting the track bar. Camber can be adjusted at any time & will have to be readjusted after making a ride height change. This is because your camber angles & contact patch of the front tires will change as your car is raised or lowered. Check you tire temperature for proper camber angles. The most important factor we must consider is chassis clearance.

If the ride height is set to low the car may bottom out on the track. This will more likely occur at high speed high banked tracks where the centrifugal forces are higher higher or at road courses where there are dips in the track. If the car bottoms out in the rear you will most likely get loose. Bottoming out up front will result in a push. If you bottom out you can do one of two things. You can raise the ride height or run stiffer springs. Personally I've always believed that lower was better, but I also believe that softer springs are better. On paper, the softer the springs & lower the car, the better off you should be. Again, this theory depends on a lot of other adjustments set within the chassis, so experimentation is the only real answer.

NASCAR 2002 allows us to adjust the ride height on the LF, LR, & RR. The RF is non adjustable & grayed out, although changing the ride height at any of the other three corners will result in changing the height of the RF. Raising the ride height at the LF & RR corner will also automatically raise the RF. Lowering the ride height at those same corners will also lower the RF. The corner that is opposite is the LR. Raising the LR will actually lower the RF ride height, taking weight off the RF & thus loosening the chassis. At the LF we are allowed to set the ride height as low as 4.50" & as high as 6.00". The LF is always the lowest point of the car & probably should always be set at 4.50". Since raising the LF will raise the RF, your raising the entire front of the car when you raise the LF. The higher the front of the car the tighter the car will be.

The LR can also be set as low as 4.50", but can be adjusted a half an inch higher than the LF to 6.50". The RR is usually the highest point of the chassis & can only be set as low as 6.00" & as high as 7.50". Adjusting the ride height effects the way weight is being transferred when cornering. Running a higher LR ride height also puts more weight on the RR. This will cause a loose condition entering the corner. Just the opposite is true when running the higher RR ride height & will create a tight condition upon entry into a corner. By adjusting the split between the LR & RR you will get different degrees of over or understeer.

Another thing you must consider when raising the ride height in the rear is how it affects the aerodynamics of the car. Raising both LR & RR ride heights raises the entire back of the car higher into the air. With that big spoiler running across the back, it will create more drag because it will be catching more wind. This will slow your straightaway speed. With more wind catching the spoiler it will also create more downforce on the back of the car which should allow the back of the car to stick better in the corners. Running a higher ride height may allow a lower spoiler setting. Trial & error will prove worthy here.

Experimentation & accepting the less of all evils should be your goal when adjusting ride height. Springs will play an important rule in determining your overall ride height. In general, the lower the car, the faster the car should be, but possibly at the expense of bottoming out. Give & take will be required in this area.

Ride Height synopsis:

- Too low a ride height could cause the car to bottom out.
- The higher the RF ride height the tighter the car will be.
- The higher the REAR ride heights, the more drag on the straight-aways, but the better the rear will stick in the corners.
- A higher LF will tighten the chassis.
- A higher LR will loosen the chassis.
- A higher RR will tighten the chassis.
- A higher LR lowers the RF and may cause the RF of the chassis to drag.

Setup Notes
Within the garage area of NASCAR 2002 we are given the option of keeping track of our adjustments during practice sessions. Due to the importance of good note keeping, I'm going to once again remind everyone the importance of keeping track of various adjustments made throughout practice sessions.

It is critical to take notes after every adjustment you make. With all the adjustments available to make, it's real easy to forget what adjustment you made 3 practice sessions ago. Record keeping is important. If you do go the wrong way with an adjustment you can always set it back to where it was before making the change by simply referring back to your notes. By tracking & logging information, it also allows you to refer back to them to see how you progressed to cure your handling problem. These notes could be useful for setups at tracks with familiar configurations which can turn out to be a real time saver. By keeping track of adjustments, you will be able to refer back to your notes to see what worked & what didn't. This will help you decide what to adjust if a similar situation arises at another track.

Above I've included two setup sheets for taking notes. You could also use the setup notes option within the garage area to track your changes. I personally would rather track notes on paper because they are are easier to refer to when trying to set up a car at another track with a similar configuration. What I do like to keep track of in the setup notes area is what type of tire wear I get with the current setup. Before running an event, I refer to these notes so I know what tire will wear 1st, & when approximately I will have to pit. Fuel mileage is another thing to keep track of. Knowing how many laps you can get on a fuel run will allow you to keep in the back of your mind, when you will be forced to pit. Can I make it on a full tank of fuel or will I need tires first. If so what lap will I have to pit should we go green the whole way.

Top speed & or lap times is also a must to keep track of. I also like to keep track of how the car reacts as tires wear, as well as how it performs with less fuel in the car. How bad do lap times decrease over X number of laps. What chassis adjustments could I make during a pit stop to help counter react the way the chassis performs with less fuel. Perhaps a track bar or tire pressure adjustment would be the way to go when pitting after so many laps. All these types of questions I have answered before entering a race because of good note keeping. Keeping track of these types of notes in the setup notes section of the garage area will allow you to perform better on the track & could even get you a win by knowing how your chassis will react before even turning a lap.

After running so many different tracks & working on so many different setups, it's real easy to forget how one setup reacts over another. Simply reading your setup notes will remind you once again what you can expect from the setup you will be running before even getting on the track. If you have multiple setups for various weather conditions reviewing these notes will allow you to choose what setup to run given the current track conditions. This is where using the track notes section of the garage area comes in handy (read the section on track notes).

Shocks

Shocks are designed to control the up & down movement of the suspension caused by weight transfer as well as bumps. A shock controls the speed at which the spring moves. Without shocks a car would handle like a boat in the water, swaying back & forth while moving up & down. Understanding shocks & how they work will give you a major advantage over those that don't. Controlling the chassis with the proper shocks is the key to getting through a corner smoothly & effortlessly. Shocks are used to help control handling problems & can even be used to induce desirable handling characteristics.

Of all the questions I am asked regarding setup options, shocks are by far the most asked & most misunderstood of all the setup options available to us in N2002. Shocks are a very easy issue to become confused about. At times, too much or too little of the same adjustment on the same shock can produce the same exact results in the chassis. (i.e. it's possible to have a push with a RF shock that is both too stiff or too soft). Such results end up in total confusion as which way is the right way to go with an adjustment. The most important thing to remember regarding shocks, is that the stiffer the shock, the less grip it will have at the corner or end of the chassis.

Shocks do NOT control the amount of weight transfer in a corner. They will however control how quickly the weight is transferred. Shocks used on WC teams are rated from 1 through 9. 1 being very soft while 9 being very stiff. We also have the same choice for shock adjustments within NASCAR 2002 at all four corners of the car at tracks where NASCAR doesn't mandate specific shock settings. Shocks are numbered for both compression & rebound. The compression of a shock is when it is being pressed down. The rebound is when it is being pulled back up. By adjusting the valving (changing the numbers) within the shock, we are able to change the stiffness or weakness of that shock when it is both compressed & pulled back or rebounded.

When you have a shock that has the same number compression as rebound it is said to be a 50/50 shock. This means that the shock when compressed, has the same resistance when pulled apart. A shock with a compression rating of 9, & a rebound rating of 9, is telling you that the shock is really hard to compress & just as hard to pull back apart or rebound. A shock with a compression rating of 9 & a rebound of 1 is what they call a split valved shock. This shock would be stiff to compress, but would rebound or pull apart real easy. Through adjustment of the shock valves you are able to control how quickly weight is unloaded left to right, & front to rear. By adjusting the valving of each shock you can fine tune your chassis through a corner. Once you understand this concept of how shocks work, you will be able to use that knowledge to turn faster & more consistent laps.

When discussing shock tuning in depth, a basic understanding of dynamic weight transfer and its effect on tire loadings is necessary. Dynamic weight transfer is the transferring of weight from side to side during cornering, from rear to front during deceleration and from front to rear during acceleration. The distribution of weight that transfers is affected by the rates of the springs used in the chassis. Basically, if one of a pair of springs receiving weight is stiffer than the other, the stiff spring receives proportionately more weight than the soft spring. The rate at which a tire is loaded or unloaded during dynamic weight transfer is affected by the compression & rebound of the associated shock. In rebound, a stiff shock slows down and a soft shock speeds up the unloading process. In compression, a stiff shock slows down and a soft shock speeds up the loading process. However, excessively soft or stiff shocks can produce effects opposite to those stated. Consequently, by changing the stiffness of the shocks used on a race car, we are adjusting the loadings on the tires at different points on the race track. If done correctly, good handling will result.

Now that you understand the compression & rebound of a shock, you must learn how & when they are used while cornering. The easiest way for me to explain when a shock is doing it's most work, is by using an ordinary automobile as an example. Imagine a vehicle going down the highway at 50mph. Now imagine this vehicle slamming on it's brakes. What occurs in the chassis? When you slam on the brakes all the weight is transferred to the front of the vehicle & the nose of the car dives while the back of the car raises up. What are the shocks going through in this state? The front shocks are being compressed & the rear shocks are extending or rebounding. Generally speaking, this is the exact same thing that occurs in a racecar upon entering the corner. (minus the locking up of the brakes of course) The shocks are going through the same basic process as the regular street car. Therefore if your having troubles getting into the corner, you would adjust the front shocks compression, & or the rear shocks rebound, since that's the stages of the shocks being utilized upon entry into a corner.

Let's take the same street vehicle & imagine it at a stand still in a parking lot. Giving the car full throttle what occurs? Just the opposite of what was explained above. The front of the car lifts while the rear of the car squats. The shocks up front are rebounding & the rear shocks are compressing. The shocks on a race car are going to react the same way in the middle of a corner when your chassis takes set to full throttle. Therefore if your having problems exiting the corners under acceleration, you would look at adjusting the rebound of the front shocks, & or the compression of the rear shocks.

Keep in mind the above comparisons are being used to help you better understand the basic concepts of shocks & how & when they perform. In reality there is a lot more involved because a racecar enters a corner with a lot more force which varies the degree of each shock & how much they are being compressed or rebounded. Add to the fact that adjustments can be made asymmetrically from left to right & or front to rear, & it opens up all new options & possibilities for additional adjustments that can produce different results.

The balance of traction between the left side and right side tires determines to a great extent how the car will handle while decelerating through the corner. For example, a race car will tend to push whenever the left side tires do not have enough influence in stopping the car (the right side tires are slowing the vehicle more than the left so the vehicle tends to go to the right). By using stiffer shocks (especially a stiffer rebound on the LR & LF), the unloading process of the inside tires (due to dynamic weight transfer) to the outside tires slows. Consequently, the left side tires remain loaded further into the corner which helps to turn the chassis. This should allow a car to drive in deeper & remain more balanced throughout a right-hand turn. Softer left side & or rebound would give just the opposite results.

