Appendix X New Features in v2.4 B

Version 2.4B adds several features, which we have grouped into these categories:

New Suspension Types or Options

The program now allows for solid front axles and for several ways of locating them. Also included are calculations showing the drive shaft angle or U joint angle changes with suspension movement. Fig 6.33.

The program has 2 new steering options:

1. One is where the steering is a steering box, there is no center link. Instead the tie rod on the spindle from one side is tied directly to the steering box arm. Then the tie rod from the other spindle is effectively tied to spindle that the steering link is attached to. This is the steering of some Jeep solid axle front suspensions. Fig 6.34.
2. The second is where the steering is a steering box, but the tie rods do not attach to the center link. Instead they attach to arms on the steering box and idler arm on arms on opposite side of the center link arms. This is the steering of some Alfa Romeo suspensions. Fig 6.35.

You can now use a panhard bar or a watts link with leaf springs as the Lateral Locator. Fig 6.36.

The program has new inputs in Vehicle Specs for:

1. Front, rear or all wheel drive, and what percent of the power is being delivered through the front drive tires. Fig 6.37.
2. The program has a new input in Vehicle Specs for inputs or inboard or outboard brakes at either the front or rear suspension. Fig 6.37.
3. Unsprung weight is now an input for front and rear and is used to determine natural frequencies and some handling characteristics. Prior to this, the program assumed a certain percent of the vehicle's weight was unsprung. Fig 6.37.

There is a Calculation Utility "Clc" screen for entering in inputs for the King Pins for solid axle front suspensions. Fig 6.38.

The program now allows you to specify what the opposite end of the car is doing. This lets you apply "pitch" to the car to see what happens to the calculations. Fig 6.39.

You can now enter specs for bump springs for the front and/or the rear suspension. (This feature is not available for push or pull rod type suspensions.) There is also a Clc screen to calculate these specs, which can be handy if you are working with "stacked" springs. Fig 6.40.

The program now calculates and displays new outputs, like Bump Spring Force and Dynamic (after dive and roll are applied) Roll Stiffness, Roll Couple, Front and Rear Lateral Load Transfer, and Natural Frequencies. This is very handy to watch what happens once the Bump Springs are encountered with suspension movement. Fig 6.40.

There are new inputs for Ride Height. You can then watch Ride Height change when you apply Bump and Roll and the new Pitch input to the suspension. When you do a top view of the suspension, the location where the Ride Height measurements are made are drawn as small boxes. These measurement locations are located in the Vehicle Specs screen, as they always have been. Fig 6.41.

New Graph, Report or Print Features

If you have swapped graph axes, like camber on the horizontal axes and movement on the vertical axes, and use the cursor, it is horizontal. Fig 6.46.

You can now include a picture file with the suspension which will be drawn on the main screen if there is room, and included in printouts of reports or graphs as you direct. Fig 6.47 and 6.49.

The program has new print options for graphs and reports of including the suspension picture file (if any). Fig 6.48.

You can now include the data table with a graph. Fig 6.49.

The printed Graph comments have new options and are described under File, then Printed Comments in the Graph Screen. Fig 6.49.

You can now graph the Jacking Component, Bump Spring Force, and Ride Height. Fig 6.47.

The Data Type you have picked to graph is now displayed under the list. Since the list is long and only the first picked data type is graphed, many times a type could be picked that you did not see in the list. Fig 6.47.

Other New Program Features

The program now reads some types of Bill Mitchell's WinGeo (.gem) files, like double a arm and MacPhearson strut. Fig 6.43.

There have been several updates to Emailing Preferences to work better with modern changes to emailing protocols. Fig 6.44.

File Comments are now shown on the main screen if there is enough room. Fig 6.33.

Zoom options for the drawing on the main screen are now included under the "View" menu button options.

The program now draws the CG in side view. Fig 6.39.

'The program now remembers some inputs you have entered in the "Clc" calculation utility screens, like for spring rate, roll 'bar rate, and the new Unsprung Weight, and more. These are saved with the file, so in the future you will know where, say, the roll bar rate came from. Fig 6.45.

The program now remembers the size and position of the main screen when you restart the program. This way, when you reopen the program, it should revert right back to the same position or size you last arranged.

