Setup Guide and Chassis Tuning Tips
(*simple version*)

By Jim Daniels

As promised the following is a walk through of how I setup my SM with a list of tuning tips I use at the track. Many have theories, thoughts and ingrained ideas on setup and tuning. I'm not trying to change any of that, I'm simply providing you with what I use on this type of racecar. I hope that you use this guide as a source to further your racing program and setup abilities. I welcome any suggestions you have, send them to me at jim@jimdaniels.com. This guide will be placed in the FAQ section of the www.specmiata.com web site.

Expect 6-8 hours the first time you do this yourself, sometimes longer depending on your mechanical ability. This time estimate is AFTER you level your floor.

Tools and equipment needed to do setup at home:

- Level surface (absolutely level, use shims to achieve if needed)
- Scales, camber gauge, toe plates, string
- Normal tools and jack stands
- Maybe some 8' sections of clear tube needed to level the workspace

Before you start, a few things need to be done to the car, a few assumptions have to be made and a couple techniques explained.

1.) The sway bars need to be disconnected on one side (I like the left side).
2.) You need to find the center of the steering rack then lock down the column with a pair of vice grips and a bungee cord. This would be a good time to adjust the steering wheel adapter if it is off center from the rack's center. I use my steering wheel like a degree wheel to find the center. Then, I removed the hub and adjust the splines until the "T" on my steering wheel is square.
3.) The tires need to be at "hot" pressures, 40 will do.
4.) The driver's weight needs to be in the car at all times, I prefer a real person to sit there the whole time. If not, try to divide up body weight for torso, legs etc…
5.) Do yourself a favor and make sure the suspension bolts, perch adjusters and other hardware you will be adjusting are free, ready to adjust but not loose.
6.) In the rear sub-fame, driver's side, just above the inboard lower bushing mounts you will see some holes cut by the factory. These holes are on both sides of the sub-frame again just up from those lower bushings. Find the two holes that are in alignment, one for the front of the sub-frame and one for the rear. Install a 3-4" bolt, the size of the hole, with a jam nut holding it in place. Have the bolts extent outward (front to the front and rear to the rear). These bolts establish the centerline of the car and will be used to square the car up in later steps (see Picture 1).

7.) I make the assumption that no parts are bent and you have used your thumb to get toe and camber where it looks ok. 2" of toe out or +3 camber on one wheel is what I mean, correct that NOW by eye, do not spend too much time on it.
8.) After each setting adjustment, bounce the car in place STOP, roll it 8-10" back then forward to where it was. NEVER, bounce again after you start rolling forward and always end your bounce going up, not down on the car.
9.) You have a factory manual and know how to use it for finding out the procedures needed to make the setup adjustments.
10.) Empty all fuel and put one gallon back in.
11.) Using a fish scale, and after all prep is done, I measure the car's resistance on a flat surface. Record what it takes to just roll the car. Later, as you do maintenance, compare the freshly prepared car to the after raced car. If you gain resistance, look to see if there is a reason for that gain (brakes, fluid break down, bearings etc…). Correct if you can keeping in mind that you might establish a new resistance number after the car has seen the track and become seated in.

Regarding setup and especially for new builds this process below will not be very fun as you will chase yourself narrowing the gap of the different settings. You will find out that when you make a change to one setting, others may be altered. Be patient, the gap will lesson until it is right.

It Begins

Step #1 (Ride Height)

Using the spring perches, adjust the ride height to 5-1\4" at the pinch weld on the bottom of the car at the rocker panel (see Picture 2 & 3). It is normal for the LR to have more threads showing on the bottom compensating for the driver's weight. This will take sometime as you get used to how the car moves on one corner while you adjust another. BE PATIENT, keep going back and forth till it is near perfect. Remember this step, you will be back here again many times. You will not be showing the same amount of threads corner to corner. Remember, the floor where your car sits AND where you measure from needs to be level!!!

Step #2 (LR Toe and Camber)

We now need to square the car up so we can run through the first of several settings adjustments. Remember those bolts I had you install, now is the time to use them. They are used to measure the lower control arm on the driver's side rear wheel verse the centerline of the car. Using a telescopic measuring device, adjust the lower cam bolts until the distance between the bolts you installed, front and rear, and the back of the outboard bushing flange of the lower control arm are the same, front and rear (see picture 4). You now have zero toe on that wheel and that wheel is pointing straight.

While doing this wheel, go ahead and make the camber -2. You are adjusting the cam bolts anyway, this is what I like to do. Often, I do not have to touch this wheel again. JUST REMEMBER, if you get out of whack, set this wheel again and go from there, keep reading. Keeping this wheel square is vital to this process!!