Asymmetrically changing the front or rear shocks can also give different results on the handling of a chassis. Decreasing the rebound on both front shocks allows the weight to transfer quicker from the front to the rear under acceleration. This will loosen a chassis more as throttle is applied. (remember stiffer means less grip on that end) Therefore with stiffer shocks on the rear, it would mean less grip on the rear tires. Increasing the rebound would produce just the opposite effects. Asymmetrically adjusting the rear shocks will also produce different effects as compared to adjusting individual corners.

Shocks & springs do work alike. If you understand springs (read the spring section) you will have a better understanding of how shocks operate. All of the asymmetrical theories that apply to springs also apply to shocks in much of the same manner. In other words a stiffer RF shock will tighten a chassis much the same as a stiffer RF spring will, albeit to a much lesser degree. A stiffer RR shock & spring will loosen the chassis, etc. etc. Stiffer front springs & shocks will make a car tight. (stiffer in this instance means less grip at the front)

The part that throws people for a loop in regards to shocks, is when after an adjustment is made the results are unseen or not felt in the chassis immediately. To begin with your not always going to feel a major change. Shocks adjustments are a fine tuning device only to be used after the rest of the chassis is close to being neutral or stable. The easiest way to adjust shocks & get a feel for how they work are to adjust them as a 50/50 shock. Or in other words start out adjusting the compression & rebound equally the same. Say 9 compression 9 rebound, or 1 compression 1 rebound. With a 9/9 shock you have a shock as stiff as it gets. A 1/1 is a weak as it gets. Try these settings one at a time at different corners of the car to see the changes & how they affect the handling of the car. A 9/9 on the RF will tighten the chassis all the way through the corner. While a 9/9 on the RR will loosen the chassis all the way through a corner. A 1/1 will have just the opposite effects. Once again I bring up stiffer equals less grip on that corner. Stiffer RF equals push because the RF will have less grip & begin to slide. Stiffer RR & that tire will have less grip & slide which will make you loose.

The reason many drivers do not feel a shock change is because they quickly forget the stiffer shock or shocks produce the least amount of grip. Therefore adjusting your 7/7 RF shock to 6/6 has little influence over your 4/4 rear shocks. The RF is still stiffer. Only once you understand the influence a so called 50/50 shock has on each corner of the car, should you attempt to adjust the split valving of each individual shock. Read the synopsis below for a better understanding of the effects on adjusting the compression & rebound of each individual shock & the effects you may experience with such an adjustment.

Before adjusting shocks, try to visualize how weight is being transferred at each corner upon deceleration, braking, & acceleration. With a better understanding, you will have a much easier time deciding which shock to adjust to help cure or smooth your corner transitioning problem properly.

Proper compression & rebound settings basically come down to what a driver feels more comfortable with. What works with one driver, might not necessarily be correct for another. This is due to the fact that different drivers have different driving techniques. Smooth throttle, brake and steering transitions will require slower shock travel because weight isn't being transferred as quickly compared to those drivers that use abrupt throttle, brake, and steering transitions.

Below is a general guide that should assist you in fine tuning your shocks.

SHOCK COMPRESSION:

The stiffer the FRONT shocks, (higher the number) the tighter the car will be when braking.
The softer the FRONT shocks, (lower the number) the looser the car will be when braking.

The stiffer the REAR shocks, (higher the number) the looser the car will be under acceleration.
The softer the REAR shocks, (lower the number) the tighter the car will be under acceleration.

SHOCK REBOUND:

The stiffer the FRONT shocks, (higher the number) the tighter the car will be under acceleration.
The softer the FRONT shocks, (lower the number) the looser the car will be under acceleration.

The stiffer the REAR shocks, (higher the number) the looser the car will be under braking.

The softer the REAR shocks, (lower the number) the tighter the car will be under braking.

Shock synopsis:

RF

- Higher compression will tighten the chassis entering a corner.
- Lower compression will loosen the chassis entering a corner.
- Higher rebound will tighten the chassis accelerating out of a corner.
- Lower rebound will loosen the chassis accelerating out of a corner.
- Overall stiffer RF shock will tighten chassis, weaker will loosen it.

RR

- Higher compression will loosen the chassis accelerating out of a corner.
- Lower compression will tighten the chassis accelerating out of a corner.
- Higher rebound will loosen the chassis entering a corner.
- Lower rebound will tighten the chassis entering a corner.
- Overall stiffer RR shock will loosen chassis, weaker will tighten it.

LF

- Higher compression will tighten the chassis entering a corner.
- Lower compression will loosen the chassis entering a corner.
- Higher rebound will tighten the chassis accelerating out of a corner.
- Lower rebound will loosen the chassis accelerating out of a corner.
- Overall stiffer LF shock will loosen chassis, weaker will tighten it.

LR

- Higher compression will loosen the chassis accelerating out of a corner.
- Lower compression will tighten the chassis accelerating out of a corner.
- Higher rebound will loosen the chassis entering a corner.
- Lower rebound will tighten the chassis entering a corner.
- Overall stiffer LR shock will tighten chassis, weaker will loosen it.

Asymmetrical changes:

- The stiffer the shock, the less grip that tire will have.
- Stiffer rebound on the left shocks will help the car turn in by slowing weight transfer to the right.
- Stiffer compression on the right shocks will help the car turn in by also slowing weight transfer to the right.
- Softer rebound on the front shocks will loosen the chassis exiting the corner.
- Softer compression on the rear shocks will tighten the chassis exiting the corner.
- Doing just the opposite mentioned above, on either compression or rebound will produce just the opposite results.
- Asymmetrical changes seem to have a greater influence than individual shock changes.

General:

- Use the above info as a guideline only. Changing just one shock may not give you the exact results mentioned above. Other factors must be considered. Other shocks & settings as well as asymmetrical changes will produce different results with varying degrees of chassis changes or feelings based on other components & driving style.

Spoiler
Your spoiler adjustment is another option that is located under the drivetrain/aero tab within the garage menu. The spoiler

itself is a wide piece of rigid aluminum located on the rear deck lid that spans the length of the trunk. The purpose of a spoiler is to add downforce to the rear of the car. This is accomplished by how the air is passed over the back of the trunk lid as it hits the spoiler.

The same basic theories that apply to an airplane wing apply to a spoiler on a race car. When an airplane takes off from a runway, you'll notice that the rear flaps on the wings point downward. This is actually just the opposite of how a spoiler works on a WC race car. When the flaps are pointed down on an airplane it assists the plane is lifting up to get off the ground. This isn't an effect you would want in a race car. On a WC car the spoiler is in just the opposite position catching air & adding downforce to the rear of the chassis. This is the effect we desire at most race tracks. The rear spoiler catches air pushing down on the back of the car allowing for better traction through the corners.

How much air catches the spoiler is determined by what angle the spoiler is placed at and the ‘rake’ of the chassis based on ride height. NASCAR 2002 allows us a range of adjustment from as low as 45 degrees, to as high as 70 degrees. The lower the number the straighter the spoiler or the less downforce there will be on the rear of the car. The higher the number the higher the angle of the spoiler & the more downforce there will be applied to the back of the car. Note: On restrictor plate tracks like Daytona and Talladega, NASCAR mandates the spoiler be set at 55 degrees and thus is non adjustable.

You may think a setting of 70 would be the best for cornering, and it might very well be depending on the track. The disadvantage to running a higher spoiler angle is that it increases drag slowing you down on a straightaway. Picture yourself holding your hand out the window of an automobile traveling 55 mph, with your palm facing down towards the road. You'll notice how the wind pushes your hand back a little bit. This would be similar to a spoiler angle of 45 degrees in a race car. Now take your hand & rotate it 90 degrees so your palm is facing the front of the vehicle. You'll notice how much stronger the wind appears to be pushing your hand when you rotate it. This would be similar to you running an angle of 70 degrees on your rear spoiler. Obviously the force on a rear spoiler going 180 mph over the length of the rear deck lid will be a lot higher than your hand out a window. But you get the idea of how wind, aerodynamics, & spoilers effect the performance of a race car.

On a high banked high speed track like Talladega, you'll probably want to run the minimum spoiler angle since downforce isn't as critical. A track like Talladega naturally creates downforce on the car. The majority of other tracks will require higher degrees of spoiler to keep the rear end glued to the track. To keep it simple, the higher the spoiler angle the tighter the rear will be. The lower the angle the looser the rear will be.

Spoiler synopsis:

- The higher the angle the slower your straight-away speeds.
- The lower the angle the faster your straight-away speeds.
- The lower the angle the looser the chassis.
- The higher the angle the tighter the chassis.

Springs

Four coil springs are located at each corner of the chassis. The springs determine how much weight is transferred to each corner of the car. The springs are mounted in such a way that they can be adjusted up or down to change ride heights. Springs are rated by how many pounds it takes to compress the spring 1". This is done using a special tool called a spring compressor.

The ideal spring combination is one that would produce equal amounts of wheel travel at all four corners of the car. At all ovals, the heaviest weight is being transferred towards the RF upon entry into a corner. This means the RF corner of the car will travel more requiring a stiffer spring than the other 3 corners. The higher the numbers the stiffer the spring. In NASCAR 2002 we are allowed spring adjustments at all 4 corners of the chassis. (excluding Daytona and Talladega) The front springs allow us an adjustment as low as 450 lbs. & as high as 2500 lbs. The front springs are adjustable in 50 lb. increments. The rear springs can be adjusted as low as 150 lbs. & as high as 700 lbs. in increments of 25 lbs.

An overall softer spring package is usually preferred over a stiffer setup. With a softer setup though, you run the risk of having the car bottom out on the track. This can be cured by using a stiffer sway bar & or raising ride heights. Using softer springs will cause the car to roll over more in the corners. This may require using higher camber angles to compensate for the roll.

In general stiffer front springs will make the car tighter. Stiffer rear springs will loosen the car. Weaker front & rear springs will have just the opposite effect. By changing the spring stagger between the LF & RF as well as the LR & RR, you are able to effect the way the car reacts under acceleration & braking. Spring stagger is the difference in spring rating between the left & right side of the chassis. Running more spring stagger up front, with a weaker left side spring, will tighten the car under acceleration while loosening it under braking. i.e. a 800 LF spring & a 1000 RF spring. The greater the difference, the greater the chassis response during these transitions. Running more spring stagger in the rear, with a weaker left side spring, will have just the opposite effect as the front. Instead of tightening the car, it will loosen the car under acceleration & tighten it while braking.

The RF & RR springs change the roll couple distribution of the chassis. A stiffer RF spring will make the car tighter. This is because the the stiffer corner won't accept the body roll & will continue forward creating a push. A stiffer RR spring will have just the opposite effect & create a loose condition. The LF & LR springs effect the chassis by changing the wedge or cross weight in the car. A stiffer LF spring will make a car looser going in & coming out of a turn because it takes wedge out of the car. A stiffer LR spring will tighten the car from the middle, out of a corner because it keeps cross weight in the car.

