

# Appendix 6 New Features in v4.0

The Version 4.0 adds several features, including a totally new Plus version. Now the program includes these 4 levels:

- Roll Center Calculator v4.0 (front suspension only)
- Roll Center Calculator 'Plus' v4.0 (front and rear suspension)
- Circle Track Analyzer v4.0 (front and rear suspension, engine, vehicle, track and lap time simulation)
- Circle Track Analyzer 'Plus' v4.0 (all CTA features plus advanced inputs and outputs)

## New Calculations

Roll Center for Double A Arm and McPhearson Strut suspensions are now calculate using the Force Based Roll Center methodology. This method is more accurate and realistic. You will no longer see roll centers being calculated, say, 50 or 1000 inches beyond the track of the car, which never made much sense. Force Based Roll Centers are more accurate than the old "Kinematic Roll Center" method of earlier versions. There are options for you to display either or both, and go back to the old Kinematic Roll Center method in you want. This is set under 'Options' in the Front Suspension (Roll Center Calculator) screen. Fig A20.

The program's Lap Time and "On Track" Handling Calculations now include mass effects of the vehicle. This will, produce more realistic handling, spring, and shock motion, body roll, dive, squat, etc as it goes around the track. Circle Track Analyzer and Circle Track Analyzer Plus Versions only.

You can now enter details about Bump Springs and Ride Height in the Front Suspension screen, and watch their effect as you go through dive, roll, and pitch. Fig A21, Fig A29.

The program lets you specify if the shock is mounted in the middle of the spring, as with coil over springs. Or you can specify if the shock is farther inboard or outboard of the spring and by how much. This can greatly affect shock absorber performance and bump spring performance if it is mounted on the shock absorber. Fig A21.

**IMPORTANT:** If the Bump Springs are mounted on the shocks, the program will calculate the force the bump springs adds to the *springs*. For example, if the shocks are, say, 5" outside the springs, the bump springs will have more effect out there because the motion ratio is higher. Let's say the actual bump spring force is 400 lbs at the shock. But at the spring itself, this could be the same as a bump spring on the spring adding 900 lbs. The program will report this as 900 lbs because that is the effect on the suspension and handling.

You can now include some simple shock absorber inputs which will affect the wheel loads and the handling ratings for the program's Lap Time and "On Track" Handling Calculations. Circle Track Analyzer and Circle Track Analyzer Plus Versions only. Fig A21

**IMPORTANT:** The vehicle dynamics simulation is assuming a perfectly smooth track and only smooth applications of throttle, brake and steering. In real racing this is hardly the case. Real world, more abrupt changes in these inputs to the vehicle will have a large effect on shock velocities and therefore shock forces.

The Circle Track Analyzer Plus version allows you to input more details about shocks and travel limits of the springs. You can also import shock data from proper versions of the Performance Trends Shock Dyno software. Circle Track Analyzer Plus Version only. Fig A21 – A24 B.

Program now has refined the method of calculating the spring Motion Ratios for Double A Arm and McPhearson Strut suspensions to better match the Suspension Analyzer.

The program will now calculate how much the Ball Joint/Spindle Angle changes as you go through suspension movement. This will help you identify if the Ball Joints can go into bind, being pushed past the limit in Ball Joint Angle change. Fig A28

Program now calculates several suspension handling outputs each time you calculate a lap time. These new outputs like Dive, Roll, Squat, etc can be reported or graphed.

Original Report Data, version 3.6 or earlier

Time	Feet
MPH	Accel Gs
% Throttle	Eng RPM
Turn #	Curvature
Downforce	Corner Gs

New Report Data, Circle Track Analyzer v 4.0

OSUS Factor	Left Camber
Right Camber	R.C. Left
R.C. Height	Roll
Dive	Squat
Left Scrub	Right Scrub
L Upper BJ Angle Change	L Lower BJ Angle Change
R Upper BJ Angle Change	R Lower BJ Angle Change

New Report Data, Circle Track Analyzer v 4.0 Plus

LF Tire Force	RF Tire Force
LR Tire Force	RR Tire Force
Total Tire Force	LF Bump at Tire
RF Bump at Tire	LR Bump at Tire
RR Bump at Tire	LF Spring Force
RF Spring Force	LR Spring Force
RR Spring Force	LF Shock Force
RF Shock Force	LR Shock Force
RR Shock Force	LF Shock Vel
RF Shock Vel	LR Shock Vel
RR Shock Vel	LF Ride Ht
RF Ride Ht	F Aero Downforce
R Aero Downforce	Change CG Ht
L Bump Force	R Bump Force

Program now has a more detailed Roll Bar Rate calculator with more inputs and better accuracy. Fig A21, A26.

The results now let you input or watch "Rear Squat" in the calculations, how much the rear suspension goes down measured from directly above the rear axle to the ground.

The Oversteer/Understeer factor has been refined to be more realistic. In earlier versions it depended too much on the front to rear weight distribution.

Ride Height is now an input and you can watch Ride Height change as the car goes through Dive, Roll and Squat. Squat (the amount the rear ride height goes down) is a new input and output. Fig A29

## New Features

You can now write the results on the Reports screen to an ASCII data file for doing your own custom analysis in other programs, like Microsoft Excel. Circle Track Analyzer Plus Version only. Fig A30.

You can now shim the upper A Arms up or down in the Front Suspension (Roll Center Calculator) screen. Fig A31.

The program now will let you report more than double of the points as before when you go around the track, for more detailed analysis, reports and graphs. Circle Track Analyzer and Circle Track Analyzer Plus Versions only.

The engine screen and engine graph are now enlarged to show more detail. Also, the Engine Screen has a note explaining the Max RPM and how critical it is to get that correct. It also has a feature to help you enter data to realistically represent the power curve at its max RPM, past the HP peak. The new version has several new crate motors added as examples. Circle Track Analyzer and Circle Track Analyzer Plus Versions only. Fig A32.

The program now works much better when closing the Analyze Suspension screen. It also gives you 2 options of "Back" (simply closing the screen) or "Back (and save as baseline)". Previous versions would ask you each time you closed this screen if you wanted to save the current results as the Baseline. Circle Track Analyzer and Circle Track Analyzer Plus Versions only. Fig A33.

Many screens and input fields are now larger to accommodate longer file names. Fig A34.

The program now lets you pick which columns of output data to display and print under the "View" option on the Report Screen. These combinations of which columns to view can be stored as "templates" for easy recall in the future. Circle Track Analyzer Plus Version only. Fig A35.

"Modifieds" are now added to the list of general body types for Aero inputs in the Vehicle Specs screen. Circle Track Analyzer and Circle Track Analyzer Plus Versions only.

Program is much more streamlined for calculating the Handling Ratings from the Main Screen, and backing out of the "Analyze Handling Performance" screen. Circle Track Analyzer and Circle Track Analyzer Plus Versions only.

There is a new Option in the Front Suspension screen of allowing very small inputs for RC size cars.

The program now works much better when calculating the handling rating. Earlier versions could require you to do the calculation 2 times to work properly.

Program now better remembers the handling rating when you enter other screens and do not make any modifications in that screen. Circle Track Analyzer and Circle Track Analyzer Plus Versions only.

Program now does not let you enter screens from the main screen until all calculations are done refreshing the handling rating on the main screen. This can avoid problems if you click through screens too fast. Circle Track Analyzer and Circle Track Analyzer Plus Versions only.

Fixed a bug where canceling from printing to a PDF printer could cause program to stop.

Doubled the max size allowed for Comments to 800 characters.

## Printing

Program has an added option for "Print Suspension Outputs" so you can print either the standard outputs, or the new handling outputs. Circle Track Analyzer and Circle Track Analyzer Plus Versions only.

You can now load a picture file (.jpg) on the Main Screen and in the Front Suspension (Roll Center Calculator) screen and have it appear on printouts. Fig A36, A38, A42.

You can now specify a "Company Logo" (.jpg) file and 2 lines of "Title Text" to be included in your printouts. Circle Track Analyzer Plus only. Fig A37, A38..

Program now lets you pick which columns of output data to display and print under the "View" option on the Report Screen. If you select to print all data, only the columns displayed will be printed, up to 15 columns max. Circle Track Analyzer Plus Versions only. Fig A35.

Program has an added a Preference for printer width adjustment.

The program can now better print the title of columns of output, which could be up to 3 lines long of text.

Help screens are now shown in Notepad so you can print them if you want.

## Graphing

You can now graph up to 4 different data types on a graph. Each of these can be assigned a factor, like "x 100". This way small numbers like "Bump at Tire" will show up if you also include very large numbers like "RPM" or "Spring Force". You can also save graph "templates" of various combinations of data and scaling factors under different names for use in the future. Fig A39.

You have a graph option of "(down shown negative)". If you choose one of these option, then a number like Dive will be graphed in the opposite direction. For example, if the Dive number increases, the graph line will go up on the graph. However, the motion in the car is for the car to go **down** as Dive increases. If you choose the "(down shown negative)" option, increasing Dive will be a graph line that goes **down** and can be easier to understand. Fig A39.

The program now lets you graph results from up to 6 different tests. Fig A40.

Because these larger labels can take up more space, and with up to 24 graph lines which can be graphed (4 data types and up to 6 different tests), there may not be enough space to display all labels. Then the program will then produce "More" buttons which can appear either above or below these labels if they can not all be displayed on the screen, so you can scroll through all the labels. Circle Track Analyzer and Circle Track Analyzer Plus Versions only. Fig A40.

There is now an option to Draw Segment Lines on the Graph Screen under Format. If you choose this, vertical lines are drawn at the start of each turn and each straightaway. These lines are drawn based on the current (latest) data. So if the latest run was a 13 second lap time and the other runs you graph are about 16 seconds, these lines are based on the 13 second lap times. Circle Track Analyzer and Circle Track Analyzer Plus Versions only. Fig A41.

Background color choice is now checked in the dropdown menu in the Graph screen. Circle Track Analyzer and Circle Track Analyzer Plus Versions only.

The Graph Line Thickness has been adjusted to be slightly thinner for the "thick" settings. Circle Track Analyzer and Circle Track Analyzer Plus Versions only.

In the Graph Screen under Format, there is a new option for printing the graph labels larger than before. Fig A41.

Figure A 20 Force Based Roll Center

Roll Center Options brings up screen lower right

What you pick here also determines which Roll Center is used for handling and lap time simulation.

The Force Based Roll Center depends on how much traction is produced by the right side tire vs the left side tire. The default is that 70% is produced by the right side tire. This is the outside when cornering. If you want to do something different, you can enter the % from the outside tire here.

Other Specs

Spring Length	Right: 8.00	Left: 7.50
Spring Compression	Right: 1.65	Left: .59
Spring Angle	Right: 0	Left: 0
Spring Rate	Right: 500	Left: 550
Wheel Rate	Right: 34.54	Left: 32.625
Bump Force	Right: 15.33	Left: 5.73
Scrub Radius	Right: 10.10	Left: 10.73
Camber, deg	Right: 267	Left: 46.5
Dyn Camber, deg	Right: 18.92	Left: 11.50
Track, in	Right: 67.2	Left: 67.2
King Pin Angle	Right: 9.15	Left: 9.24
Spindle Angle	Right: 11.68	Left: 26.01
Roll Bar Rate, lb/in	Right: 17.91	Left: 7.6
Roll Bar Length, in	Right: 267	Left: 46.5
Ball Joint/Spindle Angle Change	Right: 18.92	Left: 11.50
Upper Ball Joint	Right: -9.15	Left: -9.24
Lower Ball Joint	Right: 9.15	Left: 9.24

Roll Center Options

Options

- Use Force Base RC in Calcs.  Yes
- Show Both Roll Centers  Yes
- Use Default Traction Split  Yes
- User Defined Traction Split

Note: The new 'Force Based' roll center calculations are more accurate than the old 'Kinematic' method of v3.6 and earlier. You may want to also show the 'Kinematic' Roll Center for comparison. The default 'Traction Split' of 70% of the traction from the outside (right) tire in a turn is a setting, but numbers anywhere from 60 to also reasonable.

Force Based moves very little

Old Kinematic Roll Center moves a lot, which is not as accurate or realistic as the Force Based method.

Both Roll Centers shown here when Option set to Show Both.

Other Specs

Spring Length	Right: 8.00	Left: 7.50
Spring Compression	Right: 1.65	Left: .59
Spring Angle	Right: 0	Left: 0
Spring Rate	Right: 500	Left: 550
Wheel Rate	Right: 34.54	Left: 32.625
Bump Force	Right: 15.33	Left: 5.73
Scrub Radius	Right: 10.10	Left: 10.73
Camber, deg	Right: 267	Left: 46.5
Dyn Camber, deg	Right: 18.92	Left: 11.50
Track, in	Right: 67.2	Left: 67.2
King Pin Angle	Right: 9.15	Left: 9.24
Spindle Angle	Right: 11.68	Left: 26.01
Roll Bar Rate, lb/in	Right: 17.91	Left: 7.6
Roll Bar Length, in	Right: 267	Left: 46.5
Ball Joint/Spindle Angle Change	Right: 18.92	Left: 11.50
Upper Ball Joint	Right: -9.15	Left: -9.24
Lower Ball Joint	Right: 9.15	Left: 9.24

Static Layout Dimensions

	Right (X)	Height	Left (X)	Height	
A	24.1875	20.7	25.875	22.75	G
B	15.56	18.38	15.38	17.63	H
C	27.12	10	27.13	10.24	I
D	9.375	7.875	9.375	7.875	J
E	19.125	14	19.125	14	K
F	19.125	6	19.125	6.5	L

Help (definition)  
The amount the car's front end rolls (leans) due to cornering forces, compared to its static (standing still) angle. A positive(+) angle means the car is leaning to the Right, typical of Left turns. Use a negative(-) number to lean Left (Right turns). p 39

Figure A 21 Bump Spring Inputs

Click here to get Bump Spring and Shock Options

	Right	Left
Length	8.00	7.50
Spring Compression	1.65	.59
Spring Angle	.0	.0
Spring Rate	500	550
Wheel Rate	301	123
Motion Ratio Sq.	.218	.223
Bump Force	148.82	na
Scrub Radius	4.7	4.5
Camber, deg	-5.23	5.00
Dyn Camber, deg	-6.77	1.22
Track, in	34.54	32.625
King Pin Angle	15.33	5.73
Spindle Angle	10.10	10.73
Roll Bar Rate, lb/in		267
Roll Bar Length, in		46.5
Ball Joint/Spindle Angle Change		
Upper Ball Joint	18.92	11.50
Lower Ball Joint	-9.15	-9.24

Plus version has this option described in Figs A22, A23, A24.

