In today's open wheel world, there is endless variations of shocks available with any number of combinations of piston designs and valving. Some types of designs provide the ability to adjust shock rates quickly at the race track. With all of these choices, we have what we need to choose the exact rate of compression and rebound necessary for a particular set of conditions. This can either be an advantage or the proverbial "I've spun myself out..." syndrome. The more we learn, the better we can make decisions regarding shock selection.

More and more, racers are being educated in all aspects of chassis tuning and they want to know more about shock technology. The more we know about each of these subjects, the less fear we have. It is what we don't know that we fear the most.

The information presented here is intended as a guide to help you understand the basic principles of shock technology and the art of track tuning with shocks. Exact rates for the shocks you need for your car will depend on how your car is constructed, set up, and driven, as well as factors such as weight distribution and race track characteristics.

We would really like to give you the exact shock values that will make your car as fast as it can be, but that would be impossible due to the many variables. Those variables are why you must work with your particular car and not follow what others are doing. Each car is a little different than the others and each driver has his/her own style of driving.

Of course there is the two strokes of the shock, rebound and compression, they are looked at separately and perform functions related to different areas of track tuning. If we deal with rebound and compression separately, we need to be able to tune each independently. Now days constant development of designs of shock pistons and bleed technology enables us to do amazing things with linear and the digressive valving. Again, we are able to achieve varying results by utilizing all of the variables of shock design.

For some situations, we would use split valve shocks. Split-valving means we have different rates of resistance for rebound and compression because we need to tune each movement a little differently than the other. We can also rate the two movements differently for each corner of the car to further tune the setup. More recently we have started using shocks that have adjustments for rebound, compression, or both (double adjustable). That way, we can experiment with different shock rates without removing them from the car. Regardless of how we arrive at different shock rates, we do need to know beforehand what we are looking for and how to get there.

Shock companies provide a system of numbers or letters to reference the rates of rebound and compression. Most of these companies try to provide a cross-reference so that their numbering system can be compared to the other systems used by competing shock brands. The ultimate match between shock brands is not exact due to differences in design of the valving and the fact that companies will rate shocks at a different shaft speed.

If, for example, assuming that a shock has been ran at 6 inches per second and looking at the 3" # by one manufacturer the shock could rate at 80 pounds of resistance, comparing them would depend on what speed of movement each company rated that 80 pounds. We know the rate of resistance is directly related to shaft speed because of disk deflection. Company X might rate the 80 at pounds at 5 inches per second of shaft speed where company Y might rate the 80 pounds at 10 inches of shaft speed. We can see where the two would not feel the same to the driver. The X and Y shock will be reading different once on a dyno and run at the same speed. Long story short, it is really best to get your shocks run by one person to really see what shock package consists of rated at the same speed.

Tuning with Split-Valve Shocks

If we split the front shock compression rates with a left front (LF) 4/5 and a right front (RF) 5/5, then while the suspension is in motion due to weight being transferred onto it, then the RF suspension will move slower than the LF suspension. Additional weight will be transferred onto the RF and LR tires, causing a momentary increase in the crossweight percent in the car. This obviously tightens the car.

It is important to note that, contrary to some opinions, the weight transfers almost immediately when a force is presented to enact that transfer. As we brake into the corner, the weight transfer happens quickly. If we transfer 300 pounds on entry from the rear to the front, the 300 pounds goes to the front in an instant. The distribution of that 300 pounds between the two front wheels, while the suspension is assuming a new attitude that will support the additional weight, will depend entirely on differences in stiffness of the suspension systems at all four corners. Stiffness is defined as the resistance to movement of the shocks and springs.

Reasoning out the effect of weight transfer onto the front suspensions that are dissimilar in stiffness, the slower moving (or stiffer) corner will momentarily retain more of the transferred weight while the suspension is moving to a new attitude to support the added weight. If the RF suspension is stiffer than the LF suspension, then both the RF and LR tires will support more of the total sprung weight of the race car.

Crossweight is defined in short track racing as the percent of the combined RF and LR weight versus the total car weight. If the crossweight percent increases, the car will be tighter on entry and the car might be faster if that is the desired effect. This is exactly why it has been said that a stiffer RF shock will speed up weight transfer to that corner. In truth, some of the momentary weight that has been transferred onto the RF due to that corner being stiffer than the LF corner may well return to the LF tire as the car reaches a steady state or a steady ride height at mid-turn.