You'll notice that when making a spring change either stiffer or weaker, it will have the same effect on the chassis as it's diagonal opposite corner. In other words, if you decide to make the RF spring weaker to help loosen the car, you could also make the diagonal opposite corner (LR) weaker to also help loosen the car. In all actuality, what your doing by changing both diagonal corners together, is changing the wedge or cross weight of the chassis. Try to remember the diagonal corners as pairs. And that whatever one pair does, the opposite pair will have the opposite effect. Using this method makes remembering what spring does what a little easier. In reality then, all you have to remember is what one spring adjustment does, and you should remember how all the others corners are effected.

Let me give you an example. Just remember that a stiffer RF spring equals a tighter condition. Now I know that diagonally a stiffer LR spring also equals a tighter condition. Now a stiffer RR & LF (diagonally) would have just the opposite effect (loose) on the chassis. Now if I have a loose race car, I now know I can try a stiffer RF or LR spring, or a weaker RR or LF spring. All will help to tighten the chassis. I remember all this by simply knowing that a stiffer RF spring equals a tighter race car.

As you can see, it's really easy to get confused over what spring does what & how their strength or weakness effect a chassis while cornering. Let's try to put it in it's simplest form.

Spring synopsis:

- Weaker LF will make the car tight.
- Weaker RR will make the car tight.
- Weaker RF will make the car loose.
- Weaker LR will make the car loose.
- Stiffer RF will make the car tight.
- Stiffer LR will make the car tight.
- Stiffer LF will make the car loose.
- Stiffer RR will make the car loose.
- Overall stiffer front springs will make the car tight.
- Overall stiffer back springs will make the car loose.
- Overall weaker front springs will make the car loose.
- Overall weaker back springs will make the car tight.
- Increasing front spring stagger will tighten the car under acceleration & loosen it under braking.
- Increasing rear spring stagger will loosen the car under acceleration & tighten it under braking. (This will become more apparent as the RF tire wears and may cause the chassis to snap lose in the latter stages of a tire/fuel run)

Steering Ratio
Steering ratio is the difference in how many degrees your front wheels are turned compared to how many degrees your steering wheel is turned. Steering ratio is measured by dividing the number of degrees the tire is turned into the number of degrees the steering wheel is turned. If for example you turn your steering wheel 180 degrees & your front tires were to turn 10 degrees you would have a 18:1 steering ratio. (10 into 180 = 18)

Your steering ratio adjustments range from 12:1 to 32:1 within NASCAR 2002. The lower the ratio (12:1) the quicker the steering response. You'll notice that using a lower steering ratio will require less turning of the wheel to negotiate a corner. This low steering ratio can result in a twitchy car since the smallest of steering inputs will be felt in the car. It is very easy to over steer a car with such a low steering ratio.

A car with a higher steering ratio (32:1) will require more steering input to get through a corner. Too high a steering ratio might give the feeling of a tight race car as you find yourself turning the wheel further to negotiate a turn. This isn't a push, it's just requiring more movement in the wheel to steer the front tires the same amount as with a lower ratio. With a ratio of 12:1 at a track like Michigan you might only have to turn the steering wheel 45 degrees to the left to get through the corner. With the same exact setup, but a ratio of 32:1 you might have to turn the wheel 90 degrees or more to the left to negotiate the same exact corner.

There is no correct setting for steering ratio. It all depends on the driver & what he is comfortable with. A lot of this depends on the type of steering device used. With so many different wheels on the market, you wont know what is comfortable for you until you experiment with it yourself. You may be comfortable with a steering ratio of 24:1 at Dover with a TSW brand wheel, but find that after using a MadCatz wheel that the ratio is all wrong. This is because some wheels turn more or less degrees than others requiring different steering ratio settings.

As a general rule of thumb, the smaller the track & tighter the radius of the turn, the lower the ratio you'll want to run. Road courses are a track with slow sharp turns that would require a lower ratio. High speed long sweeping corners would not require such a low steering ratio since you are not required to turn as sharply on tracks like these.

Steering Ratio synopsis:

- The lower the ratio the quicker the steering response.
- The higher the ratio the slower the steering response.
- Lower ratios require less turning of the wheel to negotiate a corner.
- Higher ratios require more turning of the wheel to negotiate a corner.

Tire Pressure
Tires are the most important component on a race car. You can have the fastest engine or the best possible setup, but if you don't have a set of tires between you & the track, everything else is meaningless. In fact, every single thing you adjust on a race car is for the benefit of the tires. All these adjustments that I've discussed in this guide are all about trying to achieve the best possible grip from the tires to the track. If you have the best grip at all 4 wheels, then you'll have the fastest car on the track.

Tire pressure is yet another adjustment that will aid you in achieving the best possible grip. Tire pressure is simply how much air you have in a tire. The hotter tires get, the more they expand. Air contains moisture. Moisture becomes steam as the air gets hot & increases pressure. WC teams actually don't use air in their tires they use nitrogen. Nitrogen is preferred over air because it doesn't expand as much with temperature changes because it doesn't contain moisture. Since it's impossible to remove all the moisture from a tire, it will still change pressure as temperatures rises. This can be noted after running a test session & checking your tires both hot & cold. When tires expand it changes the size of the tire which in turn changes the weight on that wheel. This can be either a negative or positive situation depending on your chassis needs.

Tire pressures can be adjusted on all 4 tires from as low as 8 psi. to as high as 60 psi. Improper tire pressure can cause an ill handling car. Correct tire pressure can be determined by reading tire temperatures. A tire with a temperature reading higher in the center of a tire indicates an over inflated tire. A tire with a lower center temperature, when compared to the inside & outside of a tire indicates a under inflated tire. Over inflated tires will have a tendency to make the car tight. Under inflation can slightly loosen a chassis but give better grip. Lower tire pressure will also increase the amount of heat in that tire. Excessively low tire pressure produces more heat which can result in quicker wear. Higher pressure tires run cooler, have less drag & will be quicker at higher speeds.

Stagger isn't a direct adjustment we can make in NASCAR 2002. NASCAR regulates the size of their tires which come with stagger already built into the tire. Altering tire pressures allows us to slightly modify the stagger. Stagger is the circumference of the right side tires compared to the left side tires. The best way I can describe stagger is by using a white Styrofoam coffee cup. You know, the kind that is bigger around on the top than on the bottom. Take that cup & lay it over on it's side on a table. Now push it along the table letting it roll. You see how it turns in one direction. This is stagger. Imagine the top or larger side of the cup as the right side tires on a race car. Imagine the bottom or smaller side of the cup as the left side tires. See how it turns left? Stagger on a race car works the same exact way. By increasing tire pressure on the right side, or decreasing pressure on the left we add stagger to the chassis allowing the car to turn left better through a corner especially under acceleration.

One thing to keep in mind when dealing with tire pressures, is that your also changing the weight of the car on the corner your lowering or raising pressure at. By raising or lowering pressure your changing the ride height of the chassis. Changing the ride height adds or subtracts weight from that corner of the chassis. So tire pressure actually reacts like a spring. Adding more tire pressure makes that corner of the chassis a little stiffer. Lowering tire pressure will tend to make that corner of the car softer.

Tire psi synopsis:

- Higher psi in RF will loosen the car.
- Lower psi in the RF will tighten the car.
- Higher psi in RR will loosen the car.
- Lower psi in the RR will tighten the car.
- Higher psi in the LR will tighten the car from the middle out.
- Lower psi in the LR will loosen the car from the middle out.
- Higher psi in the LF will tighten the car.
- Lower psi in the LF will loosen the car.
- The lower the psi in a tire the hotter it will run.
- The higher the psi in a tire the colder it will run.
- Excessively low front tire psi will create a push.
- Excessively low rear tire psi will create a loose condition.

- Increasing the split (more RR psi than LR) increases stagger, helping the car to turn in the middle of a corner.
- Increasing the split of the left & right side psi (more psi on the right) increases the pull to the left.

Tire pressure allows us to fine tune the chassis. Drastic pressures changes at various corners of the chassis could produce less than desirable results. Keep an eye on tire temperatures. Although your changing the weight on each tire with tire pressure, your changing it to a much lesser degree than with a spring change. If you know & understand how springs work, you'll be that much further ahead when understanding how tire pressure changes effect the chassis.

Tire Temperatures
When I talk about the inside of each tire, I'm referring to the edge closest to the brake rotors or inside of the car. When I refer to the outside edge of each tire, I'm referring to those edges that are furthest from the brake rotors. Tires are marked within NASCAR 4 as O for outside, M for middle, & I for inside. See the accompanying photo for a better understanding of the outside & inside of each tire.

I previously mentioned that every adjustment we attempt to make on a racecar, is an attempt to try an maximize the grip of each tire. By taking tire temperatures of each tire we can "read" how well our chassis is performing. A good tire man can tell how a racecar is handling without ever watching it perform on the track & without even talking to the driver. Tire temperatures are the only scientific proof we have of how a chassis is working. It's easy for a driver to misinterpret how a car is handling. Tire temperatures eliminate that mystery by telling us which corner of the car is over or under worked.

The information I am going to discuss below, is what I've learned over the years working on real race cars. Some of the tire testing information I will mention below has given me various results within the sim. Some of this information transfers over to the sim rather well. Use this information to the best of your advantage to better understand the concept behind reading tire temperatures.

Tire temperatures are taken with a tool called a tire pyrometer. This tool is inserted into the tire on the inside, middle, & outside of each tire to give us readings across the surface of the tire. By comparing tire temperatures across the surface of the front tires we are able to tell if we have proper camber angles, proper toe, proper weight distribution, as well as proper tire inflation. By reading the average temperature of the RF & comparing it to the average temperature of the RR we can tell if the chassis is loose or tight. Comparing diagonal averages indicate the proper amount of wedge in the chassis.

The optimal tire temperatures should be in a range of 190 to 240 degrees. Keep in mind that the hotter the tire the quicker it will wear out. It's important to realize what the outside & inside of each tire is. The inside of each tire is the edge closest to the brake rotors or inside of the car. The outside edge of each tire are those edges that are furthest from the brake rotors. See photo above for outside & inside edges of tire temperatures.

On a short track it is normal for the outside edge of the RF tire & the inside edge of the LF to be 5 to 10 degrees cooler. This is because of the way the tires travel down the straightaway. On a larger track with longer straights, this spread will be even further. On an oval, the RF tire will have more negative camber, thus resulting in the inside edge of the tire contacting the track more than the outside edge giving you the higher temperature. On the LF you will run with more positive camber, so just the opposite holds true. While cornering these temperatures should even out if you have the correct amounts of camber & or weight transfer. The more camber you run, the higher these spreads will be. On a small track were you spend a lot of time cornering, you'll find the spread not as high. This is because your spending more time cornering than on the straights, thus distributing the temperatures across the face of the tire more evenly. If you try to achieve even temps across the tire you may develop a push. This is telling you that you have too much positive camber. Although the tire may be flat on the track, on a straightaway, the tire will not be flat on the track while cornering.