The "Advanced" button for Save As now uses current folder as the default folder.

The program now better draws extension lines when the lines extend WAY OFF the drawing screen so as to look more realistic.

The program now marks invalid solid front suspensions as "na" in the Vehicle Specs screen.

The Company Logo graphic now appears on the main screen. Fig 6.33.

The program now has substituted "Bump Springs" for "Symmetric Chassis" in the Vehicle Specs screen. This Symmetric Chassis feature was never activated in earlier versions.

Program now more reliably saves and reads its configuration info so the config file is less likely to get corrupted.

If the Registered Name or Registered Code becomes corrupted, the program now allows an easy fix by contacting Performance Trends.

Figure A 6.33 New Solid Axle Front Suspension Options

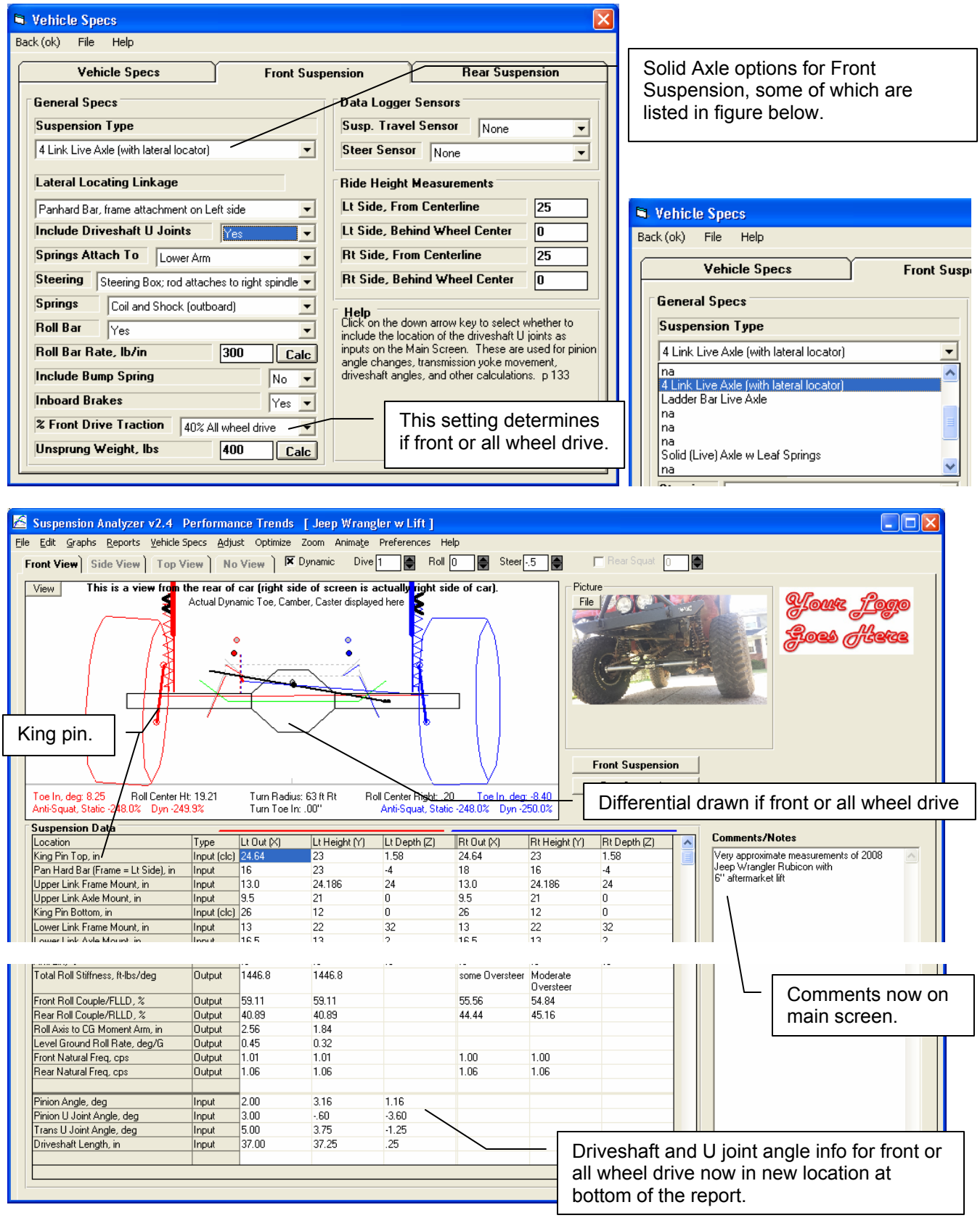
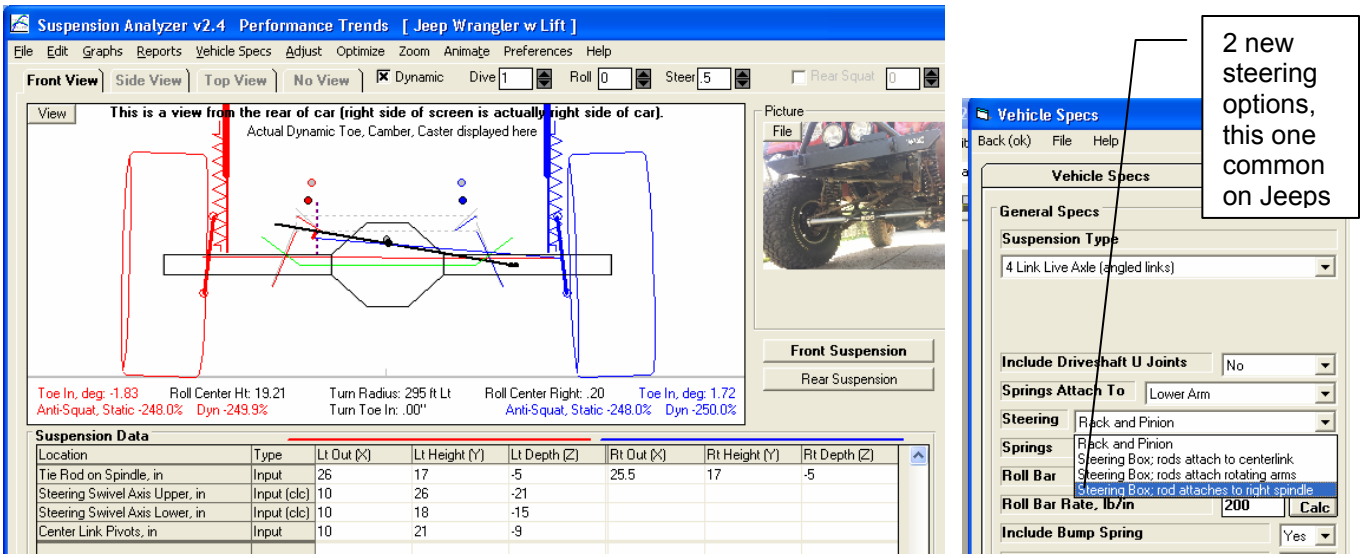