If the car is already tight on entry, after having eliminated common causes of tight entry such as tire spacing and stagger, an opposite effect can be utilized. If we increase the compression of the LF shock and/or increase the spring rate on that corner (which is usually a good idea for flat tracks), we can effectively reduce the crossweight in the car on entry while the suspension is in transition by loading the opposite diagonal, the LF and RR. As one diagonal goes up in percentage of supported weight, the other goes down. We can also work with the rear shock rebound rates to help effect changes in weight distribution and corner entry characteristics. To neutralize a car that is tight on entry, a heavier rebound setting in the LR shock and will cause more of the transferred weight to be taken from the LR than the RR tire during the transitional period. This too causes a decrease in the RF and LR weight distribution percentage that loosens the handling momentarily while the suspensions are in motion.

Exit Tuning Using Split-Valve Shocks
Corner exit performance that utilizes the shocks is primarily tuned by splitting the compression settings in the rear shocks and/or the rebound settings in the front shocks. A stiffer compression in the LR shock will load the LR and RF corners as weight is transferred to the rear while the rear suspension is in motion. A stiffer shock in rebound at the LF corner can help accomplish the same effect by causing a slower movement of that suspension and a more rapid transfer of weight off of that corner which in turn increases the percentage of weight supported by the RF and LR tires.

The term "tie down" is used to refer to a shock that has a high resistance to rebound. If the rebound rates are higher for both left side shocks than those of the right side shocks, then as the car turns left (especially with quicker turning with smaller radius turns), the tendency for the left side suspension to quickly rebound as weight is transferred from the left side to the right side is reduced.

If we can stop the sudden motion, we can keep the left side down on initial turn in and the chances are good that the whole attitude of the car through the middle of the turns will be lower. A lower center of gravity (CG) means less weight transfer off the left side of the car and more retained left side weight.

"Easy Up" shocks on the front are used to help raise the suspension quickly which does also raise the center of gravity of the sprung mass and a higher CG promotes more weight transfer. On dry, slick tracks, teams can utilize less rebound in the left side shocks and in the front shocks to promote weight transfer to the right side for better side bite and to the rear for better traction off the corners.

Putting All Of This to Use
In order to utilize the configurations we have discussed here, we must be able to use a range of different rates of shocks in order to find the right combination for our car at a particular race track. For a team that races at only one track, the process is fairly simple. You would experiment to find the fastest set of shocks and ones that suit the driver's style and stick to those. For teams that travel to different tracks, some changes will be necessary if the setup needs to change and/or the track layout is different from track to track.

Many shock experts agree with certain basics, such as:

1. The shock package should be softer overall when racing on a track that is flat with dry conditions.
2. Get your basic setup close before trying to tune with shocks. Shocks cannot solve basic handling balance problems.
3. Higher-banked tracks require a higher overall rate of shock as opposed to flat tracks. This is because of the higher speeds and the amount of downforce because of air and entering into the banking.
4. Tune entry performance first. If there are no entry problems, make small changes if you want to experiment to see if entry can be improved. Entry problems include a tight car or a loose car. The worst problem, by far, would be the loose-in condition. This is commonly a set up problem and not shock related.
5. Tune exit performance last. If there are no exit problems, don't make any significant changes. Exit problems can include a car that pushes under acceleration or one that goes loose under power. Be sure that you do not have a tight /loose condition where the car is basically tight and goes loose just past mid-turn.
6. On dirt tracks, reduce rebound settings on the left side and decrease the compression rates on the right side for dry, slick surfaces to promote more chassis movement. This helps to maintain grip as the car goes through the transitional phases of entry and exit.

A Closing Caution
The suggestions provided here are representative of trends that can enhance your handling package. Before any of this can work, the setup must be balanced, the steering characteristics must be ideal, and the car must be squared properly. If not, you will probably chase the setup and experience a lot of frustration and expense. Shock tuning, and having them correct has become very important because the cars are so even these days. Your goal is to have a balanced car that is working along with the shocks you have chosen to run.