By comparing the average temperature of all four tires you can see which corner of the chassis is working harder than the other. To figure the average temperature of a tire, add the 3 temps across the tire & divide by three. If your RF is a lot hotter than the other three tires your probably pushing because the RF is doing too much work. Work on cooling that tire off by lowering the RF spring and allowing the other tires to share some of the work load. By comparing the RF average to the RR average you can tell if the chassis is loose or tight. The RF should be about 10 degrees hotter than the RR. If it's higher your probably pushing. If it's lower your loose. A tire is being under worked when it's temperature is a lot lower than the other three tires. When a tire is cooler or under worked, try concentrating on that corner of the car. Try adding weight to that corner of the car to increase the temperature of that tire. If a tire is a lot hotter than the other 3 work on making that tire cooler.

It's also informative to compare right & left side, front & rear, as well as diagonal averages. Print & use the tire temperature sheet I've provided to help track all this information. To see if you have the proper wedge, average the RF & LR tires & compare them to the two front averages & two right side averages. Your diagonal average should be 5 to 10 degrees cooler than both the front & right side averages. If it is warmer you have too much cross weight. If it's cooler then you need more cross weight or wedge.

The best way to decipher tire temperatures is to run 10 laps on a particular setup & monitor tire temps. Don't expect to learn everything reading the temps only once. It will take a number of 10 lap sessions to sort everything out that is going on with the tires. When analyzing tire temperatures it should be done in a specific order. This is because a problem in one area may mask a problem in another area. Here is what I do.

1. Run 10 laps, adjust front cambers. Run another 10 laps.
2. Adjust tire psi. Run 10 laps.
3. Adjust toe if needed. Run 10 laps.
4. Adjust wedge. Run 10 laps..
5. Adjust for tight or loose condition based on RF & RR average. Run 10 laps.
6. Look for overheated or overworked tire. Adjust on that corner. Run 10 laps.
7. Repeat the process all over again. Run 10 more laps.

When checking tire temperatures it is important to make sure your not locking up the brakes or making any sudden changes in your steering outputs. These will all create erroneous tire temperatures readings. Let me try to simplify how to read tire temperatures by giving you this guideline.

- A tire with too much NEGATIVE camber will show an excessively higher temperature at the INSIDE edges.
- A tire with too much POSITIVE camber will show an excessively higher temperature at the OUTSIDE edges.
- A tire that is OVER inflated will have a higher middle temperature than the inside & outside edges.
- A tire that is UNDER inflated will have a lower middle temperature than the inside & outside edges.
- A car with too much toe OUT will show higher temperatures on both INSIDE edges of the front tires.
- A car with too much toe IN will show higher temperatures on both OUTSIDE edges of the front tires.
- A RF tire that is HOTTER by more than 10 degrees over the RR indicates a tight condition.
- A RF tire that is COLDER by more than 10 degrees over the RR indicates a loose condition.
- A tire with the HIGHEST average temperature is the corner of the car that is being most worked.
- A tire with the LOWEST average temperature is the corner of the car that is being least worked.
- A RF & LR diagonal average that is the same or higher than the front & right side average indicates too much wedge.
- A RF & LR diagonal average that is more than 10 degrees lower than the front & right side average indicates not enough wedge.

Let me reiterate once again that the results you see may vary. Using these guidelines will give you a better idea of what your trying to achieve & should get you in the ball park of a quicker more stable setup.

Lets look at a few examples:

	RF		
I	M	O	
208	202	194	Indicates too much negative camber.

	RF		
I	M	O	
194	202	208	Indicates too much positive camber.

RF

I M O
204 188 197 Indicates an under inflated tire.

RF
I M O
204 210 197 Indicates an over inflated tire.

RF
I M O
204 198 194 Indicates correct camber. Overall average temp is 198.6.

RR
I M O
227 225 223 Overall average temp. is 225. If the RR & RF temp above came off the same car we would have a very loose racecar. The RR is approximately 26 degrees hotter than the RF. If this RR is also the hottest tire on the car, it indicates the RR is doing the majority of the work in the corners. This is the corner of the chassis I would work on. We need to take some weight of this corner to cool this tire. I'd start by going with a weaker RR spring. This should cool this tire & tighten up the chassis.

RF
I M O
215 192 186 Outside edge is too cool indicating we need more positive camber. Average temp. is 197.6. Let's compare this with the RR below taken on the same car.

RR
I M O
190 188 186 Average temp. is 188. This tire is 10 degrees cooler than the RF indicating a neutral handling chassis. This should be good, but we could be faster with a camber change on the RF. Let's adjust the camber on the RF, run another 10 laps & take temps again below.

RF
I M O
200 195 190 Camber looks much better now. The average temp is 195.

RR
I M O
192 190 188 Average temp. is 190, but now when we compare the average of the RF & RR we find our temperatures too close to each other. After the camber adjustment we no longer have a neutral handling car, but one that is now on the verge of becoming loose. Your general feeling may be that the camber change made the handling worse, and it very well may of. But were still heading in the proper direction. You may have to take a step backwards at 1st to take 2 steps forward later. We can now work on increasing the temp of the RF or work on cooling the RR to increase our average split between the RF & RR. To increase the heat in the RF try a stiffer spring. To decrease the heat in the RR try a weaker spring. Either way you will make the car tighter. How much of a change depends on how much it changes your tire temps. Run another 10 laps & review your temperatures again. Eventually you should be faster than your neutral handling setup with improper camber in the RF.

As you can see from the above example there isn't always an immediate cure. Chassis setup is sort of like solving a puzzle. Experiment & learn as you test. Always keep in mind that you may be going the correct way, but there could be an adjustment elsewhere that may be masking your initial change. Because of this chassis setup can become very frustrating for the novice and experienced alike. For every change you believe your making for the better, it will have an adverse effect elsewhere in the chassis. If for example your car feels great going into & through the middle of a corner, but is loose on exit, you have to tighten it up somehow. Curing the loose condition exiting the corner now has probably messed up your chassis going into the turn. Now you must loosen it up again. It's a constant battle of give & take. Hopefully by monitoring tire temperatures you can eliminate some of the mystery of how & why a chassis is reacting like it does.

Tire Temperature synopsis:

- Optimal temp range is between 190-240 degrees.
- The hotter the tire the quicker it will wear.
- The hottest tire on the car is the tire that is being worked the most. The coolest tire is the least worked.
- Work on the corner of the chassis that is either the most overworked or least worked 1st.
- A tire with too much NEGATIVE camber will show an excessively higher temperature at the INSIDE edges.
- A tire with too much POSITIVE camber will show an excessively higher temperature at the OUTSIDE edges.
- A tire that is OVER inflated will have a higher middle temperature than the inside & outside edges.
- A tire that is UNDER inflated will have a lower middle temperature than the inside & outside edges.
- A car with too much toe OUT will show higher temperatures on both INSIDE edges of the front tires.

- A car with too much toe IN will show higher temperatures on both OUTSIDE edges of the front tires.
- A RF tire that is HOTTER by more than 10 degrees over the RR indicates a tight condition.
- A RF tire that is COLDER by more than 10 degrees over the RR indicates a loose condition.
- A tire with the HIGHEST average temperature is the corner of the car that is being most worked.
- A tire with the LOWEST average temperature is the corner of the car that is being least worked.
- A RF & LR diagonal average that is the same or higher than the front & right side average indicates too much wedge.
- A RF & LR diagonal average that is more than 10 degrees lower than the front & right side average indicates not enough wedge.

Track Bar

The track bar or panhard bar as I like to call it, is simply a bar that is mounted behind the rearend that keeps the rearend from moving from side to side while cornering. The left side of this bar is mounted to the rearend, while the right side is mounted to the frame. Both of these mounts are adjustable up & down & change the rear roll center of the car. Rear roll center directly effects the body roll experienced in the car.

Within the sim we are allowed to lower the bar as low as 7.00" & raise it as high as 14.00". This measurement in inches is simply telling you how far off the ground the track bar is located. Raising the track bar equally on both ends raises the rear roll center & thus loosens up the car. Lowering the track bar equally lowers the rear roll center & will tighten up the car.

We are also allowed to change the track bar stagger or split between the left & right mounting points. Adding stagger to the track bar changes the angle at which the bar is mounted. By changing the track bar from level, to either uphill or downhill (raising or lower only one side, the LR or RR) you add rear steer to the car. The easiest way to describe rear steer is by equating it with wheel base. If you measure from the center of the wheel at the RF to RR then measure the same on the LF & LR that will give to your wheel base. If one side of your wheel base measurement is NOT the same as the other, you have rear steer. When you add rear steer to the car by running track bar stagger, you change how the chassis will perform at various points throughout a corner.

Raising the right side of the track bar, or lowering the left side, will make the car looser under acceleration while at the same time tighten you up under braking. Of course lowering the right side of the track bar or raising the left side will have the opposite effect & will make the car tighter under acceleration & loosen you up while braking. How much tighter or looser? It depends on how much track bar stagger you have. The greater the angles of the bar, or the larger the difference between the LR & RR, the greater the effect on the chassis.

Track Bar synopsis:

- Raising the bar on both ends loosens the chassis.
- Lowering the bar on both ends tightens the chassis.
- Raising the right side of the bar loosens the car under acceleration, & tightens the chassis under braking.
- Lowering the right side of the bar tightens the car under acceleration, & loosens the chassis while braking.

Track Notes

The track notes section of the garage area go hand & hand with the setup notes section. If you haven't yet read the setup notes section please do so now. Proper note taking is the most overlooked aspect of chassis setup. You can never have too many notes. Without proper note taking your always trying to find a needle in a haystack. With proper note taking you will at least know in which part of the haystack to begin your search.

In the track notes section I like to keep track of weather conditions & how they effect the current setup. Was it clear or cloudy when you tested with this setup? What was the temperature? The wind speed & direction? What happens to the chassis under different weather conditions?

I'll also keep track of how I like to enter or exit the corners with the current setup. Making notes of braking & acceleration points with the current setup allows you to know what to expect from the car before hitting the track. What is the best line around the track to take with the current setup? After loading a different setup you should refer to both the setup & track notes sections to review how that setup performs under "such & such" conditions. Enter a race informed of the situation at hand. Unless you've got a photographic memory, proper note taking is the only way to remember all these past adjustments & changes made from track to track. Proper note taking will keep you one step ahead of the competition.

Transmission Ratios

The transmission is designed to change the high rotational speed and low torque (turning force) of the engine's crankshaft into the higher-torque rotation needed to turn the wheels over a range of speeds. Transmission ratios vary through the 4 gears selected during shifting and are adjustable in varying increments for each individual gear. This adjustment can be accessed by clicking the drivetrain/aero tab on the garage screen

Like the differential & transmission ratios, the final drive ratios are read in the same manner. A higher number means a lower (or shorter) gear. Short gearing gives quicker acceleration, but because the engine must turn faster, fuel mileage and top speed are lower. Tall gears give smoother acceleration and higher top speed, at the expense of quick acceleration. NASCAR 2002 allows us transmission ratio changes in within following ranges:

- 1st gear 1.360 - 3.538
- 2nd gear 1.107 - 2.412
- 3rd gear 0.885 - 1.938
- 4th gear 0.885 - 1.667

Transmission ratios are very rarely changed, unless your running at a track that requires a lot of shifting, such as a road course. Most of your ratio changes will be made at the rear end in the differential. The most important factor in selecting proper transmission ratios, is to make sure your not geared to high causing excessive wheel spin. You must also be sure you have a good split between ratios through all 4 gears. You'll want to maintain as high an rpm as possible when shifting through the gears. To large a split ratio between gears will cause slow acceleration and lost time whenever shifting is required. Most notably on a road course & or while exiting the pits.