Please Note: Steps #3 - #5 can be both time consuming and frustrating for the uninitiated. Iron Canyon Motorsports has recently released an ICM Alignment System to assist in "stringing" your Spec Miata. Visit http://www.ironcanyonmotorsports.com for more information.

Step #3 (LF Toe, Camber and Caster)

Time to get that kite string and jack stands out. Adjust 2 stands where they are slightly above the center wheel hub height. Tie your string securely to the portion of the stands that is adjustable. Now make final corrections so the string is level with the center line of the wheel hubs and tight enough to not be drooping. Ok, the Miata is wider in the rear, this is a pain. You should now have a string tied to the stands with it level with the hubs centerline with the stands stretched out about 3' past the front and rear wheels string tight. Basically, you will see a string running along the side of your car connected to the stands. Move the stands around until you have a 1" gap on the LR between the string and the wheel lip front and rear of that wheel. Once this is done, you have aligned the string to the wheel that you already aligned to the chassis, coming together for you now? As you set toe and make other adjustments, you will have to continue to square up the string to the LR wheel. BUT, after we get further along, we will drop the string and use toe plates, stay with me.

Move to the front left wheel, measure from the string to the wheel lip, front and rear of the wheel, and inline with the string. Since the rack is centered and locked down and you have that 1" gap on the rear, you are looking at how far the toe is off verse the centerline of the car. Adjust toe on the LF to zero. Of course, you will have to re-square your string each time you roll the car.

While doing this corner, you are going to set your camber to -2, your caster to +3-5 (just make sure the other side matches on caster later). Once the toe is zero, and the other settings are correct, secure this corner but do not tighten all the way just yet.

Step #4 (RR Toe and Camber)

We now are going to move to the passenger side of the car. Dust off them toe plates, their up now. Start by using your toe plates to get the RR to zero toe. While there, you guessed it, set the camber to -2. Once you are done, move to the RF corner.

Remember, tighten to keep form moving only, no need to gorilla it at this point.

Step #5 (LF Toe, Camber and Caster)

Use the toe plates to match the left side, just like you did in the rear. Set the caster and camber to match the left front.

At this point, the car is aligned with the centerline of the car, our ride height is set and our settings are in basic form. I call this the pre-scale setup. Good for you, these cars are not that corky, meaning not much chasing compared to other types of race cars.

Step #6 (Scaling)

I assume you have been on the scales this whole time, the extra height helps for all the floor work you needed to do. Some even setup their scales to coincide with a lift, that's great as long as you check everything to make sure it is square.

First, let's record the total weight of the car. Add/subtract ballast now. Once it is where you are comfortable we can move on to the scaling.

We will only be dealing with percentages not the actual weight numbers. We will never get the corners to even out AND have a level platform for the suspension. So, we change balance with percentages on this car. Percentage to total weight is a common feature on most scales (as everyone else in racing uses them too). This is what I will be referring to from here on out.

Record the Cross (always defined as the left rear and right front to total) weight %
Record the left to right %
Record the front to rear %

Trade offs have to be made so we will concentrate on Wedge (cross weight) while maintaining ride height.

NOTE: If a car has 49% of CW (cross weight) it is considered de-wedged. If it has 51% CW it is considered wedged. De-wedge helps the car turn left while tightening up the balance on rights. Vise versa with 51% wedge. I'll explain it more later.

The fun begins! You are either REAL lucky and have a 50% car, it happens, or you see a car that is wedged or de-wedged. Based on your CW %, you need to make adjustments to the spring perches. The following procedure is crucial, a must. Keeping the ride height the same is your friend on track and in doing this setup. Forget what your brain tells you, just do what I say for this part.

If you are de-wedged (less that 50%) you need to do the following.

Up on the LR & RF
Down on the RR & LF

Make the adjustments in equal turns up and down (from whole turns to quarter turns). This will increase the CW with hardly any ride height change. One round is about 1.2%, your car may differ. Get it exactly 50%, not 50.1 or 49.9, 50.00%.

If you are "wedged" (more than 50%) you need to do the following.

Up on the RR & LF
Down on the LR & RF

Make the adjustments in equal turns up and down (from whole turns to quarter turns). This will decrease the CW with hardly any ride height change. One round is about 1.2%, your car may differ. Get it exactly 50%, not 50.1 or 49.9, 50.00%.

Step #5 (the recheck)

GO BACK OVER ALL SETTINGS!

If anything is out, repeat all the above steps, something has changed. Keep going through the steps until your step #5 yields the numbers we are after with no adjustments needed. It might take a few times or you might be blessed with the racing gods and get it right the first time. Once it is right, it should also be TIGHT!!!!!! Make sure you measure LAST, not tighten last.