When the Bump Spring is encountered, you will see the Wheel Rate increase from the force produce by the Bump Spring.

When the Bump Spring is encountered, you will see the force here. Note: When the Bump Spring is not on the spring, the force shown here is not the force of the bump spring on the shock, but the effective force it puts on the suspension spring.

If you have the Plus version, you will have many more choices for Spring Travel and Shock inputs, some of which are shown here. One choice is to use a complete shock dyno curve. This is discussed in Figs A22 and A23.

Choose here if the shock is not mounted centered in the spring, like a Coil Over

Click here for more details

**Bump Spring Details**

Right Bump Spring: Yes, on shock

Shock Movement to Bump, in: 1

Bump Spring Rate, lbs/in: 400

Spring Travel: Typical

**Shock Details**

Shock: Typical High Tie-Down

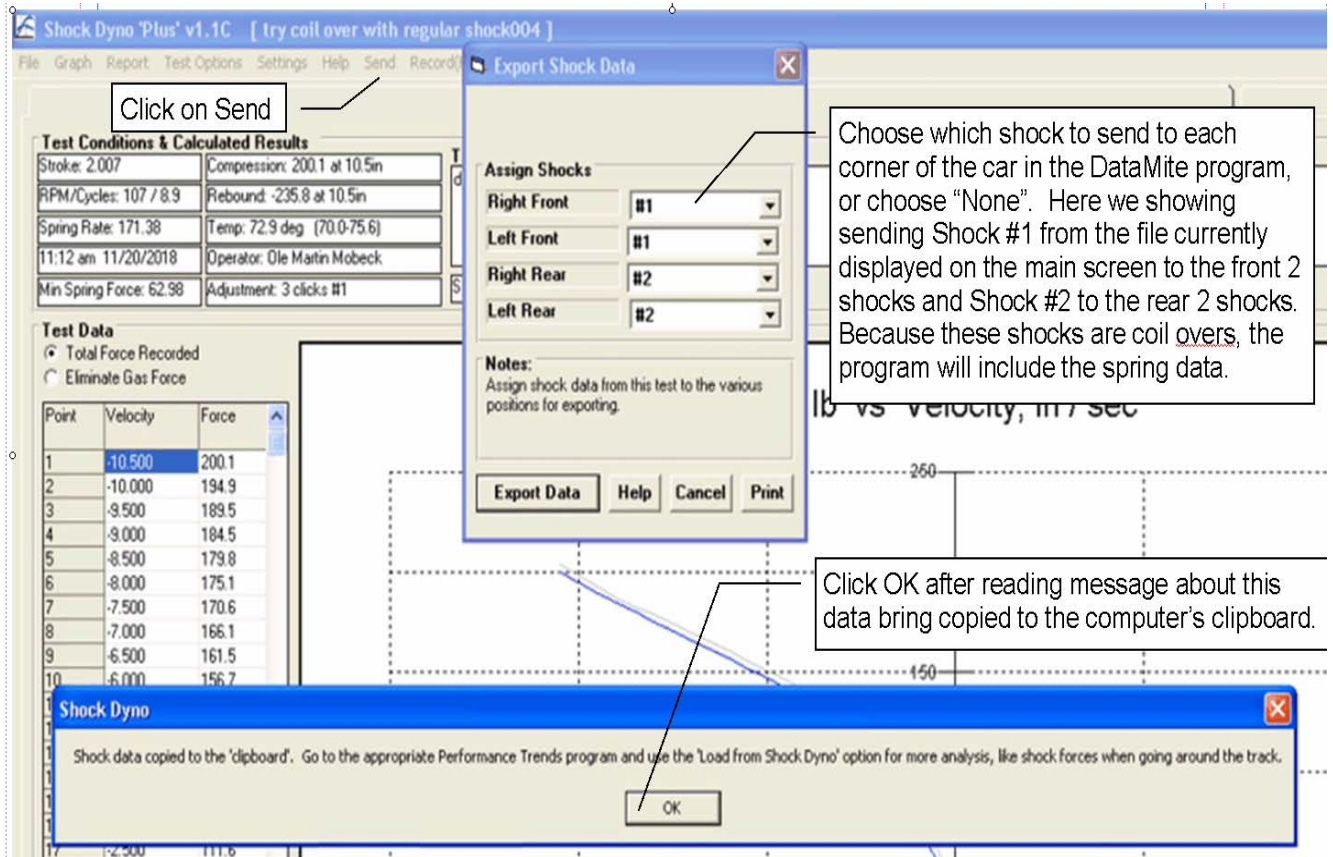
Shock Mounts: 4.75" outboard the spring

**Note:** Choose if you are using a Bump Spring and where the Bump Spring is located. Then enter the amount of Spring or Shock movement to the point where the bump spring is encountered. Also select how much 'Max' spring movement until a hard stop is encountered in the suspension. Choose Type of Shock and where shock is located compared to spring. Click Help for more info.

Buttons: Keep Settings, Help, Cancel, Print

Figure A 22 Copying Shock Data from Performance Trends' Shock Dyno Software

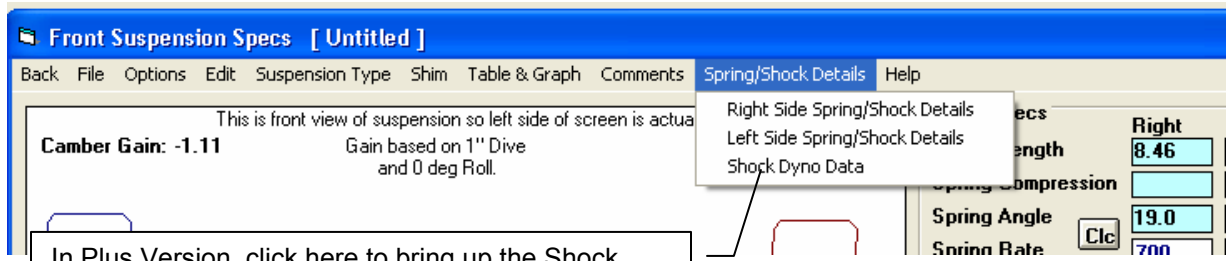
If you have an appropriate Shock Dyno Plus version, you can click on the 'Send' option and be presented with the 4 corners of the car. For each corner you can select which shock or coil over's data to send, or choose "None" for that particular corner. You may have to open other Shock Dyno files, do the Send and select different corners of the car for sending shock data for different shocks.



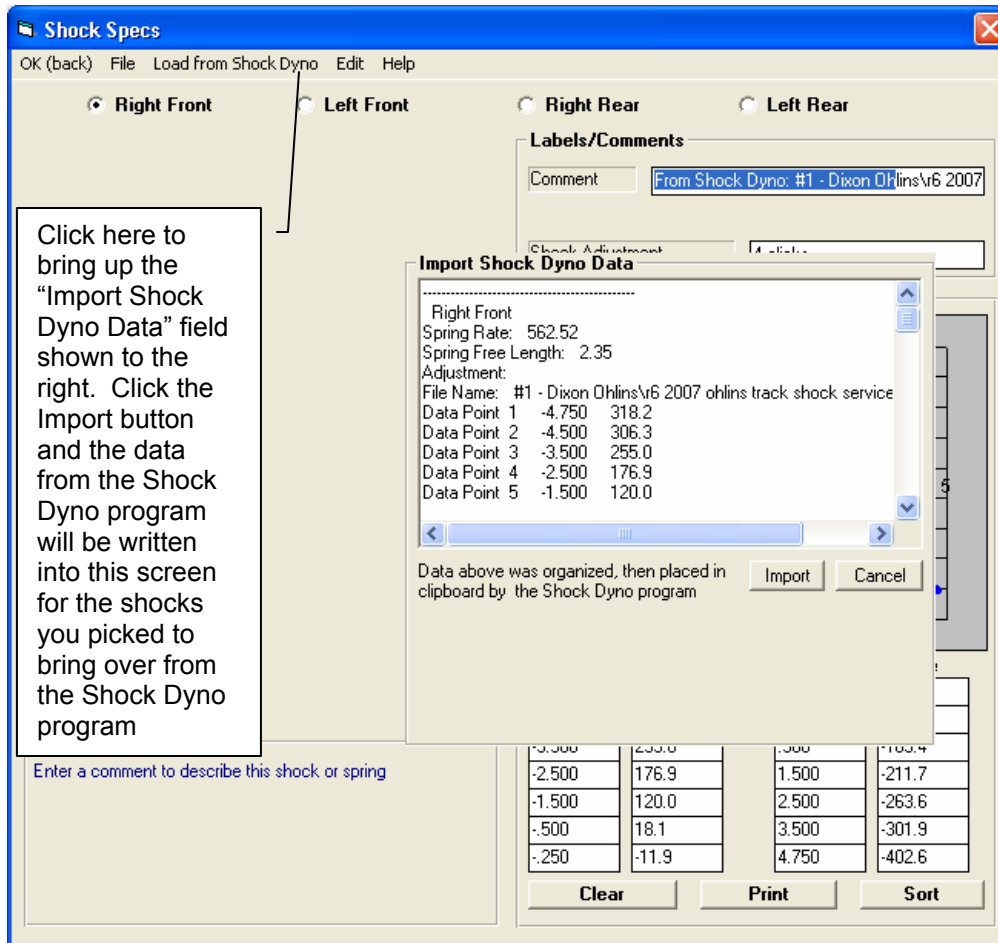
As shown in the picture above, the Export Data will copy this data to the computer's clipboard. This is the same process as doing a Windows Ctrl-C or a Copy process. Therefore, do not do a copy or paste command before you go to your Circle Track Analyzer program to import this data.



Figure A 23 Importing Shock Data from Performance Trends' Shock Dyno Software



In Plus Version, click here to bring up the Shock Dyno table shown below, and Fig A 24. This option is also available in the Rear Suspension screen.



Click here to bring up the "Import Shock Dyno Data" field shown to the right. Click the Import button and the data from the Shock Dyno program will be written into this screen for the shocks you picked to bring over from the Shock Dyno program

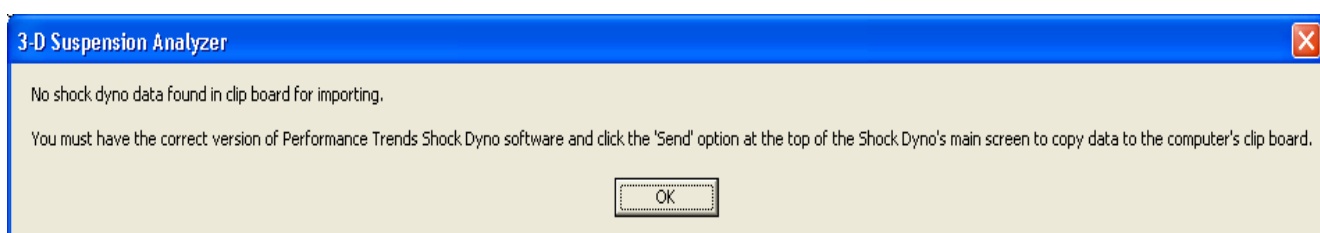




Figure A 24 A Importing Shock

Click Options to see different shock tables.

This Shock Data is currently being used.

When you select Right Front, this label shows that the program will use this data to calculate shock forces.

Here we have selected to use a complete Shock Dyno Table to describe the Right Front Shock.

If you enter data into the table out of order, just click on this Sort button and the program will reorder the data. See picture below.

**Right Spring Details**

**Bump Spring Details**

Right Bump Spring: None

Spring Movement to Bump, in: [ ]

Bump Spring Rate, lbs/in: [ ]

Spring Travel: Typical

Max Compression, in: [ ]

Max Rebound, in: [ ]

**Shock Details**

Shock: Use Shock Dyno Table

Compress: Typical Shock

Rebound: Typical, Use Specs Below

Shock M: Use Shock Dyno Table

**Shock/Spring Specs**

Right Front Left Front Right Rear Left Rear

Labels/Comments

Comment: [ ]

**Shock Dyno Graph**

Velocity	Force	Velocity	Force
10	-400	13	-420
5	-300		
2	-250		
0	20		
-3	60		
-10	100		

Clear Print Sort

After clicking the Sort button, the data is organized and the graph looks correct.