Transmission Ratio synopsis:

- The higher the ratio/number (6.56) the higher the rpms. Provides quicker acceleration, but slower top speeds.
- The lower the ratio/number (2.86) the lower the rpms. Provides slower acceleration, but higher top speeds.

Wedge
The wedge can be adjusted by clicking the weight bias tab on the garage screen. Wedge is also known as cross weight or diagonal weight. Wedge is the total weight of the RF & LR corners divided by the cars total weight. Wedge is used to keep the back of the car tight entering a corner while also adding bite exiting a corner.

Within NASCAR 2002, wedge can be adjusted as low as -150lbs. (47.9%) to as high as 150lbs. (52.1%).

The total amount of wedge required depends on track size & roll couple in the car. A setup that will spin it's tires easily will require more wedge to counter act the traction loss under power. A setup with a higher gear ratio or one that does not spin the tires will require less wedge. Wedge is required to get through the corners. Excessive amounts of wedge can slow the car down & wear the RF & LR tires prematurely.

Where as changing the front & left side bias is done by moving lead ballast, changing the wedge is done by screwing up or down on load bolts located over the RF & LR springs. You might think that by changing wedge you would change left side or front bias, but that isn't the case. No matter how you adjust the wedge the left & front bias will always remain the same. Increasing wedge will tighten the chassis. Decreasing wedge will loosen the chassis.

Wedge synopsis:

- Increasing wedge tightens the chassis.
- Decreasing wedge loosens the chassis.

Steering Linearity
I believe it is important to bring up the subject of steering linearity in this chassis guide although it really isn't a garage/chassis option. Steering linearity can effect the way your car performs through the corners. You can adjust your steering linearity under the options/controls tab within NASCAR 2002. You are allowed a range of adjustment from 0% Non-linear to 100% Linear.

The reason this option is available to use is because of all the available steering devices on the market. Although I don't suggest it, you are able to race with a joystick, as well as every type of wheel device you can imagine. Not all steering devices are created equal. Various manufactures provide different degrees of wheel movement. In other words, while one steering device may take you a quarter turn to negotiate a corner at Michigan, another wheel manufacture may require a half turn on the steering wheel to negotiate that same corner with the same exact steering ratio & linearity settings. Steering linearity allows us an adjustment to compensate for the differences in steering devices. As a general rule, most steering wheel devices will provide better precision when set towards a higher linear setting than low. Joystick users would probably prefer a lower non-linear setting.

With 100% linear steering, the wheels always turn an even amount of degrees relative to how you turn your controller. With non-linear steering, the steering is slower when the controller is close to center position and progressively quickens the more you turn the controller. At 100% linear, you will be required to steer less, but the steering will be a lot more sensitive or twitchy with the slightest of steering input. At a lower or non-linear setting, you will need to turn your wheel more to enter a corner, but you may experience a more comfortable feel, which will allow you to make better or more accurate steering decisions.

There is no right or wrong answer when it comes choosing the proper steering linearity. It all depends on what the driver is more comfortable with & what works best with what steering device you are using. A loose setup may work better with a different linearity setting than a tight setup. Adjusting your linearity can change your lap times for the better or worse. It can also change your tire wear for the better or worse. Adjusting your steering ratio along with your linearity will provide you with even more or less steering feedback.

Don't be afraid to experiment with this option. You may find a certain comfort zone with a certain linearity setting & stick with it from here on out. You may find yourself changing your linearity settings based on how tight the turning radius is for the track your competing at. Either way, experimentation is the only way your going to find out what is comfortable for you.

Qualifying Chassis Adjustments (Bob Stanley)
There are two distinct differences in NR2002S as compared to N4; first, we now get two laps of qualifying at every oval track, second, we have to use the race motor. Even though we get two laps, we shouldn’t waist the first lap for any track except the superspeedways. Often times you’ll find that the first lap is the quickest.

There are probably two main philosophies about qualifying setups; we could build something that's very radical but it drives much differently than our race setup or we could build something that basically drives the same as our race setup but we take advantage of the fact that we’re not concerned with tire wear at all so we build a setup that we can drive hard for two laps and not have to worry about changing our driving style that much. I prefer that latter philosophy. The next section talks about the chassis adjustments I may make and the order I make them.

Chassis Adjustments:

Tire Pressures: The first thing we want to do is add some tire pressure to reduce rolling drag and bring the temps up quicker so we get maximum bite. We don’t want to raise tire pressures so much though that we lose bite because we’ve severely reduced the tires contact patch by crowning it too much. The tire model in NR2002S is much more realistic than it was in N4 and not having enough contact patch is much more apparent. Typically, we want the tires to crown about 4-6 degrees.

Tape: Next we add tape but at most tracks you're not going to be able to tape the whole grille up or you'll blow the motor before you've completed two laps. As a matter of fact, you'll want to baby the car through the gears as you're pulling off pit lane. Remember that adding tape increases front downforce which will loosen the car up some.

Wedge: If you use any negative wedge on your race setup, put the wedge back to neutral which will offset the added downforce of increased tape.

Final Drive ratio: I use a taller 4th gear than I think I need especially at the short tracks where rear wheel spin can rob you of serious time. DO NOT use rear wheel spin to turn the car during qualifying. If the rev idiot light comes on at the end of the straights, 4th gear is too short. A chassis that pushes on exit also robs you of time. Use the front swaybar to fine tune that.

Camber: In NR2002S, the true measure of camber may not show up for 15 or more laps and we already know that we don't want our tire temp spread to be any more that 10 degrees across the tire for maximum grip. (Again, this is much improved over N4) So for qualifying we may want to add a bit more negative camber to the RF and positive to the LF.

Forward Weight: Since we have the car gripping a little better up front because of the tape and camber and we're probably going to enter the corners a bit faster, we may want to move weight forward a little for stability on corner entry. We don't want to make drastic changes here or it will throw off how the car handles in the middle, therefore how we drive the car.

Rear Spring split: To overcome moving weight forward and increased corner entry speeds, I increase the split in the rear springs which further stabilizes the car on entry and helps the car turn better from the middle off. For race setups, I use very little rear split because as the RF tire wears a big rear split has a tendency to make the car snap loose on exit.

Springs: Stiffer springs can give you slightly better straight speeds but at the cost of handling. If you do stiffen or soften the springs, you'll want to do evenly on all 4 corners to keep the chassis handling about the same. You can measure this by using roll couple.

Shocks: If anything, I may increase the compression stiffness of the RF shock which allows the weight to stay on the left a little longer remembering that we really don't care about tire wear here. For race setups, a stiff RF compression will cause the RF to scrub more thereby wearing it out quicker.

Sway bars: I may increase the front swaybar some if the car is a little too loose. Roll couple does not matter in a qualifying setup except that drastically changing the roll couple will change the overall handling characteristics of the car. Remember our goal through this whole process is to make the car quicker but not change how we drive it very much if at all.

Rear Spoiler: I use 70 degrees everywhere except at Atlanta, Lowes, and Michigan. Those tracks have straights long enough and the corners are banked enough to warrant the decreased drag at the expense of downforce. (55 degrees is mandated at the Dega and Daytona)

Ride height: I normally don't mess with this except as a last resort when I want the car to be just a tad looser or tighter. Lower is now better as it should be in NR2002S but wasn't necessarily the case in N4.

Caster: The very last thing I change because I normally have the way I want it from my race setup.

From a driving standpoint, we're not concerned with tire wear but remember that sliding the car (excessive squealing of the tires) through the corners robs you of time. You definitely have to have the mindset of driving the car as hard as possible but even smoother than you do during a race. You may have to slightly adjust you're braking/entry points to maintain mid corner speeds. Concentration and driver ability will be much more important than changing the chassis in NR2002S.

Building a Race Setup From Scratch (Bob Stanley)
OK, we've read through the whole guide and we understand what everything is, how it works, and we can drive consistent laps with the fast setup but where the heck do we start if we want to build our own setups? First, I have to reiterate the driving part, please do not waist your own time in the garage if you cannot drive consistent laps yet. Consistent means you're hitting lap after lap within a tenth of a second of each other. Next, let's define our goals; we want the car to be fast, we want the car to be good on (RF) tire wear, we want the other 3 corners of the car to share as much of the load as possible, we want the car to be drivable in traffic, and we want the car to be forgiving enough to get out of bad situations should we mess up a little like by hitting the apron or having to check up really hard. We've got good goals; it's now time to start turning some wrenches.

From a clean sheet start here and do the following before you take your first test spin:

Springs: Start every track with a 700lb LF spring and a 900lb RF spring. At the back use 350 on the LR and 400 on the RR.

Sway bars: Start with 1 inch sway bars front and rear. This is a little unrealistic but NR2002S does not take into account roll stiffness from tire pressures so we have to get a little crazy making up for that by using an extremely stiff rear sway bar.

Roll couple: If you're building a speedway setup, you're going to want your roll couple to be in the low 70-percentile range. If you're building a short track or road course setup the roll couple will be closer to 80%. This may necessitate slightly different springs ratings and swaybar dimensions from above. But try to stick with a 200lb split at the front and a 50lb split at the rear.

Front Bias: For speedways, start at 50.5% for shorter tracks, start at 50%. The only time you may want to go less than 50% is at Martinsville and New Hampshire where you may use as little as 47 or 48%.

Left Bias: Always max left weight except for road courses.

Camber: Start with +5.0 on the LF and 2.0 on the RF everywhere.

Trackbars: Start with a 9-11 split everywhere.

Wedge: Start with 0.

Tire pressures: Start with the tire pressures used on the fast setup.

Shocks: Start with the same settings as used on the fast setup.

Spoiler: Start with 65 at Atlanta, Michigan, and Texas, Use 70 everywhere else.

Ride Height: Start with 4.5 on the left side and 6.0 on the RR. Except for the roadies where you'll need to start with at least 5.0 on the LF and 6.25 at the back on both sides.

Gear ratios and final drive: start with the same settings used on the fast setup.

Caster: At the big tracks, start with 0 on the LF and +2.0 on the RF. Gradually increase that using the same 2 inch split as the tracks get smaller. Out of all the setup options, this is the loosest 'rule'. Caster is extremely driver dependent and will vary wildly between different drivers depending on controllers and your own personal preferences for feel.

Brake Bias: Use as little front bias as possible but enough so I can brake confidently in any situation. I use 72% as a baseline and try to get it to 67%

Linearity: I personally like to use 85% everywhere. Less linearity seems to enhance the pull to the left.