Figure A 6.34 New Steering System Option, “Steering Box, rod attaches to right spindle”



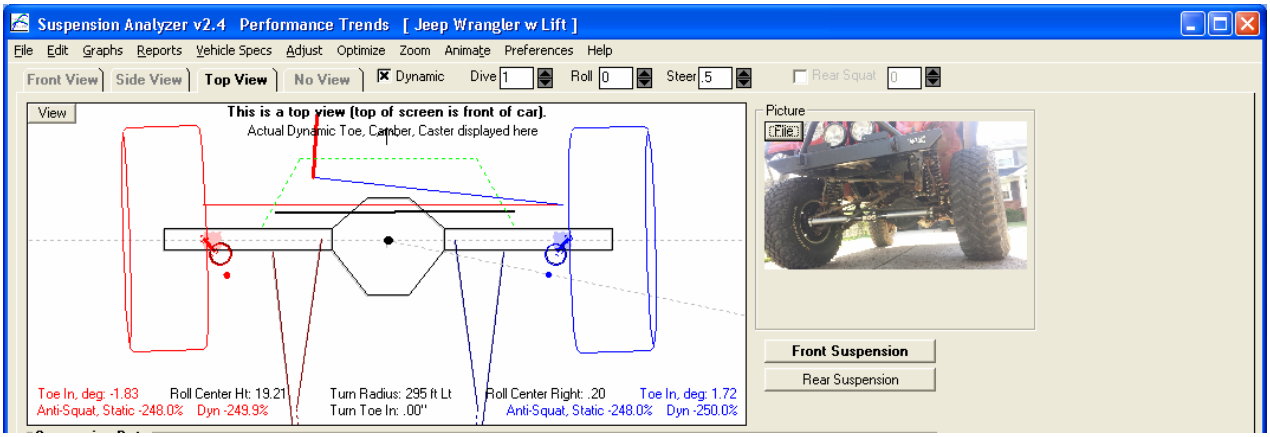
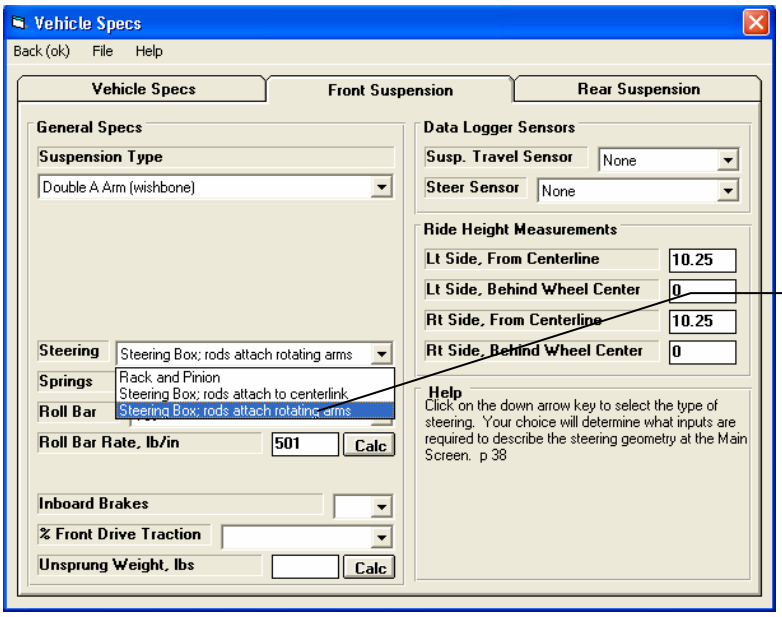
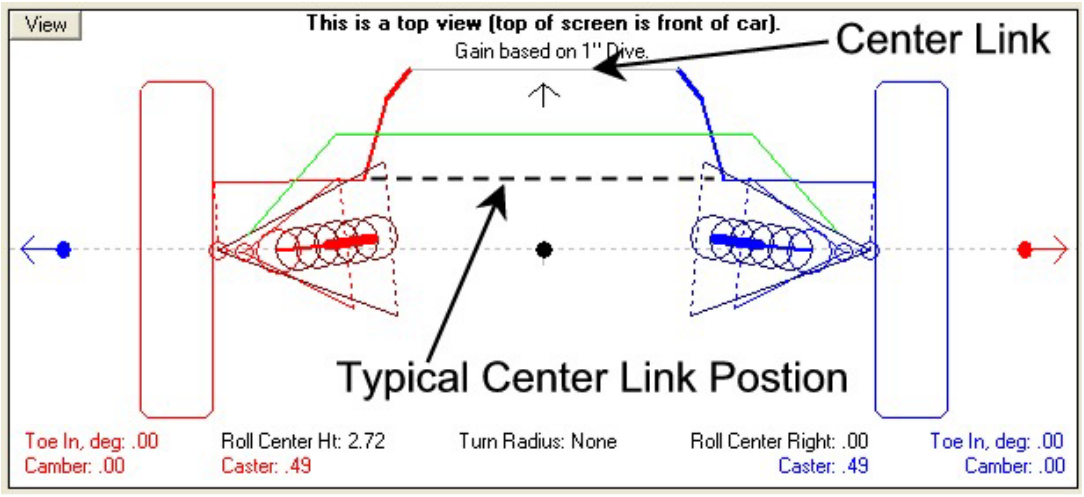