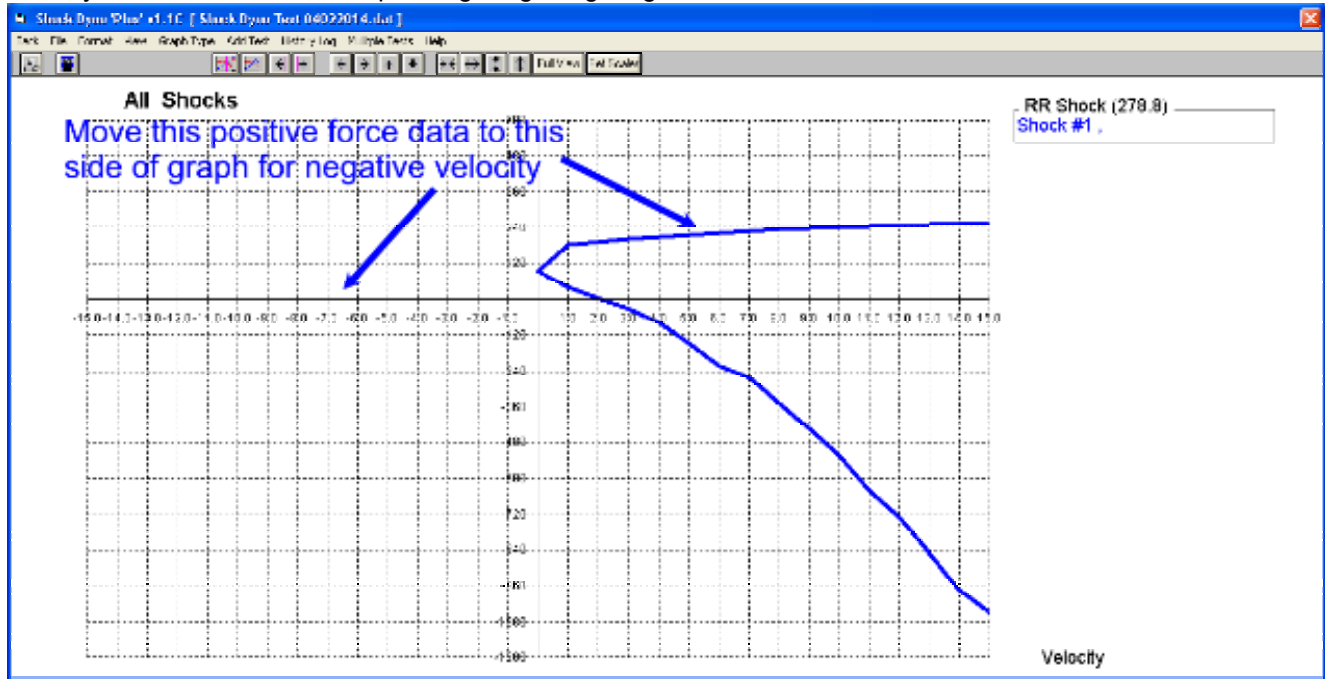
**Shock Dyno Graph**

Velocity	Force	Velocity	Force
-10	100		
-3	60		
0	20		
2	-250		
5	-300		
10	-400		
13	-420		

Clear Print Sort

Figure A 24 B Manually Entering Shock Data

A typical Shock Dyno graph is shown below, a graph of shock force vs **absolute** velocity. The graph shows both the compression and rebound force (positive and negative force). But the velocity is only shown as a positive number, which is not actually correct. One reason for this is the industry does not have a common definition of positive and negative velocity. In Performance Trends programs, we have defined that a positive velocity is when the shock is expanding, or getting longer.



So, if you have a shock dyno graph like above, just take the positive forces and assign them as occurring at a negative velocity. If done correctly, the graph will angle from the upper left down to the lower right as shown below.

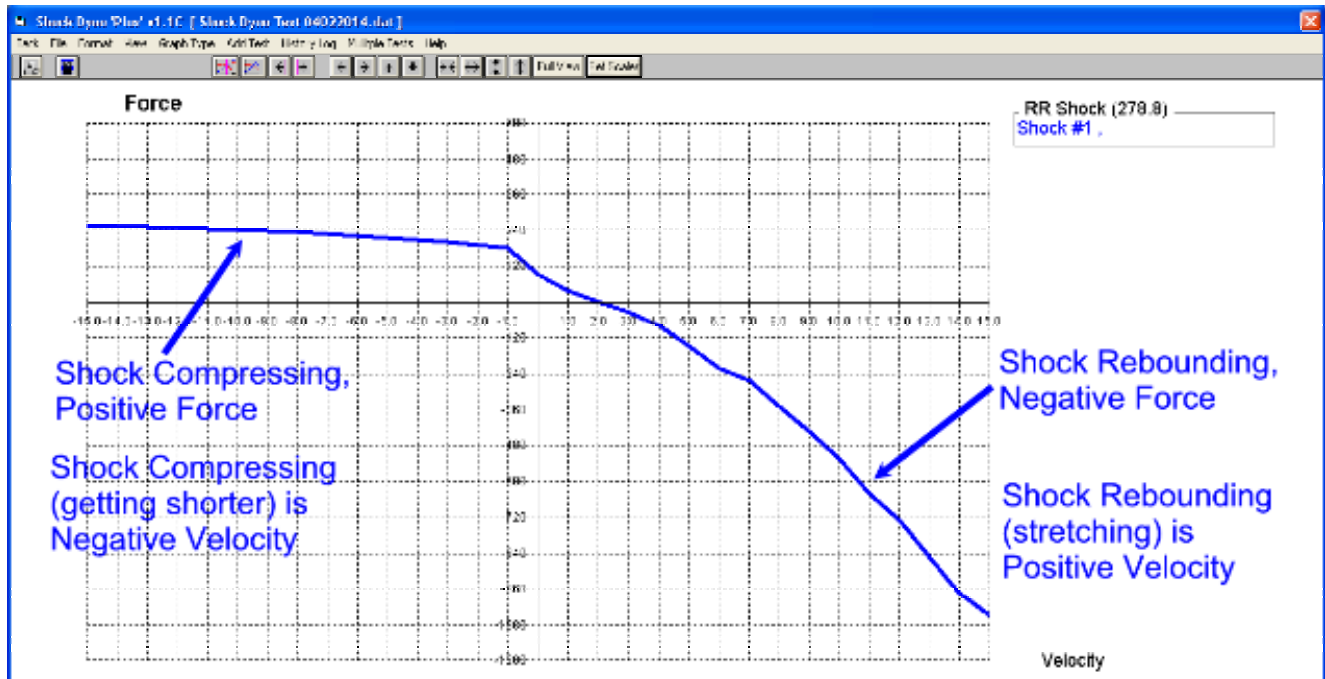


Figure A 25 More Detailed and Accurate Anti-Roll Bar Calculation Utility

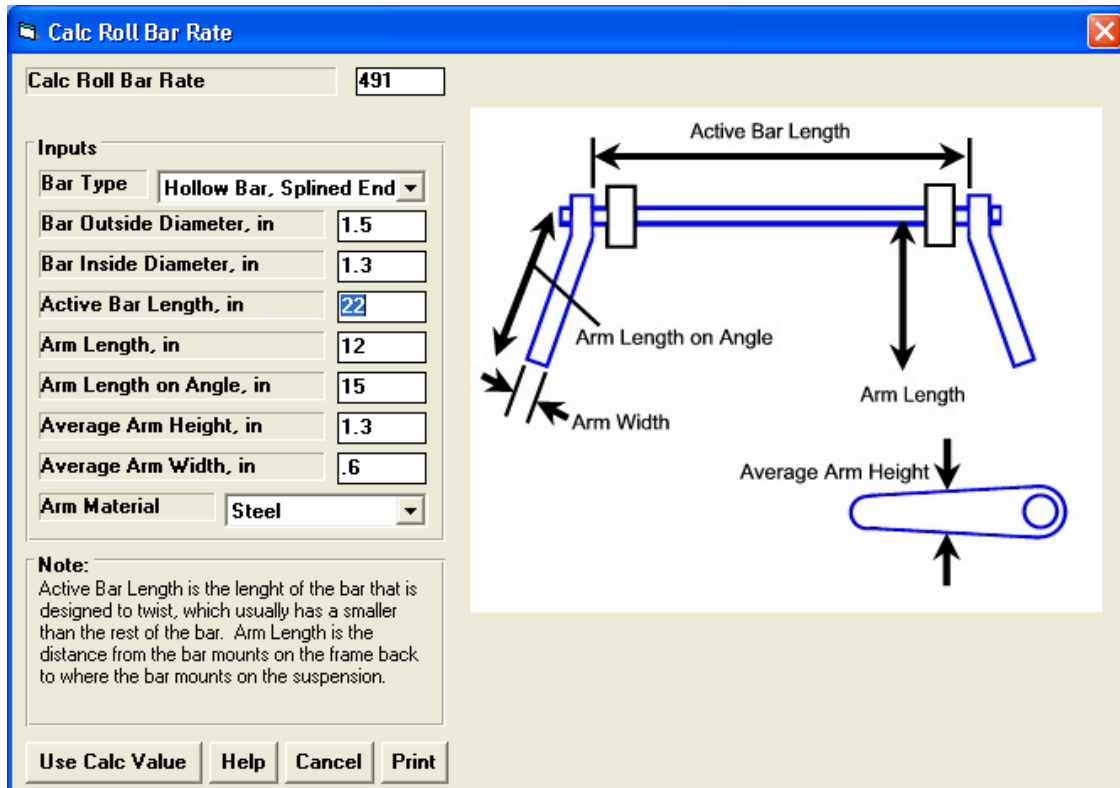
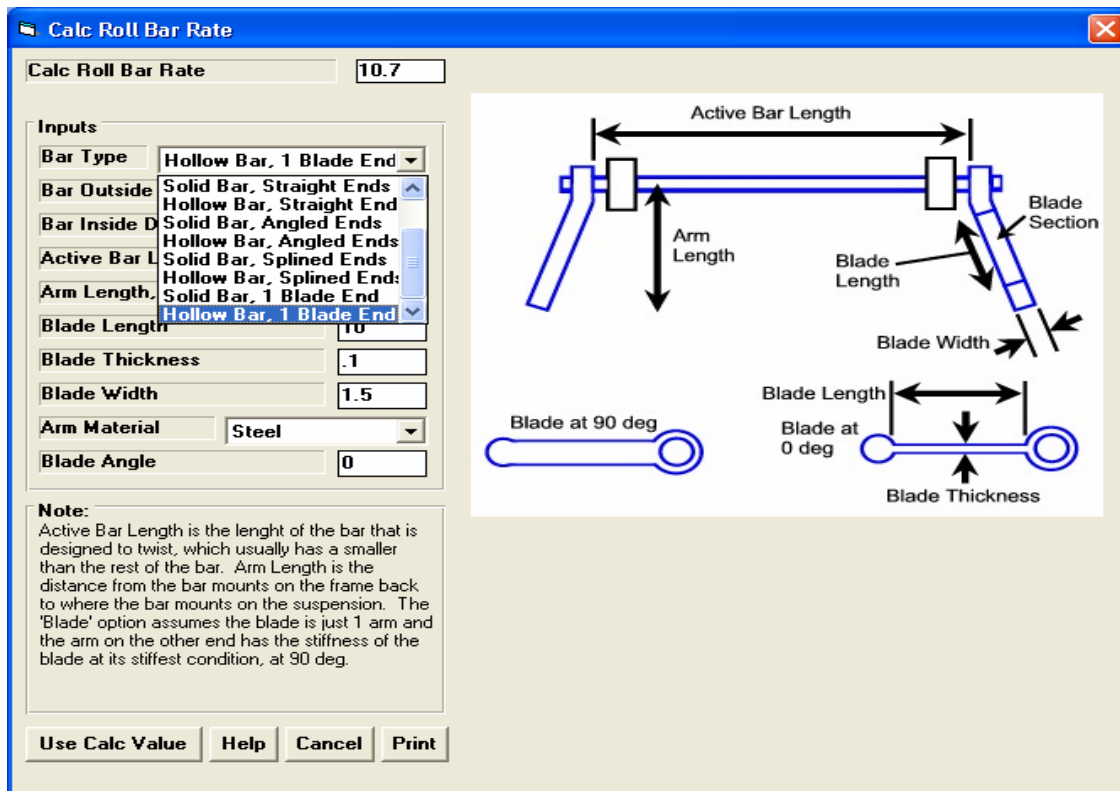
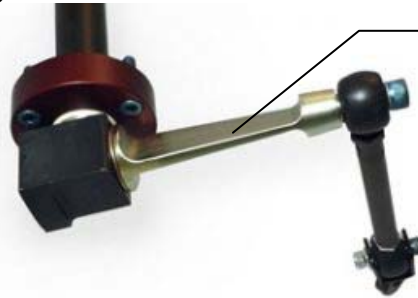
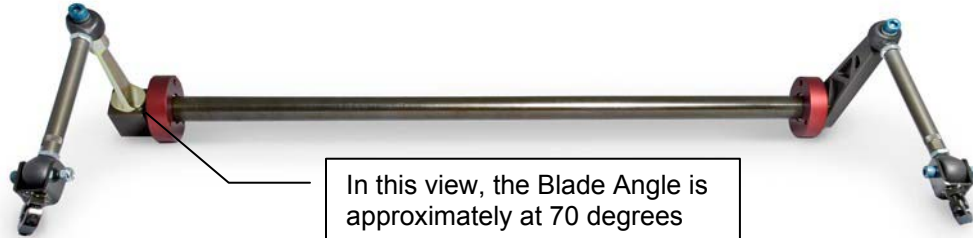


Figure A 26 Blade Anti-Roll Bar



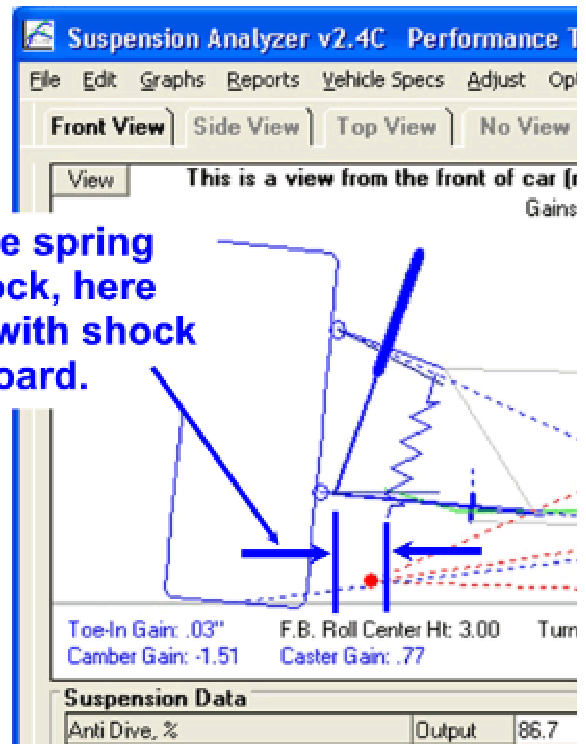
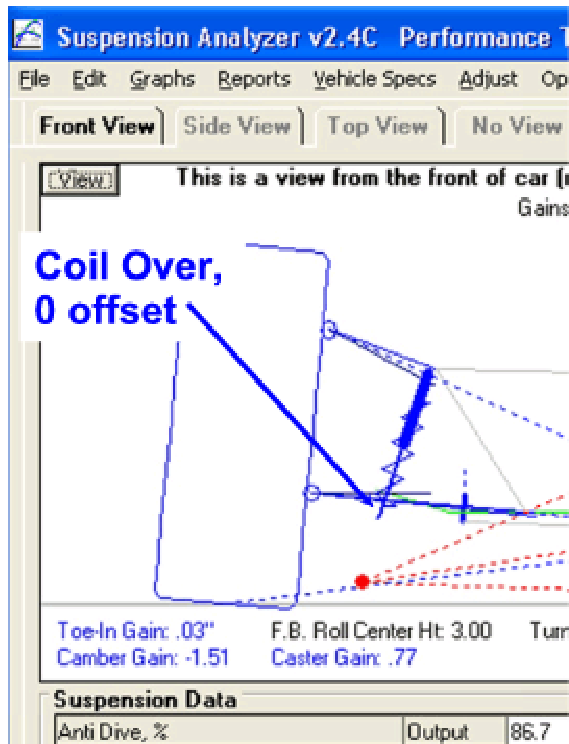
In this view, the Blade Angle is approximately at 10 degrees

photos courtesy [elephantracing.com](http://elephantracing.com)