Step #6 (completion)

Once you are finished either because it is right or because you just gave up, we have more things to do.

First, set the sway bars to full stiff up front and full soft in the rear, NO PRELOAD!! Then, remove the vise grips from the column and let the guy that has been sitting in the car this whole time get out or remove the weight you used to simulate your body weight.

The car will not look right, with no driver the platform is not level, and that's GOOD.

We now have the car sitting there with zero toe all four, -2 camber all four, +3-5 caster both fronts (but the same side to side), 50% CW AND sitting with driver at 5-1/4" pinch weld to ground.

Next, I will tell you what I do at the track to tune this beast! BUT, I've won many competitive races with this very setup and all but the last 3-6 tenths is capable with the settings above.

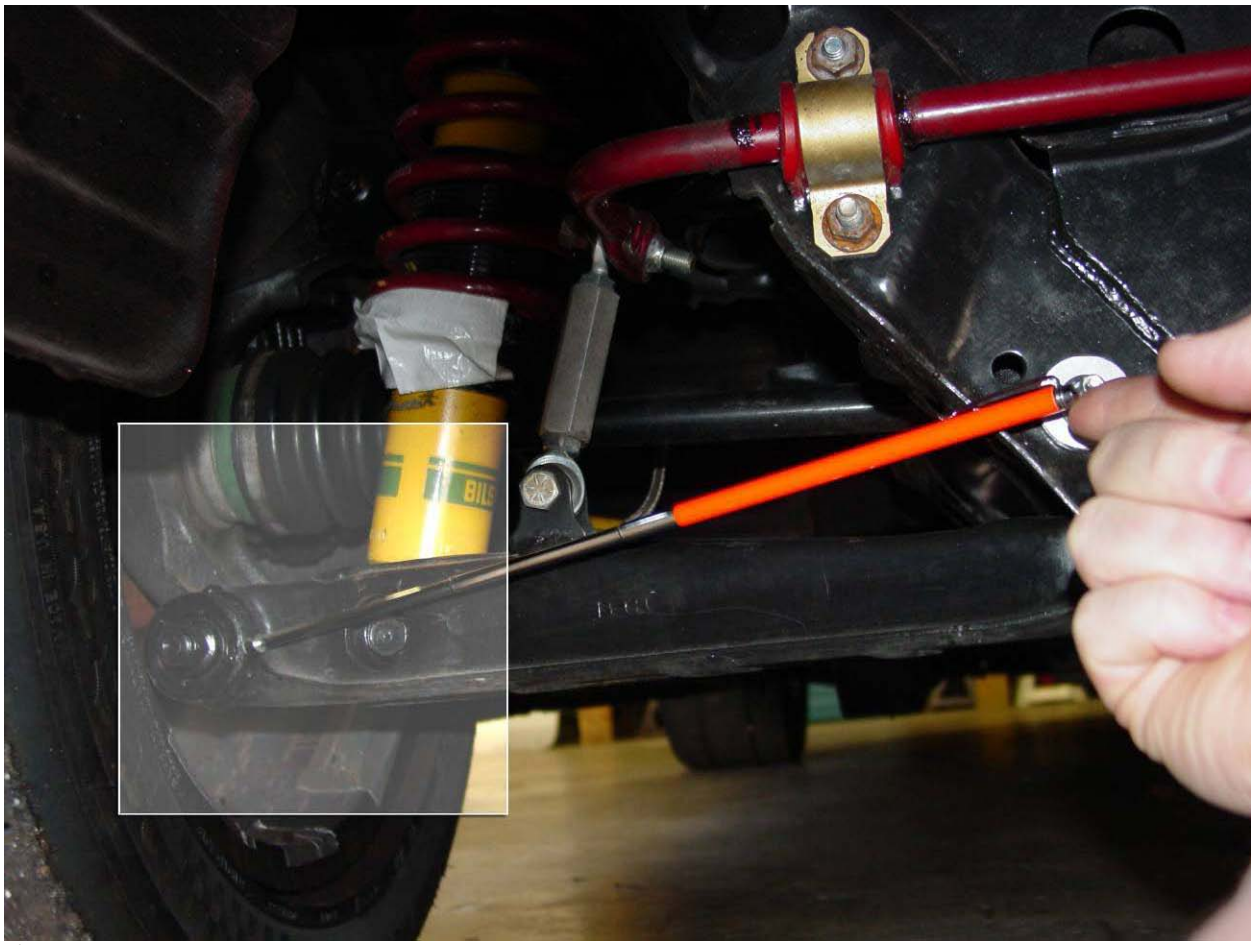
Enjoy, hope it helps!

Jim Daniels signature series

Picture 1

Picture 2

Picture 3



Picture 4