Wheel lock: Use as much as you can but still be able to turn the car. Too little wheel lock (smaller number) will cause the car to be twitchy. Typically, the wheel lock that is used on the 'fast' setups is about right.

Now you're ready to take the car out for a few laps and will probably think that the car is a bit loose because you're using far less roll couple than what we've used in the past. But drive it anyway even if you have to drive it really easy for about 20 laps. Pay attention to these things: what do your tire temps look like, what is the middle temp in relation to the edges, are the edges more than 10 degrees apart and how do the 4 tires temps compare to each other. See the tire section for help. Don't worry too much about the handling at this point unless miraculously, your tire temps are already right. Nah, that never happens the first time we 'rough' a setup in. Your tire temps do more to tell you how the car is handling than your empirical senses do.

As far as tire temps go, my individual testing during beta testing suggested that the best compromise between wear and rolling drag was a tire that had a middle temp about the same as the inner edge with the split between the edges no more than 10 degrees. In other words, your tire temps should look something like this;
LF RF
195/195/187 220/220/210
LR RR
198/198/192 221/221/215

These temps show a very well balanced chassis although a little bit loose. But remember loose is fast and better for RF tire wear. But as always, there is a compromise and we must be able to drive the setup. Especially in traffic. For qualifying and sprint setups, you'll want to crown the middle temps slightly.

Go back to the garage and adjust camber and tire pressures to get the temps right. Don't adjust anything else yet. We're not real concerned yet with the tires temps in relationship to each other yet.

Go back out on the track and run 20 more laps. Repeat the above step if the tire temps still aren't right.

Once the temps are correct, you have the middle temps running about the same as the inner edge and there's no more than a 10 degree split between the edges, we can start looking at forward bias.

On bigger tracks if you really feel like you can't drive the car in hard enough, move weight forward. We're still in the roughing in section so we're still not worrying about what the individual tire temps are in relationship to each other. Even though moving weight forward is going to put more static load on the front we can adjust for that elsewhere later on. Keep moving weight back and forth until the car feels at least relatively close to being right for entering, holding the middle and exiting. It wont be exactly right but we have to get the weight close before we can move on.

Once the car feels close we start looking at the tire temps again and how they compare to each other. For example, if the RF is running 20 degrees hotter than the RR and the LF is running 40 degrees cooler than the LR, the car is too loose and we don't have enough load on the LF. We need to move weight forward and maybe take out some wedge or stiffen the rear springs or increase the track bar. Or a combination of all the above. At this point, I don't believe there is systematically correct method for tweaking the setup. I do believe that we're looking for tire temps that are close to the example shown above because they show that each tire is handling it's fair share of the load. There are many ways to get to there from here. To keep myself sane I use the following guidelines but in no way profess that these are the right guidelines;

Get the roll couple in the right range.
Make sure camber is correct. (Adjust LS camber so that the car turns in well but may have to compromise with using less incase we hit the apron)
Make sure tire temps are correct.
Make sure each tire is handling its fair share of the load.
Use enough spoiler to insure the car does not get loose in traffic.
Use the softest springs possible but not so soft the car bottoms out.
Never use more than a 50lb split on the rear springs except for qualifying.
Use wedge to fine tune a loose or tight condition.
After everything else seems to be right, play with caster, you can find big gains here.

Use the rest of this guide to reach the above objectives. Again, I don't believe there is only one correct methodology as far as what order or how much you adjust an individual setting. The tire temps tell all in regards to how the car is handling and until you get them right, you shouldn't do much to the car in regards to your personal feel. Once you do have the tire temps right, play with caster to dial in feel. You can further tweak shocks (very fine tuning adjustment) and you can mess with the asymmetric's, spring split's tire pressures, track bars, etc… While the there is definitely a science to measuring tire temps, there isn't an exact measurement, use the pressures to fine tune handling characteristics. If you must have some order for adjusting things, you might consider using the order we used to rough in the setup for the same fine tuning but with more emphasis on caster. Personally, I believe the order for adjusting things changes for every track and boils down to how much you really know about what does what and what affects what. There is a ton of info in this guide to try and help you do that but at best we can only hope this will speed up the process of learning things on your own.

TROUBLESHOOTING

Chassis adjustments & possible causes
This section will list excessive chassis adjustments & what there effect on the chassis & or handling of the car will be. Please use this section only as a general guide. You may not see the same exact results as mentioned below. Other component settings may mask changes made in different areas. Adjustments in other areas may be needed first before you see some of the changes indicated below in certain areas. All troubleshooting answers assume the rest of the chassis is already set correctly or close to being correct.

CAMBER

Too much negative RF camber:

- Inside of tire excessively hot.
- Car turns into a corner too quickly or becomes loose.

Too much negative LF camber:

- Inside of tire excessively hot.
- Reduced pull to the left entering a corner.
- Chassis will tighten up from the middle out.

Too much negative RR camber:

- Inside of tire excessively hot.
- Tight condition from the middle out.

Too much negative LR camber:

- Inside of tire excessively hot.
- Loose condition entering a corner.

Too much positive RF camber:

- Outside of tire excessively hot.
- Car turns into a corner too slowly & feels tight.

Too much positive LF camber:

- Outside of tire excessively hot.
- Increased pull to the left entering a corner.
- Chassis will loosen up from the middle out.

Too much positive RR camber:

- Outside of tire excessively hot.
- Loose condition from the middle out.

Too much positive LR camber:

- Outside of tire excessively hot.
- Tight condition entering a corner.

CASTER

Too much caster:

- Car is more difficult to steer, more effort is required. (more noticeable with a force feedback wheel)
- Car will tend to loosen up the more the wheel is turned.

Not enough caster:

- Car too sensitive, steering becomes twitchy.
- Very little steering feel, less effort is required to turn. (more noticeable with a force feedback wheel)

Excessive caster stagger:

- Harder to steer in one direction than the other.
- Car will pull towards the side with less caster.
- Car will feel loose entering a corner.

DIFFERENTIAL RATIO

Too high a ratio:

- High rpms, potential for a blown engine.
- Loss of traction or wheel spin when accelerating.
- Loss of top speed at the end of a straight-away.

Too low a ratio:

- Low rpms.
- Car feels sluggish upon acceleration.
- Car feels under powered.

FRONT BIAS

Too much front bias:

- Will cause car to push.

Not enough front bias:

- Will cause car to be loose.

FRONT BRAKE BIAS

Too much front brake bias:

- Will cause car to push while braking.

Not enough front brake bias:

- Will cause car to become loose while braking.

FRONT SWAY BAR

Too large a bar:

- Car feels stiff, unstable & does not roll while cornering.

- Car pushes through the corners.
- Front may tend to slide & not take set.
- Car may get tighter as you progress through turn.

Too small a bar:

- Car rolls excessively while cornering & could bottom out on the RF.
- Back of the car is hard to control & feels real loose.
- Car is slow to respond when changing directions.

FRONT TOE OUT

Too much toe out:

- Car feels difficult to turn into corner.
- Car may not take set in the corner.
- Car will want to push.
- Car may wander under heavy braking.

Too much toe in:

- Car turns into a corner quicker than it should with very little wheel movement.
- Car will feel loose upon entry into a corner & is generally unstable.

GRILL TAPE

Too much tape:

- Water temperature will rise. Potential engine damage.
- Increased speeds
- Front end will stick extremely well causing a loose condition.

Not enough tape:

- Cool engine temperatures.
- Slower top speeds.
- Little or no front downforce will cause the car to push.

LEFT BIAS

Too much left bias:

- Will cause car to pull to the left.
- Car will turn left much easier than right.
- Car will loosen itself up when negotiating left hand turns.

Not enough left bias:

- Car will not turn left into a turn as easy.
- Car will turn right much more easier.
- Car will feel tight when negotiating left hand turns.

REAR SWAY BAR

Too large a rear sway bar:

- Car will feel loose
- May feel excessive wheel spin on exit.

Too small a rear sway bar:

- Car will feel tight.

RIDE HEIGHT

Too low a ride height:

- Car will bottom out.
- On the RF,LF, & RR the car will feel loose.
- On the rear will increase straightaway speeds.

Too high a ride height:

- On the LR will loosen the chassis.
- On the LR may cause the RF to bottom out.
- On the RF will tighten the chassis.
- On the rear will increase rear traction & bite.

SHOCKS

Front shocks too stiff:

- Car will push entering the corner while braking.
- Car will also push while accelerating exiting a corner.

Front shocks too weak:

- Car will be loose entering a corner while braking.
- Car will also feel loose exiting a corner while under acceleration.

Rear shocks too stiff:

- Car will be loose entering a corner while braking.
- Car will also feel loose exiting a corner while under acceleration.

Rear shocks too weak:

- Car will push entering the corner while braking.
- Car will also push while accelerating exiting a corner.

SPOILER

Too high a spoiler:

- You'll notice slower straight-away speeds.
- Chassis will feel tight while cornering.

Too low a spoiler:

- Quicker straight-away speeds.
- Chassis will feel loose while cornering.

SPRINGS

Front springs too stiff:

- Car will Understeer.
- Car feels stiff & unresponsive.

Front springs too weak:

- Car will Understeer.
- Front of car will dive entering a corner & may bottom out while braking.

- Excessive body roll.
- Mid turn push.

Rear springs too stiff:

- Car will Oversteer when accelerating.
- Excessive wheelspin.

Rear springs too weak:

- Car will Understeer.
- Excessive rear squat when accelerating possibly bottoming out.
- Car will roll over onto the RR.
- Car may be slow to take a set.

RF too stiff:

- Car will push or Understeer.

RF too weak:

- Car will be loose or Understeer.

LF too stiff:

- Car will be loose or Understeer.

LF too weak:

- Car will push or Understeer.

RR too stiff:

- Car will be loose or Understeer.

RR too weak:

- Car will push or Understeer.

LR too stiff:

- Car will push or Understeer.

LR too weak:

- Car will be loose or Understeer.

STEERING RATIO

Too high a ratio:

- Slow steering response.
- More steering required to negotiate a corner.

Too low a ratio:

- Quick steering response.
- Very little steering needed to negotiate a corner.
- Car feels sensitive or twitchy.

TIRE PRESSURE

Front pressure too low:

- Excessive heat in tire.
- Car will Understeer.

Front pressure too high:

- Cooler tire temperatures.
- Higher temp. in the middle of the tire.

Rear pressure too low:

- Excessive heat in tire.
- Car will Oversteer.

Rear pressure too high:

- Cooler tire temperatures.
- Higher temp. in the middle of the tire.

RF too high:

- Car will feel loose.

RF too low:

- Car will feel tight.

RR too high:

- Car will feel loose.

RR too low:

- Car will feel tight.

LR too high:

- Car will feel tight from the middle out.

LR too low:

- Car will feel loose from the middle out.

LF too high:

- Car will feel tight.

LF too low:

- Car will feel loose.

TRACK BAR

Too low:

- Car will roll less.
- Car will Understeer or feel tight.

Too high:

- Car will roll more.
- Car will Oversteer or feel loose.