In this view, the Blade Angle is approximately at 70 degrees

Figure A 27 Shock Offset



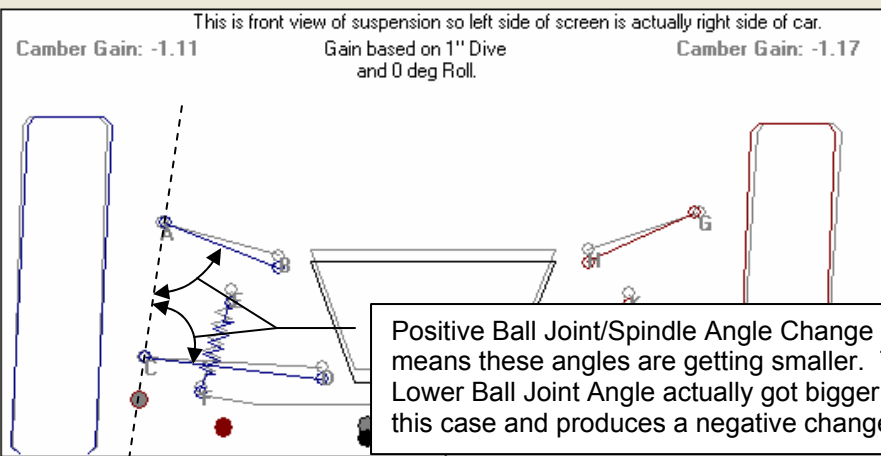
These pictures are from our Suspension Analyzer (which allows for more detailed inputs) to explain this input

Figure A 28 Ball Joint/Spindle Angle Change

**Front Suspension Specs [Untitled]**

Back File Options Edit Suspension Type Shim Table & Graph Comments Spring/Shock Details Help

This is front view of suspension so left side of screen is actually right side of car.  
 Camber Gain: -1.11 Gain based on 1" Dive and 0 deg Roll. Camber Gain: -1.17



Positive Ball Joint/Spindle Angle Change means these angles are getting smaller. The Lower Ball Joint Angle actually got bigger in this case and produces a negative change.

Other Specs

	Right	Left
Spring Length	8.46	8.46
Spring Compression	.61	.61
Spring Angle	19.0	19.0
Spring Rate	700	625
Wheel Rate	208	201
Motion Ratio Sq.	297	321
Bump Force	na	na
Scrub Radius	7.0	4.6
Steer, deg	-1.97	3.75
Camber, deg	-3.08	2.58
Track, in	35.97	30.52
Pin Angle	8.36	7.79
Spindle Angle	6.39	11.54
Roll Bar Rate, lb/in	300	
Roll Bar Length, in	46	
<b>Ball Joint/Spindle Angle Change</b>		
Upper Ball Joint	6.35	6.67
Lower Ball Joint	-4.64	-4.71

Lt Swing Arm 51.0, Ht 2.5  
 Rt Scrub: .085  
 Orig. Roll Center height = 2.6  
 Roll Center height = 1.6  
 Using Force Based Roll Center

You can watch Ball Joint/Spindle Angle Change as you put suspension through motion. If this angle change is high, you are likely putting the ball joint into bind, pushing it beyond its limits.

Static Layout Dimensions

	Right [X]	Height		Left [X]	Height	
A	26.125	19.3125	Upper Ball Joint	23.125	20.125	G
B	15.41	16.565	Upper Frame Pivot	12.91	17.065	H
C	27.75	8.25	Lower Ball Joint	24.75	8.25	I
D	11.49	7.425	Lower Frame Pivot	8.49	7.175	J
E	19.75	13.75	Upper Spring Pad	16.75	13.5	K
F	22.5	5.75	Lower Spring Pad	19.5	5.5	L

	Length	Angle		Length	Angle
	11.06	14.38	Upper Arm Dim.	10.66	16.68
	16.28	2.9	Lower Arm Dim.	16.30	3.8

Snow Dive, Roll, Squat

Yes  No

Dive, inch: 1 Roll, deg: Rear Squat: 0

Help (definition)  
 The amount the car's front end rolls (leans) due to cornering forces, compared to its static (standing still) angle. A positive(+) angle means the car is leaning to the Right, typical of Left turns. Use a negative(-) number to lean Left (Right turns). p 39

**Circle Track Analyzer 'Plus' v4.0 Performance Trends [Asphalt Modified Chevelle clip Ted]**

Back Graph View Print Analyze Suspension Analyze Perf

Notes Summary: Aggressive Driving. Details.

You can watch Ball Joint/Spindle Angle Change as you go around the track. You can also graph this data.

Squat	Left Scrub	Right Scrub	L Upper BJ Angle	L Lower BJ Angle	R Upper BJ Angle	R Lower BJ Angle	LF Tire Force	RF Tire Force
-0.18	.05	.14	8.35	6.32	9.48	6.53	332.2	1182.9
.08	-.04	-.20	-5.71	-4.94	-7.90	-4.95	521.1	506.1
1.37	-.09	-.30	-8.48	-7.12	-10.98	-7.00	668.3	150.7
2.82	-.02	-.08	-2.85	-2.34	-3.65	-2.38	603.1	288.0
2.65	-.02	.16	4.53	4.29	8.05	4.88	387.0	866.3
1.49	-.03	.27	10.78	9.39	17.30	10.95	394.5	1456.7
-.11	.00	.20	8.60	7.24	12.52	8.06	458.5	1291.4
-1.11	.02	.01	1.23	.79	.93	.76	632.2	784.7

Figure A 29 Ride Height

Use this screen to specify where Ride Height is measured and what Ride Height is at static conditions.

The location of where Ride Height is measured is shown by this square.

Click here to bring up Ride Height screen.

Click on the "More Details" button (now showing "Hide Details" because "More Details" are being shown) to bring up this screen.

This is front view of suspension so left side of screen is actually right side of car.

Camber Gain: -1.11  
Gain based on 1" Dive and 0 deg Roll.

Camber Gain: -1.17  
Gain based on 1" Dive and 0 deg Roll.

Ride Ht = 2.8  
Orig. Ride Ht = 4.5

Ride Ht = 5.0  
Orig. Ride Ht = 5.0

If you have specified Ride Height details, you will see it here, both at static and dynamic conditions. In Plus version, Ride Height will also show up in the Reports and can be graphed.

Other Specs

	Right	Left
Spring Length	8.46	8.46
Spring Compression	1.21	.09
Spring Angle	19.0	19.0
Spring Rate	700	625
Wheel Rate	202	203
Motion Ratio Sq.	.289	.325
Bump Force	na	na
Scrub Radius	7.0	4.6
Camber, deg	-1.97	3.75
Dyn Camber, deg	-2.32	1.59
Track, in	35.97	30.52
King Pin Angle	8.36	7.79
Spindle Angle	6.39	11.54
Roll Bar Rate, lb/in	300	
Roll Bar Length, in	46	
Ball Joint/Spindle Angle Change		
Upper Ball Joint	8.76	4.93
Lower Ball Joint	-5.32	-4.65

Static Layout Dimensions

	Right [X]	Height		Left [X]	Height
A	26.125	19.3125	Upper Ball Joint	23.125	20.125
B	15.41	16.565	Upper Frame Pivot	12.91	17.065
C	27.75	8.25	Lower Ball Joint	24.75	8.25



Figure A 30 Writing ASCII Data Files

Plus version has "ASCII File" option here.

The screenshot shows the Circle Track Analyzer Plus v4.0 interface. A 'Save as ASCII File' dialog box is open, showing options for file format (Comma Separated, Include Text, Create MS Excel file) and file name. A 'CTA' window below it displays the file path and a note about the file extension change to .csv. The background shows a data table with columns: LF Tire Force, RF Tire Force, LR Tire Force, RR Tire Force, Total Tire Force, LF Bump at Tire, RF Bump at Tire, LR Bump at Tire, RR Bump at Tire.

LF Tire Force	RF Tire Force	LR Tire Force	RR Tire Force	Total Tire Force	LF Bump at Tire	RF Bump at Tire	LR Bump at Tire	RR Bump at Tire
332.2	1182.9	378.1	1012.7	2905.9	0.52	0.95	-0.31	0.12
521.1	506.1	515.2	850.9	2393.4	-0.10	-1.06	0.41	-0.54
668.3	150.7	654.5	1283.6	2757.2	-0.26	-1.53	1.66	0.39
603.1	288.0	1726.7	1946.4	4564.2	-0.11	-0.48	2.63	2.26
387.0	866.3	557.1	2108.6	3919.0	-0.09	1.13	1.91	3.13
394.5	1456.7	478.0	1738.4	4067.6	0.14	2.03	0.65	2.53
458.5	1291.4	457.3	960.2	3167.4	0.22	1.39	-0.51	0.66
632.2	784.7	534.3	374.4	2325.5	0.14	0.05	-0.95	-1.05
728.6	455.0	682.6	396.3	2262.4	0.04	-0.75	-0.44	-1.23
705.0	204.6	832.9	931.3	2673.9	-0.05	-0.61	0.68	0.13
626.7	468.0	920.2	1535.1	3550.0	-0.03	0.19	1.72	1.94
544.9	906.5	917.7	1697.0	4066.1	-0.02	0.63	2.10	2.74
543.3	715.4	870.7	1229.0	3358.5	-0.19	-0.14	1.75	1.80
695.1	251.7	834.7	616.5	2398.0	-0.41	-1.44	1.13	0.10
834.9	0.0	917.3	323.6	2075.8	-0.49	-1.94	0.74	-0.70
791.2	0.0	944.9	557.4	2293.5	-0.45	-1.24	0.61	-0.18

The screenshot shows Microsoft Excel with a table containing performance data. The columns are labeled: Time, Feet, MPH, Accel Gs, % Throttle, Eng RPM, Turn #.

Time	Feet	MPH	Accel Gs	% Throttle	Eng RPM	Turn #
0	0	72.5	0	0	3971	2 & 4
0.2	21	73.2	0.35	67	4011	2 & 4
0.4	43	75.4	0.56	100	4130	2 & 4
0.6	66	77.8	0.56	100	4264	2 & 4
0.8	89	80.3	0.56	100	4399	2 & 4
1	113	82.8	0.57	100	4535	2 & 4
1.2	138	85.2	0.57	100	4671	2 & 4
1.4	163	87.7	0.57	100	4808	2 & 4
1.6	189	90.3	0.57	100	4945	2 & 4
1.8	216	92.8	0.58	100	5083	2 & 4
2	244	95.3	0.58	100	5221	2 & 4
2.2	272	97.8	0.58	100	5360	2 & 4
2.4	301	100.3	0.57	100	5497	2 & 4
2.6	331	102.8	0.56	100	5633	2 & 4
2.8	362	105.3	0.54	97	5767	2 & 4
3	393	107.6	0.53	96	5895	2 & 4
3.2	425	110.0	0.55	100	6026	-
3.4	458	112.4	0.54	100	6157	-
3.6	491	114.7	0.53	100	6286	-
3.8	525	117.0	0.52	100	6412	-
4	560	119.3	0.51	100	6535	-
4.2	595	121.5	0.49	100	6656	-
4.4	631	123.6	0.48	100	6772	-
4.6	667	125.6	0.48	100	6886	-
4.8	704	127.4	0.48	100	6998	-
5	742	129.1	0.48	100	7108	-
5.2	781	130.7	0.48	100	7216	-
5.4	821	132.2	0.48	100	7322	-
5.6	862	133.6	0.48	100	7426	-
5.8	904	134.9	0.48	100	7528	-
6	947	136.1	0.48	100	7628	-
6.2	991	137.2	0.48	100	7726	-
6.4	1037	138.2	0.48	100	7822	-
6.6	1084	139.1	0.48	100	7916	-
6.8	1133	140.0	0.48	100	8008	-
7	1184	140.9	0.48	100	8098	-
7.2	1236	141.7	0.48	100	8186	-
7.4	1290	142.5	0.48	100	8272	-
7.6	1345	143.2	0.48	100	8356	-
7.8	1402	143.9	0.48	100	8438	-
8	1460	144.5	0.48	100	8518	-
8.2	1520	145.1	0.48	100	8596	-
8.4	1581	145.6	0.48	100	8672	-
8.6	1644	146.1	0.48	100	8746	-
8.8	1709	146.5	0.48	100	8818	-
9	1775	146.9	0.48	100	8888	-
9.2	1843	147.2	0.48	100	8956	-
9.4	1913	147.5	0.48	100	9022	-
9.6	1985	147.7	0.48	100	9086	-
9.8	2059	147.9	0.48	100	9148	-
10	2135	148.0	0.48	100	9208	-
10.2	2213	148.1	0.48	100	9266	-
10.4	2293	148.1	0.48	100	9322	-
10.6	2375	148.1	0.48	100	9376	-
10.8	2459	148.1	0.48	100	9428	-
11	2545	148.0	0.48	100	9478	-
11.2	2633	147.9	0.48	100	9526	-
11.4	2723	147.7	0.48	100	9572	-
11.6	2815	147.5	0.48	100	9616	-
11.8	2909	147.2	0.48	100	9658	-
12	3005	146.9	0.48	100	9698	-
12.2	3103	146.5	0.48	100	9736	-
12.4	3203	146.1	0.48	100	9772	-
12.6	3305	145.6	0.48	100	9806	-
12.8	3409	145.1	0.48	100	9838	-
13	3515	144.5	0.48	100	9868	-
13.2	3623	143.9	0.48	100	9896	-
13.4	3733	143.2	0.48	100	9922	-
13.6	3845	142.5	0.48	100	9946	-
13.8	3959	141.7	0.48	100	9968	-
14	4075	140.9	0.48	100	9988	-
14.2	4193	140.0	0.48	100	10006	-
14.4	4313	139.1	0.48	100	10022	-
14.6	4435	138.2	0.48	100	10036	-
14.8	4559	137.2	0.48	100	10048	-
15	4685	136.1	0.48	100	10058	-
15.2	4813	135.0	0.48	100	10066	-
15.4	4943	133.8	0.48	100	10072	-
15.6	5075	132.6	0.48	100	10076	-
15.8	5209	131.3	0.48	100	10078	-
16	5345	130.0	0.48	100	10078	-
16.2	5483	128.7	0.48	100	10076	-
16.4	5623	127.3	0.48	100	10072	-
16.6	5765	125.9	0.48	100	10066	-
16.8	5909	124.4	0.48	100	10058	-
17	6055	122.9	0.48	100	10048	-
17.2	6203	121.3	0.48	100	10036	-
17.4	6353	119.7	0.48	100	10022	-
17.6	6505	118.0	0.48	100	10006	-
17.8	6659	116.3	0.48	100	9988	-
18	6815	114.5	0.48	100	9968	-
18.2	6973	112.7	0.48	100	9946	-
18.4	7133	110.8	0.48	100	9922	-
18.6	7295	108.9	0.48	100	9896	-
18.8	7459	106.9	0.48	100	9868	-
19	7625	104.9	0.48	100	9838	-
19.2	7793	102.8	0.48	100	9806	-
19.4	7963	100.7	0.48	100	9772	-
19.6	8135	98.5	0.48	100	9736	-
19.8	8309	96.3	0.48	100	9698	-
20	8485	94.0	0.48	100	9658	-
20.2	8663	91.7	0.48	100	9616	-
20.4	8843	89.4	0.48	100	9572	-
20.6	9025	87.0	0.48	100	9526	-
20.8	9209	84.6	0.48	100	9478	-
21	9395	82.1	0.48	100	9428	-
21.2	9583	79.6	0.48	100	9376	-
21.4	9773	77.0	0.48	100	9322	-
21.6	9965	74.4	0.48	100	9266	-
21.8	10159	71.7	0.48	100	9208	-
22	10355	69.0	0.48	100	9148	-
22.2	10553	66.3	0.48	100	9086	-
22.4	10753	63.6	0.48	100	9022	-
22.6	10955	60.9	0.48	100	8956	-
22.8	11159	58.1	0.48	100	8888	-
23	11365	55.4	0.48	100	8818	-
23.2	11573	52.6	0.48	100	8746	-
23.4	11783	49.8	0.48	100	8672	-
23.6	11995	47.0	0.48	100	8596	-
23.8	12209	44.2	0.48	100	8518	-
24	12425	41.4	0.48	100	8438	-

If you check "Create MS Excel File", the program will write a file with a .csv extension. Then when you open the file, Microsoft Excel will open it by default.

Here's an example of a file written to a .txt file with "Comma Separated" unchecked and "Include Text" checked. This file opens by default in Notepad.



Figure A 31 New Shim Up/Down Feature

**Calc Shim Adjustment - Right Side**

Moved Up: 1.0000  
 Estimated New Camber will be: -.92  
 Current Camber is: -1.97

Distance Moved  
 Move Mount: Up  
 Distance Up: 1

Notes:  
 This screen moves the Upper A Arm Mount on the frame Up or Down as much as you specify, and estimates the Camber Change assuming the same length A Arm is used. If you choose to Keep this change, all geometry will change to reflect moving this mount and keeping the A Arm.

Buttons: Use Calc Value, Help, Cancel, Print

**Front Suspension Specs [Untitled]**

Other Specs

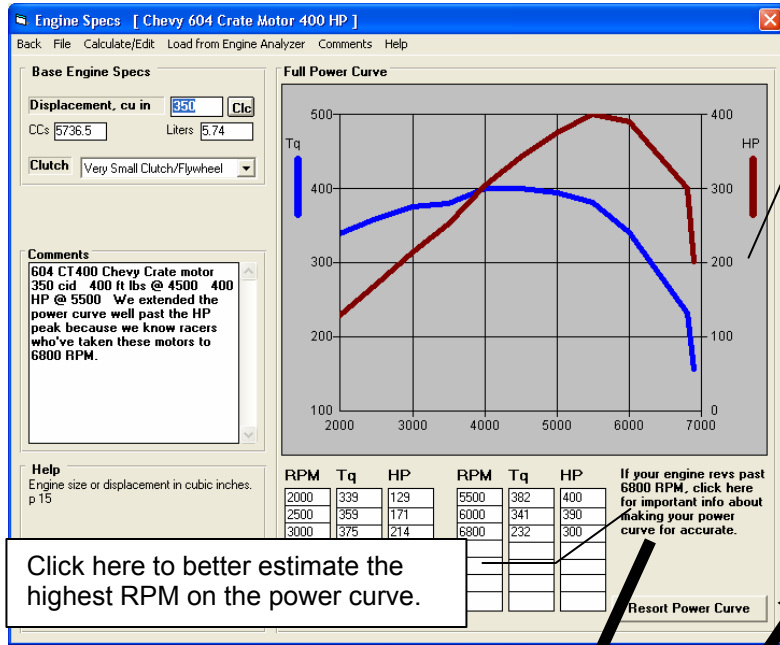
	Right	Left
Spring Length	8.46	8.46
Spring Compression		
Spring Angle	19.0	19.0
Spring Rate	700	625
Wheel Rate	246	208
Motion Ratio Sq.	.351	.333
Bump Force		
Scrub Radius	7.2	4.6
Camber, deg	-91	3.75
Dyn Camber, deg		
Track, in	35.97	30.52
King-Pin Angle	7.30	7.79
Spindle Angle	6.39	11.54
Roll Bar Rate, lb/in		300
Roll Bar Length, in		46
Ball Joint/Spindle Angle Change		
Upper Ball Joint		
Lower Ball Joint		

Static Layout Dimensions

	Right (X)	Height		Left (X)	Height	
A	26.33	19.34	Upper Ball Joint	23.125	20.125	G
B	15.41	17.57	Upper Frame Pivot	12.91	17.065	H
C	27.75	8.25	Lower Ball Joint	24.75	8.25	I
D	11.49	7.425	Lower Frame Pivot	8.49	7.175	J
E	19.75	13.75	Upper Spring Pad	16.75	13.5	K

Other suspension data:  
 Lt Swing Arm 58.7, Ht 4.7  
 Rt Swing Arm 109.9, Ht 3.1  
 Roll Center height = 1.5  
 Roll Center Right = 7.2  
 Using Force Based Roll Center

Figure A 32 New Engine Specs Screen Features



Larger graph for more detail

Here you can enter the highest RPM you have seen on your engine on the track, where the engine is still making some power.

Click here to better estimate the highest RPM on the power curve.

Enter Your Max RPM ?

Enter the maximum RPM your engine can rev to. This could be a rev limiter RPM or the highest RPM you have seen on your tach.

7140

OK Cancel

Enter Your Max RPM ?

The program assumes you filled in the power curve out to the highest RPM the engine still makes any power. If you engine is revving past 6800 RPM, you need to fill in one more RPM point with this highest RPM and enter an ESTIMATED HP at this RPM. Note that this HP is likely much less than the peak HP from your dyno curve.

Do you want the program to enter a point based on what you know to be the max RPM of your engine ?

Yes No

Engine Specs [ Chevy 604 Crate Motor 400 HP ]

File Calculate/Edit Load from Engine Analyzer Comments Help

- New Engine
- Open Example Engine
- Open Saved Engine
- Save Engine
- Save Engine As
- Windows Printer Setup
- Print

Click here for Example engines.

New Crate Motors.

Open Ex Engine File

28 Ex Engines in Library

12/13/2020	GM LS 376 Crate Motor 533 HP
11/24/2020	Ford 347 Crate Motor 415 HP
11/24/2020	Chevy 604 Crate Motor 400 HP
11/23/2020	Chevy 602 Crate Motor 350 HP
3/26/1999	STREETST.DCK
3/5/1999	96-BUSCH.V-8
3/5/1999	96-BUSCH.V-6
3/4/1999	SCAT.V-4
3/4/1999	PONT4-MI.DGT

Chosen Ex Engine File:

Tip: Single click on a Ex Engine name to 'choose'

Figure A 33 New "Back" Options in Analyze Suspension

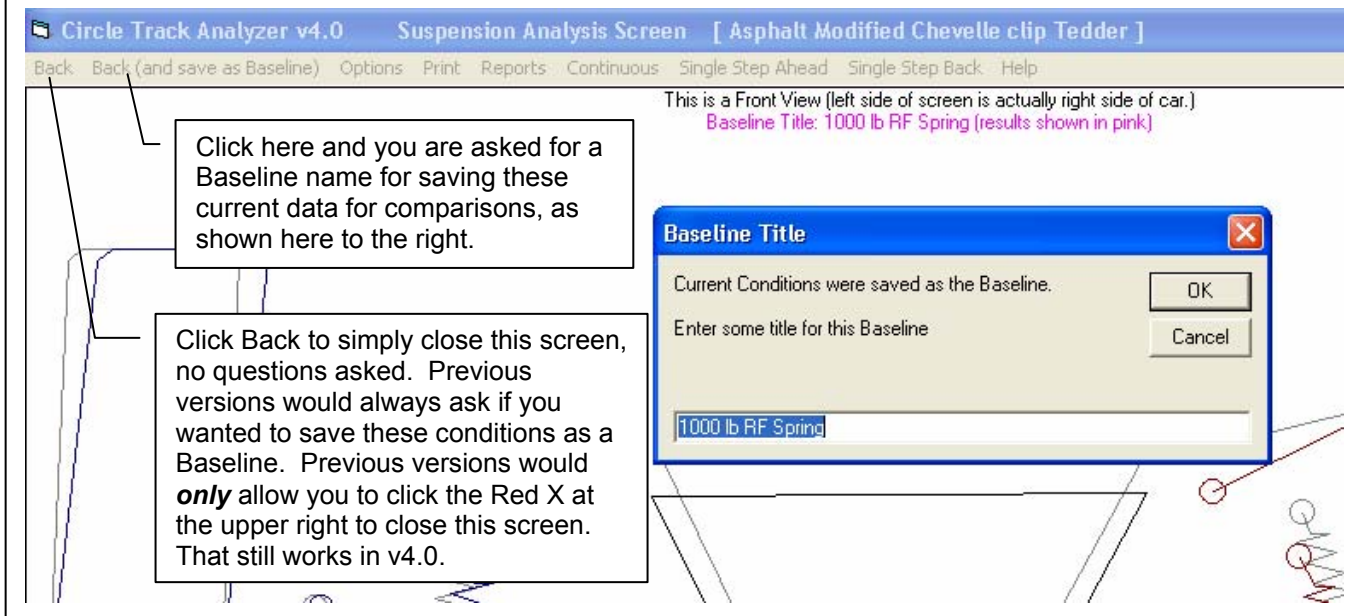


Figure A 34 New Larger Fields to Accommodate Longer File Names

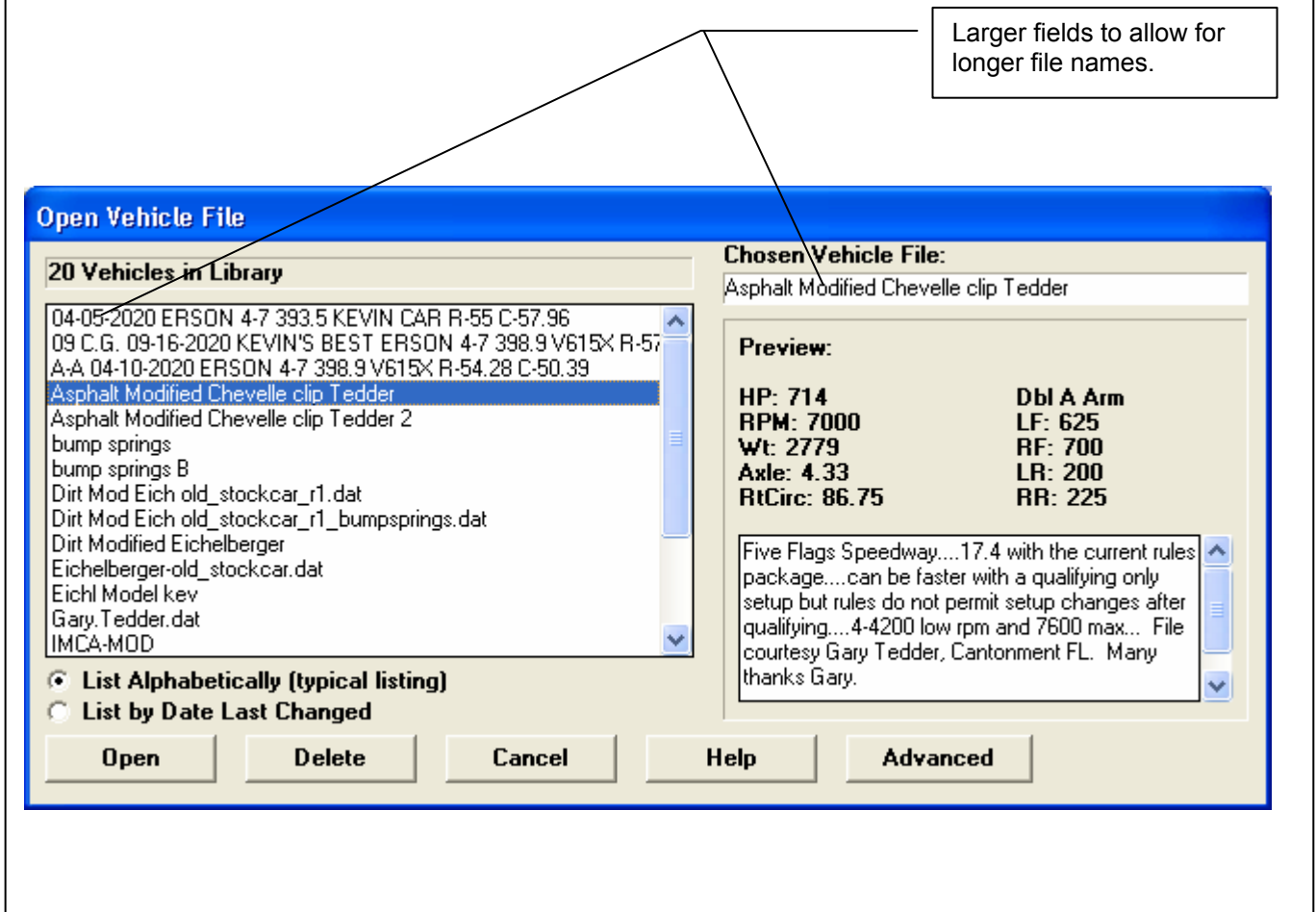


Figure A 35 New "View" Option, Plus Version Only

Click here to "View" only certain columns of data.