Right side too low:

- Car will feel loose entering a corner while braking.
- Car will push exiting a corner while accelerating.

Right side too high:

- Car will push entering a corner while braking.
- Car will feel loose exiting a corner while accelerating.

TRANSMISSION RATIO

Too high a ratio:

- High rpms, potential for a blown engine.
- Loss of traction or wheel spin when accelerating.
- Loss of top speed at the end of a straight-away in 4th gear.

Too low a ratio:

- Low rpms.
- Car feels sluggish upon acceleration in 4th gear.
- Car feels under powered.

WEDGE

Too much:

- Car will push.
- Prematurely worn RF & LR tires.

Not enough:

- Car will be loose.
- RF & LR tires not carrying there fair share of the load.

Handling problems & possible causes
This section will list various handling problems & what might be causing those handling problems. Please use this section only as a general guide. You may not see the same exact results as mentioned below. Other component settings may mask changes made in different areas. Adjustments in other areas may be needed first before you see some of the changes indicated below in certain areas. All troubleshooting answers assume the rest of the chassis is already set correctly or close to being correct.

CAR FEELS UNSTABLE

- Excessive front toe.
- Too soft a shock.
- Too much camber stagger.
- Excessive front or rear bias.
- Not enough caster
- Excessive caster stagger.
- Front sway bar too stiff.
- Excessive front or rear brake bias.
- Fuel load had changed.
- Too much grill tape.
- Too low a ride height
- Spoiler too low.
- Wrong spring.
- Steering ratio too low.
- Steering linearity too high.
- Tire psi. too low.

CAR FEELS UNRESPONSIVE

- Tire psi too low.
- Springs too soft.
- Shocks too soft.

- Front sway bar to small.
- Track bar too high.
- Too much caster

CAR FEELS OVER RESPONSIVE

- Tire psi too high.
- Springs too stiff.
- Shocks too soft.
- Front sway bar to large.
- Track bar too low.

CAR IS LOOSE ENTERING CORNER

- Too much stagger.
- Not enough toe out.
- Too much negative RF camber.
- Too much positive LF camber.
- RR camber too high.
- Too much caster stagger.
- RF caster too high.
- Not enough front brake bias.
- Not enough front bias.
- Front sway bar too small.
- Too much grill tape.
- Too large a rear sway bar.
- LR ride height too high.
- LR shock rebound too stiff.
- LF shock compression too soft.
- RR shock rebound too stiff.
- Front shock compression too soft.
- Rear shock rebound too stiff.
- Spoiler angle too low.
- Front springs too weak.
- Front spring stagger to high.
- Rear springs too stiff.
- RF spring too soft.
- RR spring too stiff.
- Front spring stagger too high.
- Steering ratio too high.
- RF tire psi. too high.
- RR tire psi. too high.
- LF tire psi. too low.

- RF caster too high.
- Track bar too high.
- Right side track bar too low.
- Wedge too low.
- Too much trail braking.
- Driver error. (erratic throttle & steering inputs)

CAR IS LOOSE IN THE MIDDLE OF A CORNER

- Wedge too low.
- RF spring too soft.
- RR spring too stiff.
- Too much rear spring stagger.
- Front sway bar too soft.
- RR psi. too high.
- Stagger too high.
- Track bar too high.
- Front tire psi. too high.
- LR tire psi. too low.
- Excessive front toe (in or out)
- Improper camber settings.
- Not enough negative LF camber.
- Excessive positive camber in the RR.
- Too much positive caster.
- Too high a differential ratio causing wheel spin.
- LF shock compression too low.
- LR shock rebound too high.
- RR shock compression too high.
- Right side track bar too high. (too much split on banked tracks)
- Left side track bar too high, (Not enough split on flat tracks)
- Not enough front bias.
- Spoiler too low.
- Driver error. Compensating for a corner entry push.

CAR IS LOOSE EXITING A CORNER

- Too much stagger.
- Wedge too low.
- LF caster too low.
- Too much positive LF camber.
- LR spring too soft.
- RR spring too stiff.
- Decrease rear spring stagger.

- RR tire psi. too high.
- LR tire psi. too low.
- Too high a differential ratio causing wheel spin.
- Not enough front bias.
- Too small a front sway bar.
- Excessive front toe (in or out).
- Too much grill tape.
- Too large a rear sway bar.
- LR ride height too high.
- Rear shock compression too stiff.
- Front shock rebound too soft.
- Spoiler too low.
- Rear spring stagger too high.
- Front springs too weak.
- Rear springs too stiff.
- Track bar too high.
- Track bar on right side is too high.
- Driver error. (erratic throttle & steering inputs)

CAR PUSHES ENTERING CORNER

- Not enough stagger.
- Too much toe out.
- Not enough negative RF camber.
- Not enough positive LF camber.
- Not enough caster stagger.
- Too much front brake bias.
- Too much front bias.
- Front sway bar too large.
- Not enough grill tape.
- Too small a rear sway bar.
- LR ride height too low.
- LR shock rebound too weak.
- Front shock compression too stiff.
- Rear shock rebound too weak.
- Spoiler angle too high.
- Front springs too stiff.
- Front spring stagger to low.
- Rear springs too weak.
- RF spring too stiff.
- RR spring too soft.

- Front spring stagger too low.
- Steering ratio too low.
- RF tire psi. too low.
- RR tire psi. too low.
- LF tire psi. too high.
- RF caster too low.
- Track bar too low.
- Right side track bar too high.
- Wedge too high.
- Driver error.

CAR IS TIGHT IN THE MIDDLE OF A CORNER

- Wedge too high.
- RF spring too stiff.
- RR spring too soft.
- Not enough rear spring stagger.
- Front sway bar too stiff.
- RR psi. too low.
- Stagger too low.
- Track bar too low.
- Front tire psi. too low.
- LR tire psi. too high.
- Excessive front toe (in or out)
- Improper camber settings.
- Too much negative LF camber.
- Not enough positive camber in the RR.
- Not enough positive caster.
- Too low a differential ratio.
- LF shock compression too high.
- LR shock rebound too low.
- RR shock compression too low.
- Right side track bar too low. (not enough split)
- Too much front bias.
- Spoiler too high.
- Driver error. Compensating for corner entry looseness.

CAR PUSHES EXITING A CORNER

- Not enough stagger.
- Wedge too high.
- LR spring too stiff.
- RR spring too soft.

- RR tire psi. too low.
- LR tire psi. too high.
- Too low a differential ratio.
- Too much front bias.
- Too large a front sway bar.
- Excessive front toe (in or out).
- Not enough grill tape.
- Not enough positive LF camber.
- Too small a rear sway bar.
- LR ride height too low.
- Rear shock compression too soft.
- Front shock rebound too stiff.
- RR shock compression too low.
- Spoiler too high.
- Rear spring stagger too low.
- Front springs too stiff.
- Rear springs too soft.
- Track bar too low.
- Track bar on right side is too low. (not enough split)

On track adjustments
This section will discuss the adjustment options we have available to us during a race while pitting.

Once the race begins, were limited as to what we can adjust to help improve our chassis. The following is a list of options we can change during a pit stop:

- F3 Fuel
- F5 Tires/psi.
- F6 Wedge
- F7 Track Bar
- F8 Grill Tape

To change the amount of fuel you would like during a pit stop you must press the F3 button on your keyboard. From here you can use you left & right arrows to select how much fuel you want to take on. You are allowed to take on a splash of fuel as well as 1/2, 1, 1 1/2, or 2 cans. A splash of fuel will give you 2-3 gallons. 1/2 can gives you 5-6 gallons. 1 can equals 11-12 gallons, 1 1/2 cans will give you 17-18 gallons. 2 cans will fill your tank with 22 gallons. The less fuel you carry the faster you should be. Use this to your advantage when planning pit stops, race strategy, & fuel mileage.

Pressing the F5 button on your keyboard will bring up the tire change screen. Here you are able to decide how many tires you would like changed as well as any psi adjustments you would like to make. Pressing the space bar will allow you to toggle between taking on 4 tires, left sides, right sides or no tires. Using the up & down arrows on the keyboard will allow you to select each individual tire that you would like to make an air pressure adjustment too. Hitting the left & right arrows will allow you to increase or decrease the pressure of the selected tire in 1/2 lb. increments. Tire psi is the most difficult of all adjustments to remember while pitting because it can be changed in conjunction with other tires to produce various results.

The F6 button on your keyboard will allow you to make a wedge adjustment. Use the left & right arrows to increase or decrease the desired amount of wedge. You can change the wedge in 5 lb. increments. Increasing wedge (higher %) will tighten the chassis. Decreasing wedge (lower%) will loosen the chassis.

Use the F7 button to adjust your track bar. Using the left & right arrows we can raise or lower the track bar in 1/4" increments. The important thing to remember when adjusting the track bar during a pit stop, is that your raising or lower the RIGHT side ONLY. In the garage were allowed adjustments on both sides. Because were only adjusting the right or frame side of the track bar, we are adding rear steer to the chassis. Therefore raising the the track bar during a pit stop will make the car looser under acceleration while at the same time tighten you up under braking. Lowering the right side of the track bar will have the opposite effect & will make the car tighter under acceleration & loosen you up while braking. The more you raise or lower the bar, the greater the effect on the chassis.

Adding or removing grill tape is another adjustment we can make by using the F8 button on the keyboard. The left & right arrows will add or subtract tape in 5% increments. Adding grill tape reduces drag & increases speed. Adding tape also places more downforce on the front end & can be used to loosen the car up through the corners. Be sure to keep an eye on your gauges. Too much tape will raise your water temperature & overheat your engine, you might be forced to make an extra pit stop to remove the tape to help cool the engine.

As you can see, the number of adjustments we have available to us during a race, are far less than we have in the garage. Because of this it is important to have your setup close before entering a race. Use the above adjustments to fine tune the chassis for the various weather conditions & to readjust your chassis as a race progresses.

Troubleshooting by component

This section will discuss each adjustable chassis component & there effect on the handling of the car. Please use this section only as a general guide. You may not get the same exact results as mentioned below. Other component settings may mask changes made in different areas. Adjustments in other areas may be needed first before you see some of the changes indicated below in certain areas. All troubleshooting answers assume the rest of the chassis is already set correctly or close to being correct.

Camber

- More negative RF camber allows the car to turn into a corner quicker & will loosen up the chassis.
- Less negative RF camber takes away some of the pull to the left. The car won't turn in as quicker into a corner & will tend to tighten the chassis.
- More negative LF camber will reduce the pull to the left while tightening the chassis from the middle out.
- More positive LF camber will increase the pull to the left & allow the car to turn into a corner quicker loosening the chassis.
- More positive camber in the RR will loosen the car from the middle out.
- More negative camber in the LR will loosen the chassis entering a corner.

Caster

- More positive caster will loosen the chassis the more the wheel is turned through a corner.
- Caster adjustments are better felt through a force feedback wheel.
- The car will pull to the side with the lower amount of positive caster.
- The higher the caster stagger, the easier the car will turn into a corner.
- The higher the caster stagger, the less steering effort required. This will tend to give you a loose feeling upon corner entry.