The image shows three screenshots from the Circle Track Analyzer 'Plus' v4.0 software. The top screenshot shows the main application window with the 'View' menu open, highlighting 'Show Only Picked Data'. A callout box points to this option. The middle-left screenshot shows the 'Report Columns' dialog box with a list of data types. Callout boxes explain that the template name is shown at the top, and that users can click 'Open' to load a previous template or click on data types to select them (using Shift and Ctrl for multiple selections). The middle-right screenshot shows the 'Report Columns' dialog box with the 'Save View Template' option selected. A callout box explains that clicking 'Save' saves the current data selections as a template for future use. The bottom screenshot shows the main application window displaying a report with only the selected data types (columns) visible. A callout box explains that this report shows only the selected data types, which is useful for printing specific data on a sheet of paper.

Enter View Template Name

Enter a name for this View Template.

The current settings will then be saved under this name so you can recall them later.

Report Columns

File Template: Tire Spring Bump Spring Force

LF Shock Force  
RF Shock Force  
LR Shock Force  
RR Shock Force  
LF Shock Vel  
RF Shock Vel  
LR Shock Vel  
RR Shock Vel  
LF Ride Ht  
RF Ride Ht  
F Aero Downforce  
R Aero Downforce  
Change CG Ht  
L Bump Force  
R Bump Force

Template name (if using template) shown here.

Click Open to open previous set of selected data as a saved Template.

Click on Data types to display them in the reports. Hold down the Shift and Ctrl keys while clicking to do select multiple data types.

Note:  
Hold down the 'Ctrl' key and click on items to include. Hold down the 'Ctrl' key and click on SELECTED items to remove them from list. Hold down 'Shift' key and click an item to select everything from last selected item to the item you just clicked.

Keep Settings Help Cancel Print

Report Columns

File Template: Tire Spring Bump Spring Force

Open Saved View Template  
Save View Template

Graph Templates

Basic Data  
New v4.0 Data  
Tire Force Shock Force and Vel  
Tire Spring Bump Spring Force

Use Template Delete Cancel

Note:  
Hold down the 'Ctrl' key and click on items to include. Hold down the 'Ctrl' key and click on SELECTED items to remove them from list. Hold down 'Shift' key and click an item to select everything from last selected item to the item you just clicked.

Keep Settings Help Cancel Print

Circle Track Analyzer 'Plus' v4.0 Performance Trends [ Asphalt Modified Chevelle clip Tedder ]

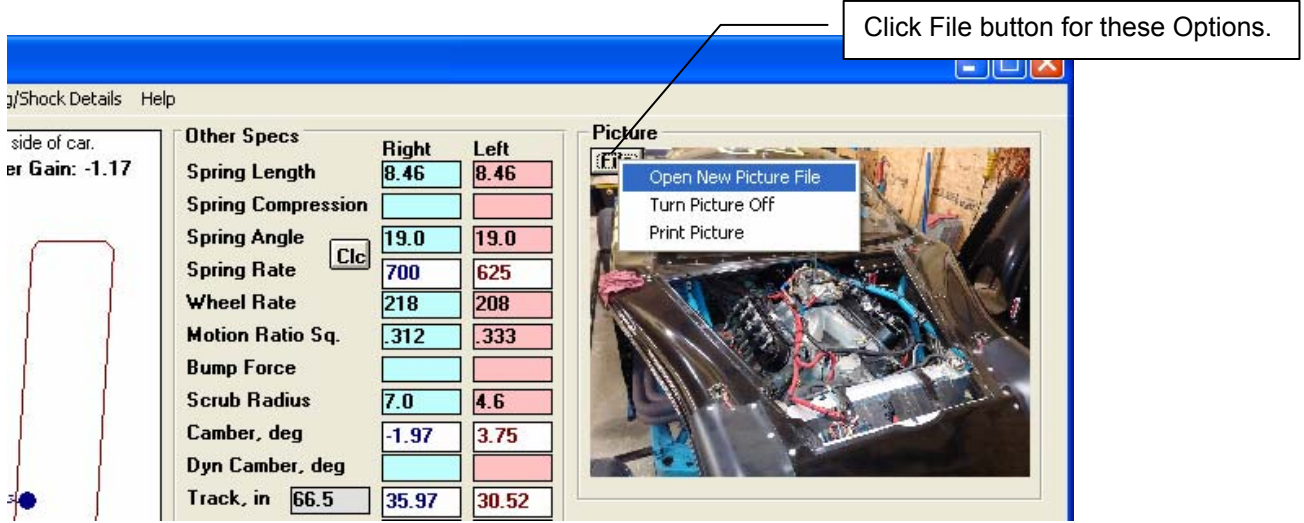
Notes Summary: Aggressive Driving. Click on Notes for more Details.

New Lap Time 18.26 MPH 98.6  
Last Lap Time 18.26 98.6  
Improvement .00 .0

Time	LF Bump at Tire	RF Bump at Tire	LR Bump at Tire	RR Bump at Tire	LF Spring Force	RF Spring Force	LR Spring Force	RR Spring Force	L Bump Force	R Bump Force
.00	1.34	1.66	0.25	0.57	12.7	628.7	-505.1	727.7	0.00	0.00
.20	1.11	1.44	0.41	0.74	-34.5	579.5	-480.4	779.4	0.00	0.00
.40	0.81	1.16	0.76	1.10	-89.8	511.3	-427.9	883.2	0.00	0.00
.60	0.56	0.81	1.17	1.42	-111.4	403.7	-343.7	951.1	0.00	0.00
.80	0.39	0.43	1.47	1.51	-86.6	261.6	-250.5	917.7	0.00	0.00
1.00	0.30	0.10	1.55	1.34	-41.2	124.7	-181.7	796.8	0.00	0.00
1.20	0.25	-0.11	1.40	1.04	-7.2	36.0	-143.3	639.7	0.00	0.00
1.40	0.19	-0.15	1.10	0.76	-2.7	9.6	-123.0	493.8	0.00	0.00
1.60	0.10	-0.08	0.77	0.58	-28.5	31.6	-116.8	393.3	0.00	0.00
1.80	0.00	0.00	0.50	0.50	-63.4	64.6	-109.3	331.3	0.00	0.00
2.00	-0.08	0.04	0.36	0.47	-86.4	78.4	-94.8	293.3	0.00	0.00
2.20	-0.12	0.00	0.34	0.46	-88.3	62.9	-75.5	269.7	0.00	0.00
2.40	-0.13	-0.10	0.43	0.46	-70.0	21.5	-49.4	250.9	0.00	0.00

Report showing only selected Data Types (columns). If you make a printout, only these selected Data Types will be printed. This way you can get the data you are interested in to fit on a sheet of paper.

Figure A 36 Include Pictures with your Vehicle Files



If you choose Open, the program will typically default to the Vehicle Pictures folder, but you can browse to any folder on your computer. Note that if you move or change the location of the picture file you pick, it will not be found in the program and can not be used. For that reason it is best to keep a copy of a picture file in the Vehicle Pictures folder.

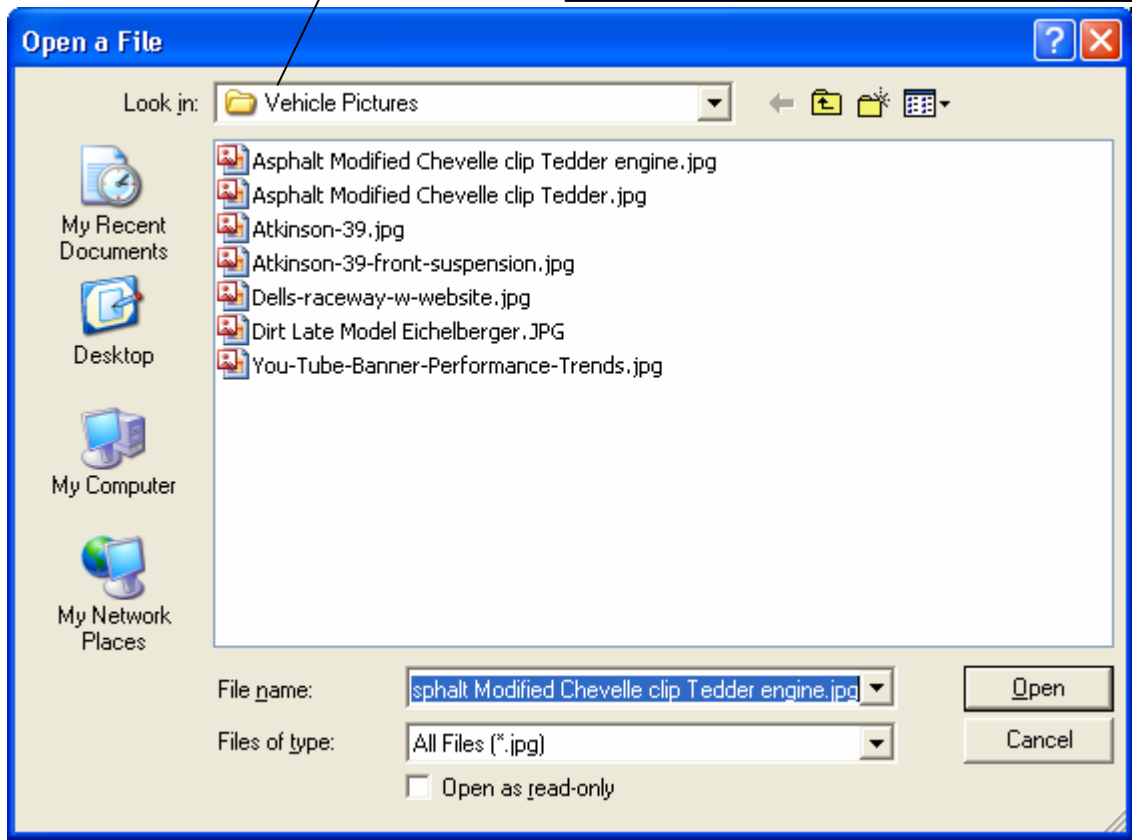
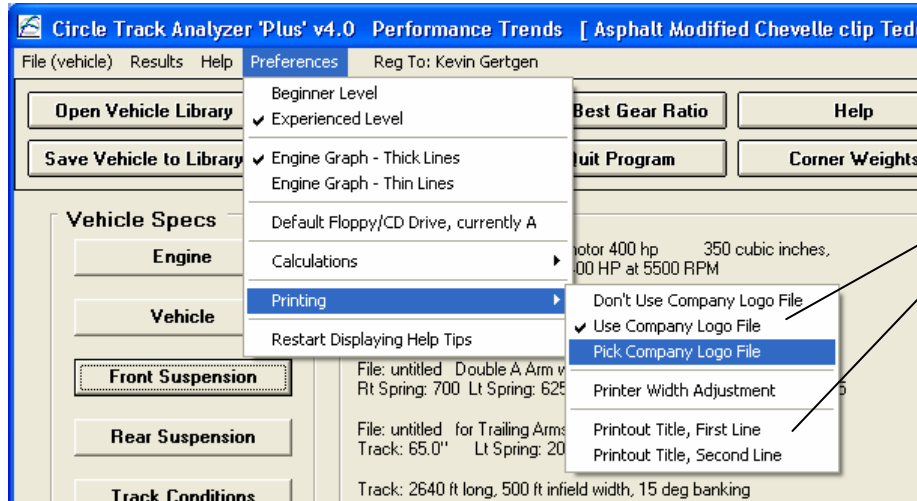
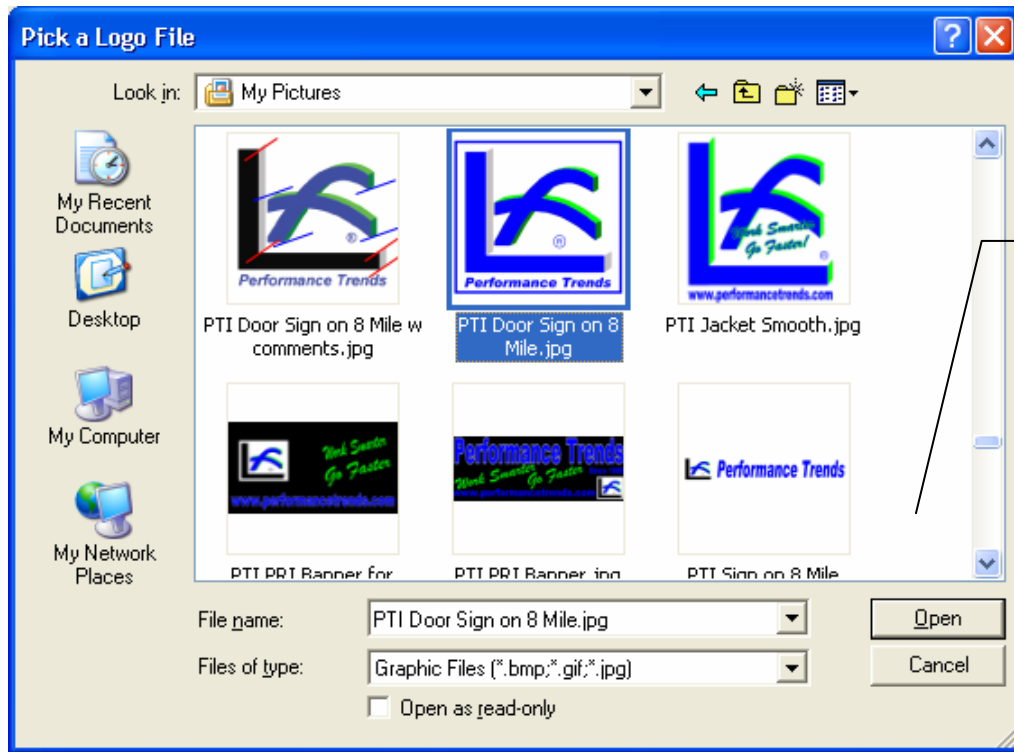


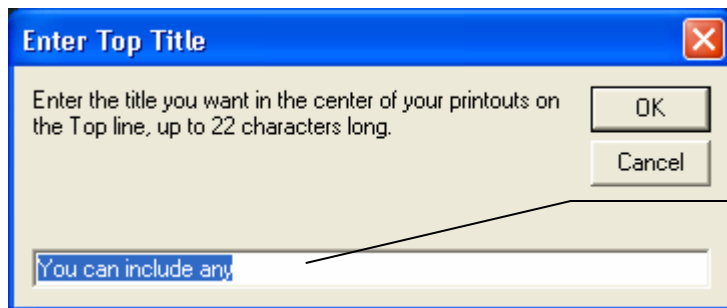
Figure A 37 Include Company Logo and Titles on your Printouts, Plus Version Only



Plus Version includes these Printing Options



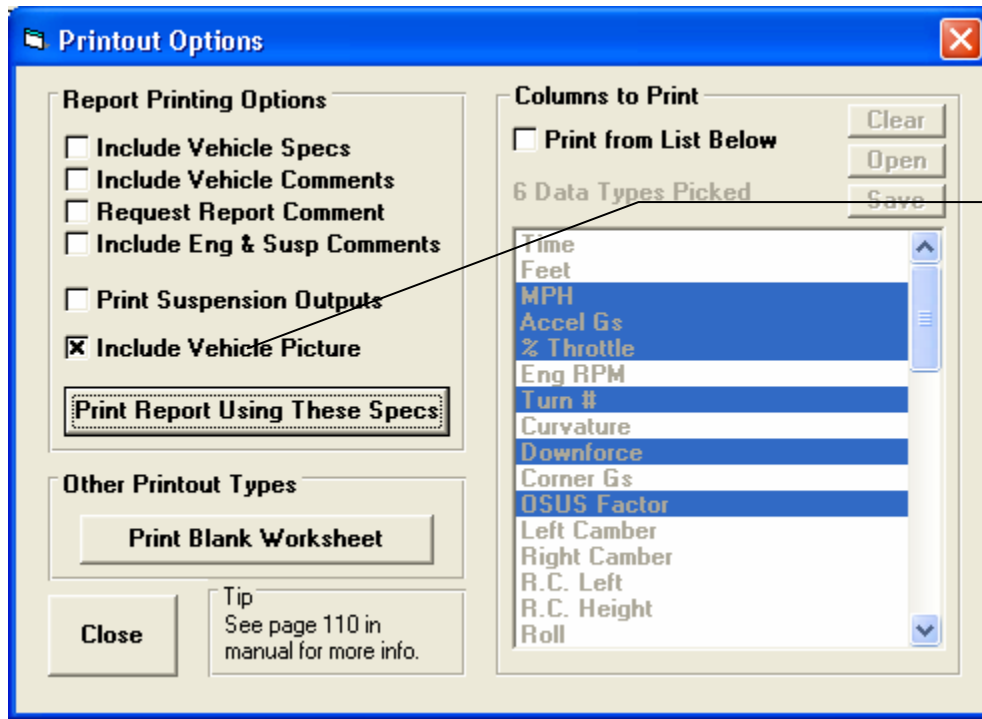
Browse to locate a .jpg file to use as your Company Logo file.



Enter 2 lines of text to appear at the top of your printouts. You do this through 2 separate screens.




Figure A 38 Include Company Logo and Titles on your Printouts, Plus Version Only, cont



If you make a Report Printout (columns of numbers), you can select to include the Vehicle Picture here. This is the picture on the Main Screen, not the Front Suspension screen.


Company Logo graphic will appear here on printouts.

Two lines of text Titles will appear here.



Circle Track Analyzer v4.0  
Eng: Open-Wheel-Modified-Atkinson-39  
Calculated Test Results

You can include any Business Info here  
Perf. Trends (C) 2020



This Report Printed:  
4:27:11 pm 12-13-20  
Page: 1

Time	LF Bump at Tire	RF Bump at Tire	LR Bump at Tire	RR Bump at Tire	LF Spring Force	RF Spring Force	LR Spring Force	RR Spring Force	LF Shock Force	RF Shock Force	LR Shock Force	RR Shock Force	LR Shock Vel	L Bump Force
.00	0.50	1.26	-0.50	0.27	-126.7	349.3	-449.2	415.4	-60.07	-51.33	5.13	6.87	0.41	0.00
.25	0.20	0.98	-0.25	0.53	-166.9	316.9	-412.0	473.8	-88.89	-88.86	19.39	19.40	1.56	0.00
.50	-0.23	0.53	0.31	1.06	-216.8	254.8	-306.3	572.0	-114.86	-124.38	31.25	29.35	2.51	0.00
				1.55	-254.5	171.5	-177.5	639.4	-101.53	-128.68	22.94	17.51	1.84	0.00
				1.66	-267.7	80.3	-85.7	611.7	-71.75	-108.67	3.07	-4.31	0.25	0.00
				1.38	-266.9	8.8	-68.7	515.0	-38.61	-65.45	-13.66	-19.02	-1.10	0.00

Vehicle Picture will appear here, unless you print in landscape. Then it will appear smaller next to company logo graphic.



Figure A 39 New Graph Features

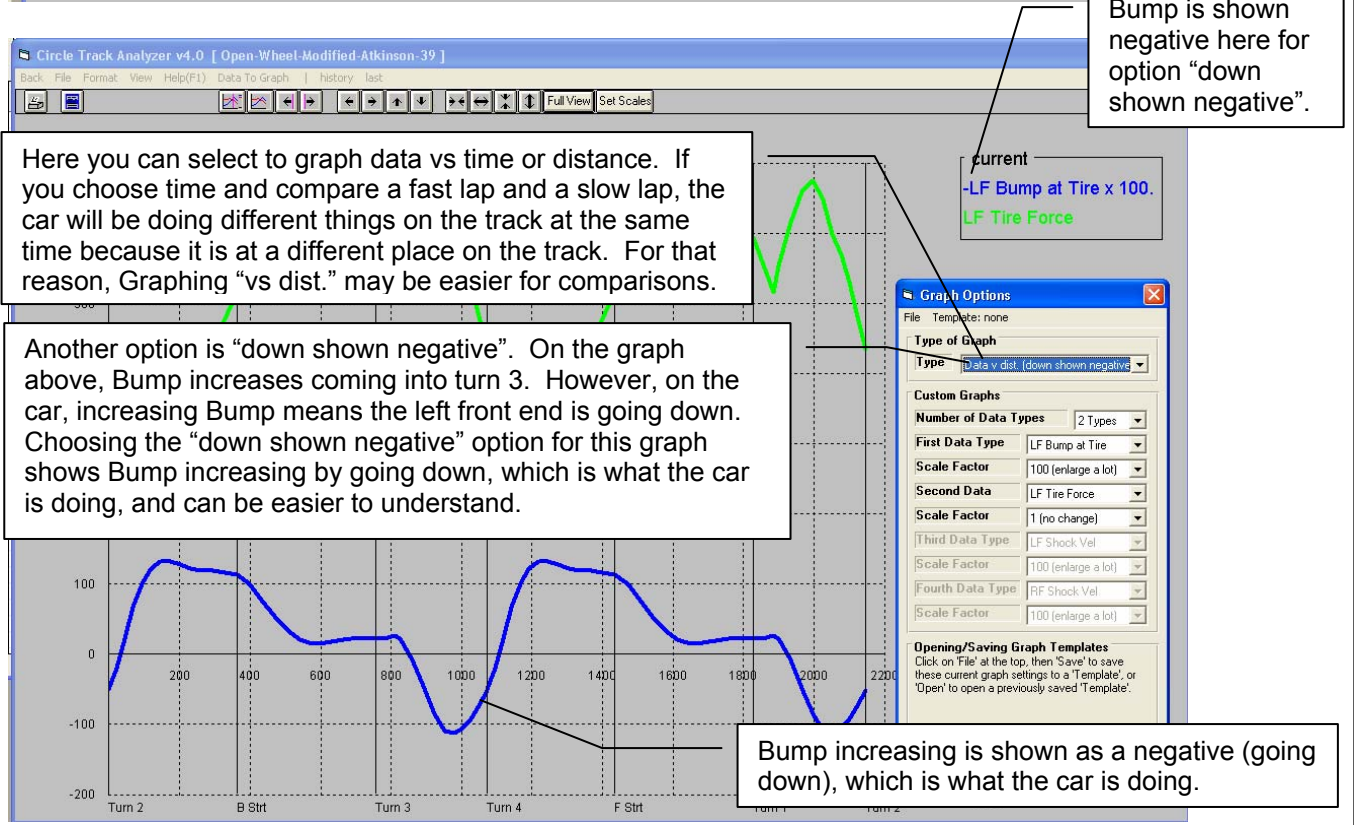
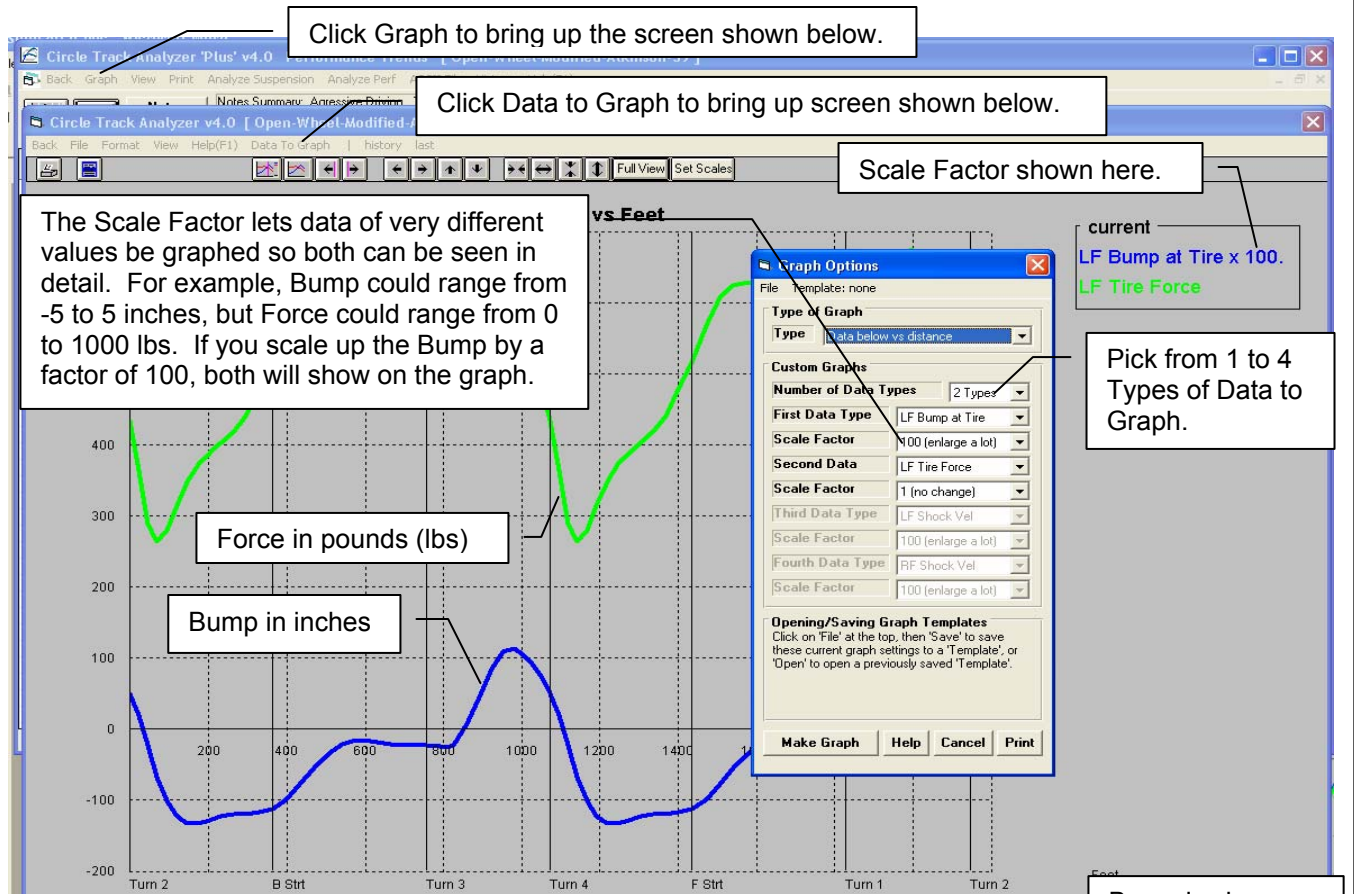