Differential Ratio

- The higher the ratio/number (6.56) the higher the rpms. Provides quicker acceleration, but slower top speeds.
- The lower the ratio/number (2.86) the lower the rpms. Provides slower acceleration, but higher top speeds.

Final Drive Ratios

- The higher the ratio/number the higher the rpms. Provides quicker acceleration, but slower top speeds.
- The lower the ratio/number the lower the rpms. Provides slower acceleration, but higher top speeds.

Front Bias

- More front bias will tighten the chassis.
- Less front bias will loosen the chassis.

Front Brake Bias

- More front brake bias will tighten the chassis entering a corner under braking.
- Less front brake bias will loosen the chassis entering a corner under braking.

Front Sway Bar

- The larger the bar the tighter the chassis.
- The smaller the bar the looser the chassis.

Front Toe Out

- Excessive front toe out will make a car turn slower into a corner, & cause a tight condition.
- Excessive front toe in will make a car turn into a corner quicker, & may create a loose condition.

Fuel Level

- Less fuel equals faster speeds.
- The less fuel in the tank the tighter the chassis will become.
- Splash = 2-3 gallons, 1/2 can = 5-6 gallons, 1 can = 11-12 gallons, 1 1/2 cans = 17-18 gallons, 2 cans = full tank.

Grill Tape

- Higher tape % will increase speeds.
- Higher tape % equals higher water temperatures.
- Higher tape % will loosen the chassis.

Left Bias

- Higher left side bias will help turn the car left into a corner & loosen a chassis when making left hand turns.
- Higher right side bias will cause the car to Understeer when making a left hand turn.

Rear Sway Bar

- The larger the bar the looser the chassis.
- The smaller the bar the tighter the chassis.

Ride Height

- Too low a ride height could cause the car to bottom out.
- The higher the RF ride height the tighter the car will be.
- The higher the REAR ride heights, the more drag on the straight-aways, but the better the rear will stick in the corners.
- A higher LF will tighten the chassis.
- A higher LR will loosen the chassis.
- A higher RR will tighten the chassis.

Shocks

RF

- Higher compression will tighten the chassis entering a corner.
- Lower compression will loosen the chassis entering a corner.
- Higher rebound will tighten the chassis accelerating out of a corner.

- Lower rebound will loosen the chassis accelerating out of a corner.

RR

- Higher compression will loosen the chassis accelerating out of a corner.
- Lower compression will tighten the chassis accelerating out of a corner.
- Higher rebound will loosen the chassis entering a corner.
- Lower rebound will tighten the chassis entering a corner.

LF

- Higher compression will tighten the chassis entering a corner.
- Lower compression will loosen the chassis entering a corner.
- Higher rebound will tighten the chassis accelerating out of a corner.
- Lower rebound will loosen the chassis accelerating out of a corner.

LR

- Higher compression will loosen the chassis accelerating out of a corner.
- Lower compression will tighten the chassis accelerating out of a corner.
- Higher rebound will loosen the chassis entering a corner.
- Lower rebound will tighten the chassis entering a corner.

Asymmetrical changes:

- The stiffer the shock, the less grip that tire will have.
- Stiffer rebound on the left shocks will help the car turn in by slowing weight transfer to the right.
- Stiffer compression on the right shocks will help the car turn in by also slowing weight transfer to the right.
- Softer rebound on the front shocks will loosen the chassis exiting the corner.
- Softer compression on the rear shocks will tighten the chassis exiting the corner.
- Doing just the opposite mentioned above, on either compression or rebound will produce just the opposite results.
- Asymmetrical changes seem to have a greater influence than individual shock changes.

General:

- Use the above info as a guideline only. Changing just one shock may not give you the exact results mentioned above. Other factors must be considered. Other shocks & settings as well as asymmetrical changes will produce different results with varying degrees of chassis changes or feelings based on other components & driving style.

Spoiler

- The higher the angle the slower your straight-away speeds.
- The lower the angle the faster your straight-away speeds.
- The lower the angle the looser the chassis.
- The higher the angle the tighter the chassis.

Springs

- Weaker LF will make the car tight.
- Weaker RR will make the car tight.
- Weaker RF will make the car loose.
- Weaker LR will make the car loose.

- Stiffer RF will make the car tight.
- Stiffer LR will make the car tight.
- Stiffer LF will make the car loose.
- Stiffer RR will make the car loose.
- Overall stiffer front springs will make the car tight.
- Overall stiffer back springs will make the car loose.
- Overall weaker front springs will make the car loose.
- Overall weaker back springs will make the car tight.
- Increasing front spring stagger will tighten the car under acceleration & loosen it under braking.
- Increasing rear spring stagger will loosen the car under acceleration & tighten it under braking.

Steering Ratio

- The lower the ratio the quicker the steering response.
- The higher the ratio the slower the steering response.
- Lower ratios require less turning of the wheel to negotiate a corner.
- Higher ratios require more turning of the wheel to negotiate a corner.

Tire Pressure

- Higher psi in RF will loosen the car.
- Lower psi in the RF will tighten the car.
- Higher psi in RR will loosen the car.
- Lower psi in the RR will tighten the car.
- Higher psi in the LR will tighten the car from the middle out.
- Lower psi in the LR will loosen the car from the middle out.
- Higher psi in the LF will tighten the car.
- Lower psi in the LF will loosen the car.
- The lower the psi in a tire the hotter it will run.
- The higher the psi in a tire the colder it will run.
- Excessively low front tire psi will create a push.
- Excessively low rear tire psi will create a loose condition.
- Increasing the split (more RR psi than LR) increases stagger, helping the car to turn in the middle of a corner.
- Increasing the split of the left & right side psi (more psi on the right) increases the pull to the left.

Tire Temperatures

- Optimal temp range is between 190-240 degrees.
- The hotter the tire the quicker it will wear.
- The hottest tire on the car is the tire that is being worked the most. The coolest tire is the least worked.
- Work on the corner of the chassis that is either the most overworked or least worked 1st.
- A tire with too much NEGATIVE camber will show an excessively higher temperature at the INSIDE edges.
- A tire with too much POSITIVE camber will show an excessively higher temperature at the OUTSIDE edges.

- A tire that is OVER inflated will have a higher middle temperature than the inside & outside edges.
- A tire that is UNDER inflated will have a lower middle temperature than the inside & outside edges.
- A car with too much toe OUT will show higher temperatures on both INSIDE edges of the front tires.
- A car with too much toe IN will show higher temperatures on both OUTSIDE edges of the front tires.
- A RF tire that is HOTTER by more than 10 degrees over the RR indicates a tight condition.
- A RF tire that is COLDER by more than 10 degrees over the RR indicates a loose condition.
- A tire with the HIGHEST average temperature is the corner of the car that is being most worked.
- A tire with the LOWEST average temperature is the corner of the car that is being least worked.
- A RF & LR diagonal average that is the same or higher than the front & right side average indicates too much wedge.
- A RF & LR diagonal average that is more than 10 degrees lower than the front & right side average indicates not enough wedge.

Track Bar

- Raising the bar on both ends loosens the chassis.
- Lowering the bar on both ends tightens the chassis.
- Raising the right side of the bar loosens the car under acceleration, & tightens the chassis under braking.
- Lowering the right side of the bar tightens the car under acceleration, & loosens the chassis while braking.

Transmission Ratios

- The higher the ratio/number (6.56) the higher the rpms. Provides quicker acceleration, but slower top speeds.
- The lower the ratio/number (2.86) the lower the rpms. Provides slower acceleration, but higher top speeds.

Wedge

- Increasing wedge tightens the chassis.
- Decreasing wedge loosens the chassis.

Glossary

Aero-Loose: An oversteer or loose condition created when a car follows to too closely. The car behind you takes air off your spoiler giving you little or no down force on the rear of of car. The result is a car that all the sudden becomes very loose.

Aero-Push: An understeer or tight condition created when you follow a car too closely. The car in front of you takes air off the front of your car giving you little or no down force on the front of your car. The result is a car that all the sudden becomes tight or pushes.

Apex: The area of a corner, not just a clipping point, where the inside front wheel runs closest to the inside of a given corner. Where you apex is directly related to how you entered at the turn and will effect how you exit the turn. An apex varies from corner to corner and, for example can be too early or to late.

Apron: The paved flat surface that separates the racing surface from the infield.

Blend Line: The painted white or yellow line that you must stay below before merging into traffic when exiting the pits.

Camber: Camber is the inward or outward tilt of the wheel at the top of the wheel.

Caster: Caster is the leaning forward or back of the tire at the top of the wheel.

Cross Weight: the total weight of the RF & LR corners divided by the cars total weight.

Diamond: A method of cornering where you have an early apex entry into turns 1 & 3, followed by a late apex exit from turns 3 & 4. This line forms a diamond and is preferable at certain tracks.

Drifting: Drifting is or should be a controlled function, it is a balance. It is directly opposed to sliding or skidding which are out-of-control conditions.

Dynamic weight transfer: Is the transferring of weight from side to side during cornering, from rear to front during deceleration and from front to rear during acceleration.

Groove: The groove is usually considered the fastest way around the race track. It is visible by the darkened asphalt around the racing surface.

Line: This refers to the physical line of movement that car car takes through any given turn from entry, to apex, to exit. A line can be either good or bad, right or wrong.

Oversteer: When you have adhesion and traction with the front wheels of the car, but the rear wheels lose traction and slide toward the front. It is also referred to as being "loose" or "coming around."

Panhard Bar: A bar that is mounted behind the rearend that keeps the rearend from moving from side to side while cornering.

Ride Height: The distance measured in inches from the bottom of the frame rails to the ground.

Roll Center: The point about which the car rolls.

Roll Couple: The percentage of how much body roll is distributed between the front and the rear suspension systems.

Rear Steer: When the rear wheels decrease wheel base on one side & increase on the other.

Stagger: The difference in circumference between the right side tires & left.

Takes set: A term used in cornering when all weight transfer has taken place and the tires are at maximum slip angles.

Traction Sampling: Periods when you are in danger of exceeding the limits of tire adhesion, such as when cornering, braking, and accelerating.

Trail Braking: Trail braking occurs anytime your turning and decelerating (not necessarily braking), at the same time.

Trailing Throttle Oversteer: A condition when the back of the car wants to pass by the front entering a corner. A car that becomes loose usually due to abrupt throttle and brake transitions. Trailing throttle oversteer is caused by quickly letting of the throttle or hitting the brakes too hard turning into a corner. When this occurs, all the weight from the car is being transferred towards the front of the vehicle. This causes the back of the car to become light or loose and most likely results in a spin. This is the most common mistake made by rookie drivers.

Understeer: When you have traction with the rear wheels but the front wheels lose traction regardless of the steering correction. Also referred to as "pushing" or "plowing."

Wheel Base: The distance as measured from the center of the front wheel to the center of the rear wheel.