Figure A 40 New Graph Features, cont

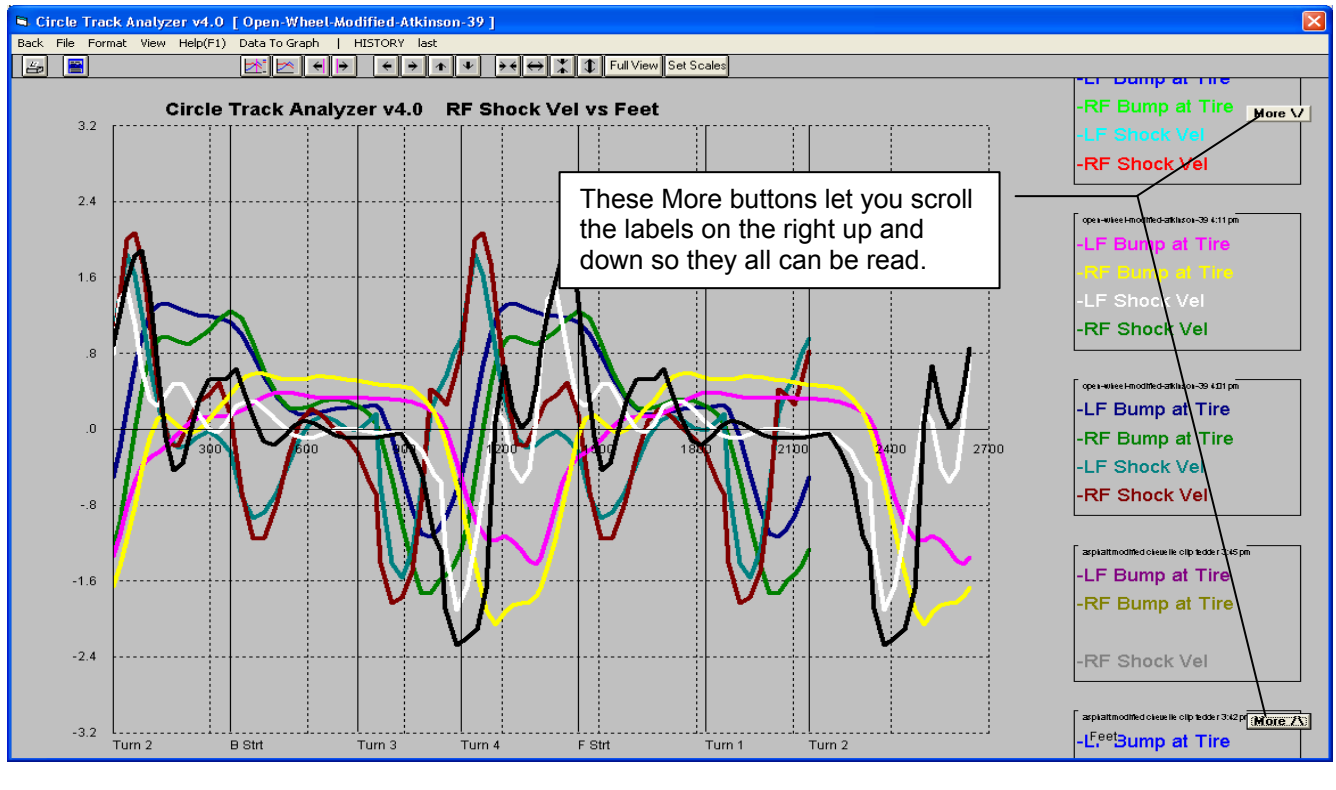
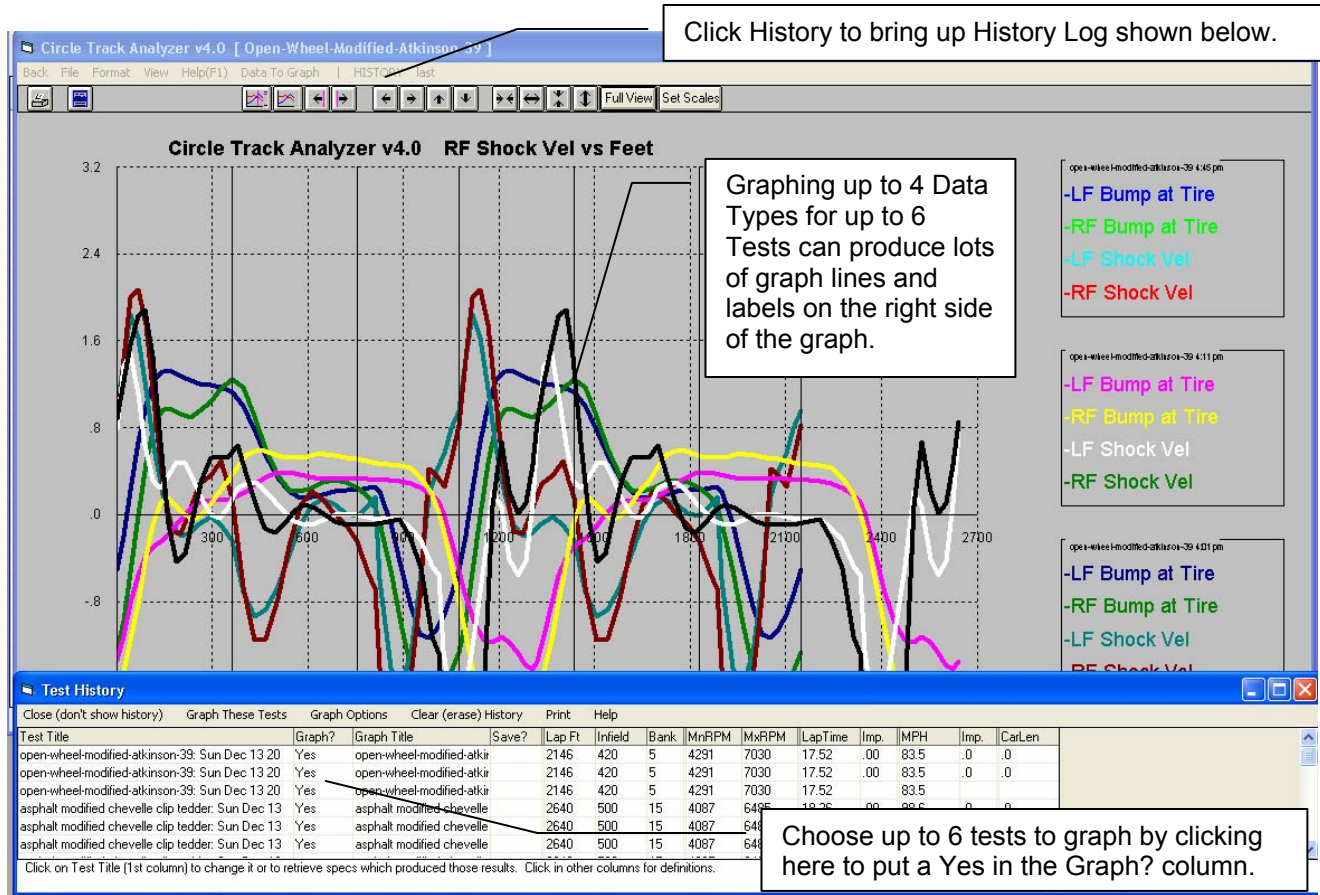


Figure A 41 New Graph Features, cont

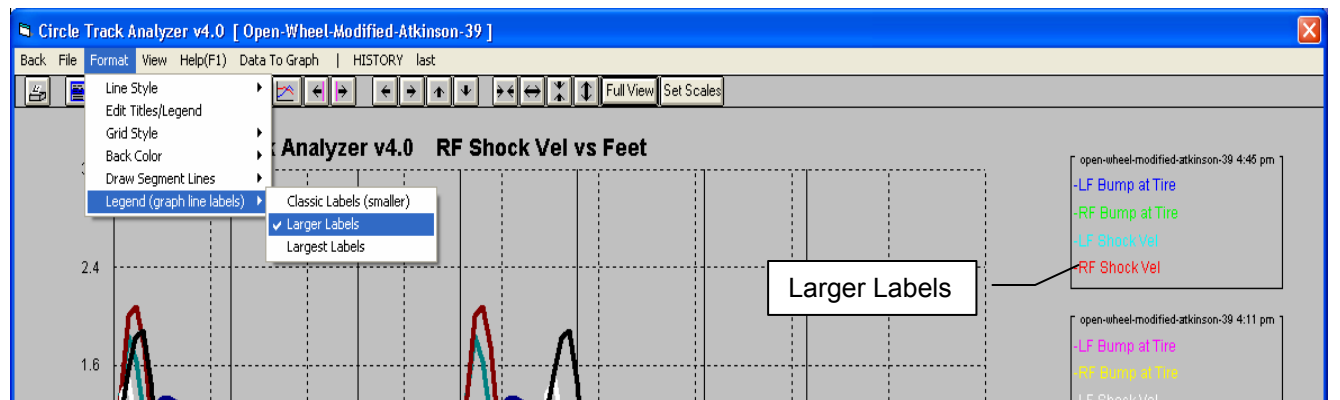
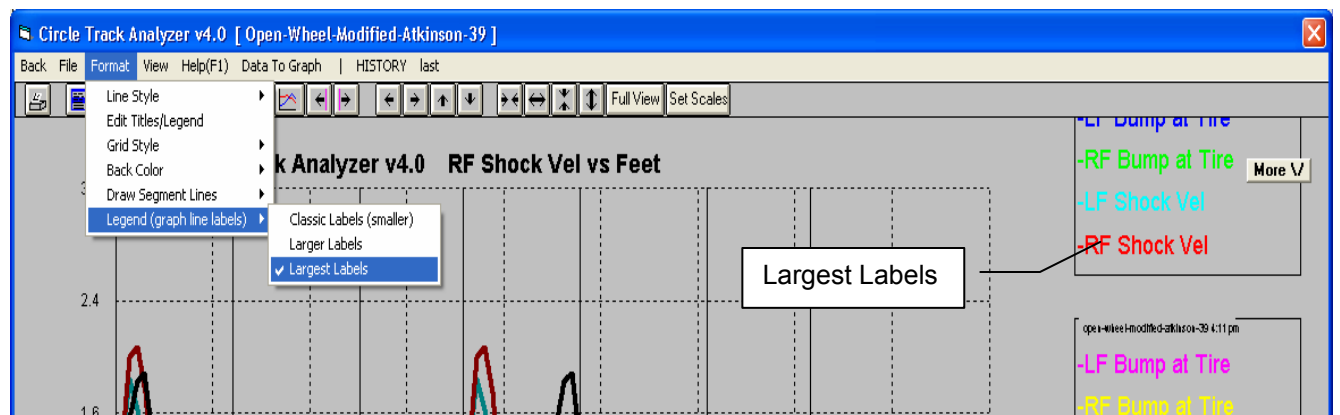
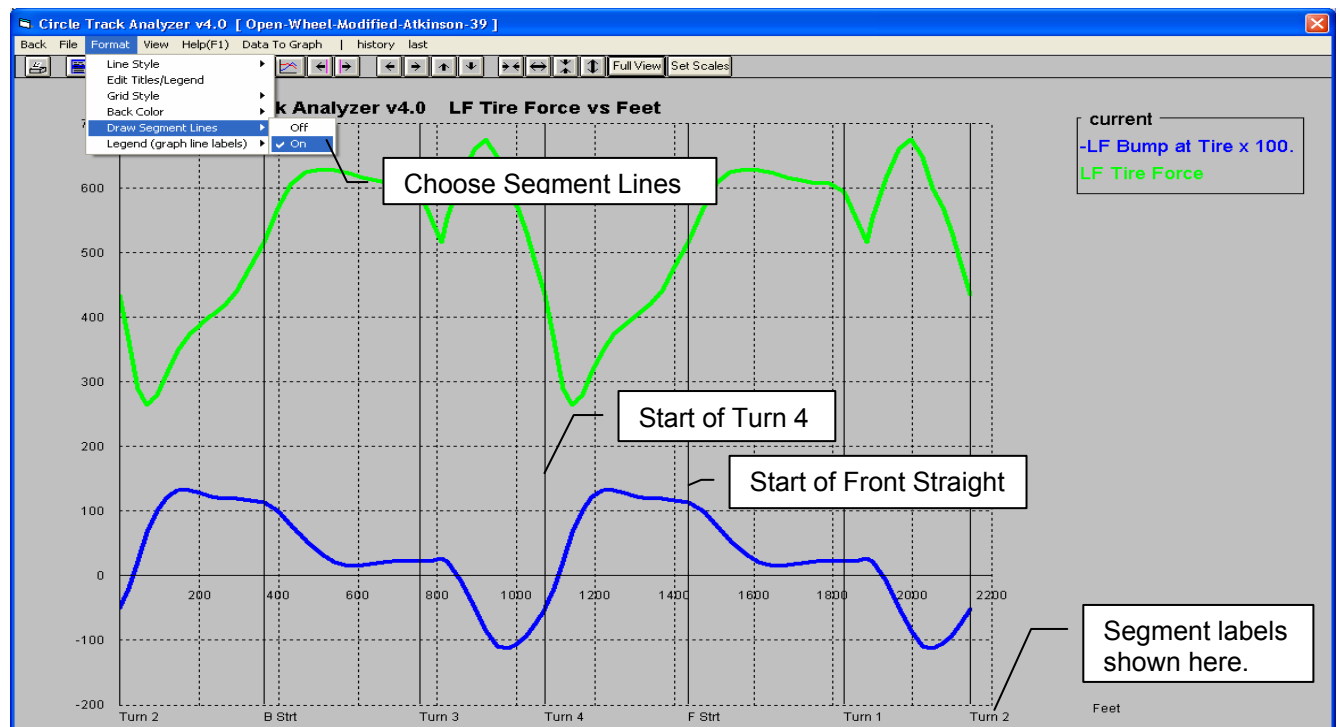


Figure A 42 New Graph Features, cont

Plus version allows for logo and title lines.

Circle Track Analyzer v4.0  
Eng: Open-Wheel-Modified-Atkinson-39  
Calculated Test Results

You can include any Business Info here  
Perf. Trends (C) 2020

This Graph Printed:  
10:08 pm 12-13-20  
Page: 1



Vehicle picture from Main Screen gets printed here.