Figure A 6.35 New Steering System Option, “Steering Box: Rods attach to rotating arms”



This steering system is common on Alfa Romeo



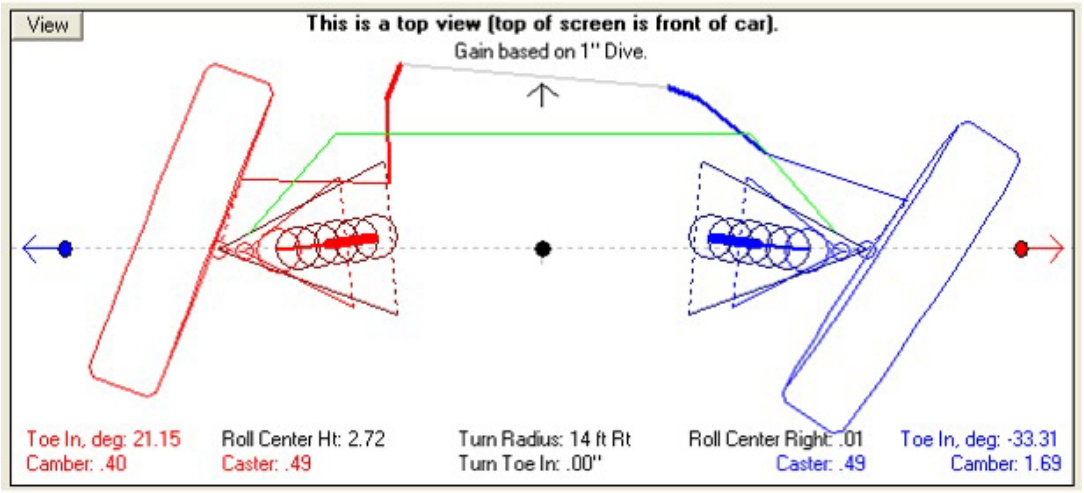
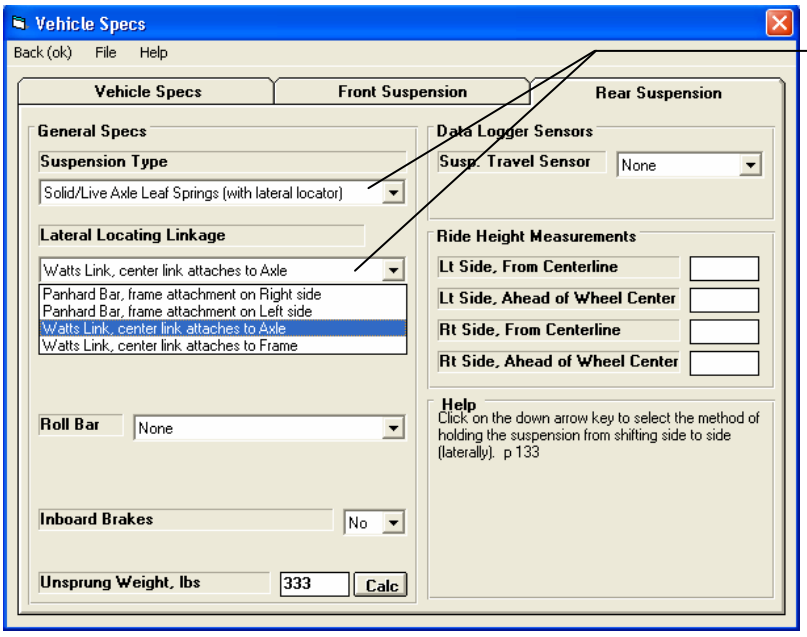
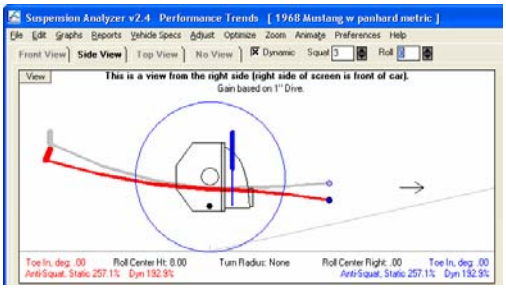
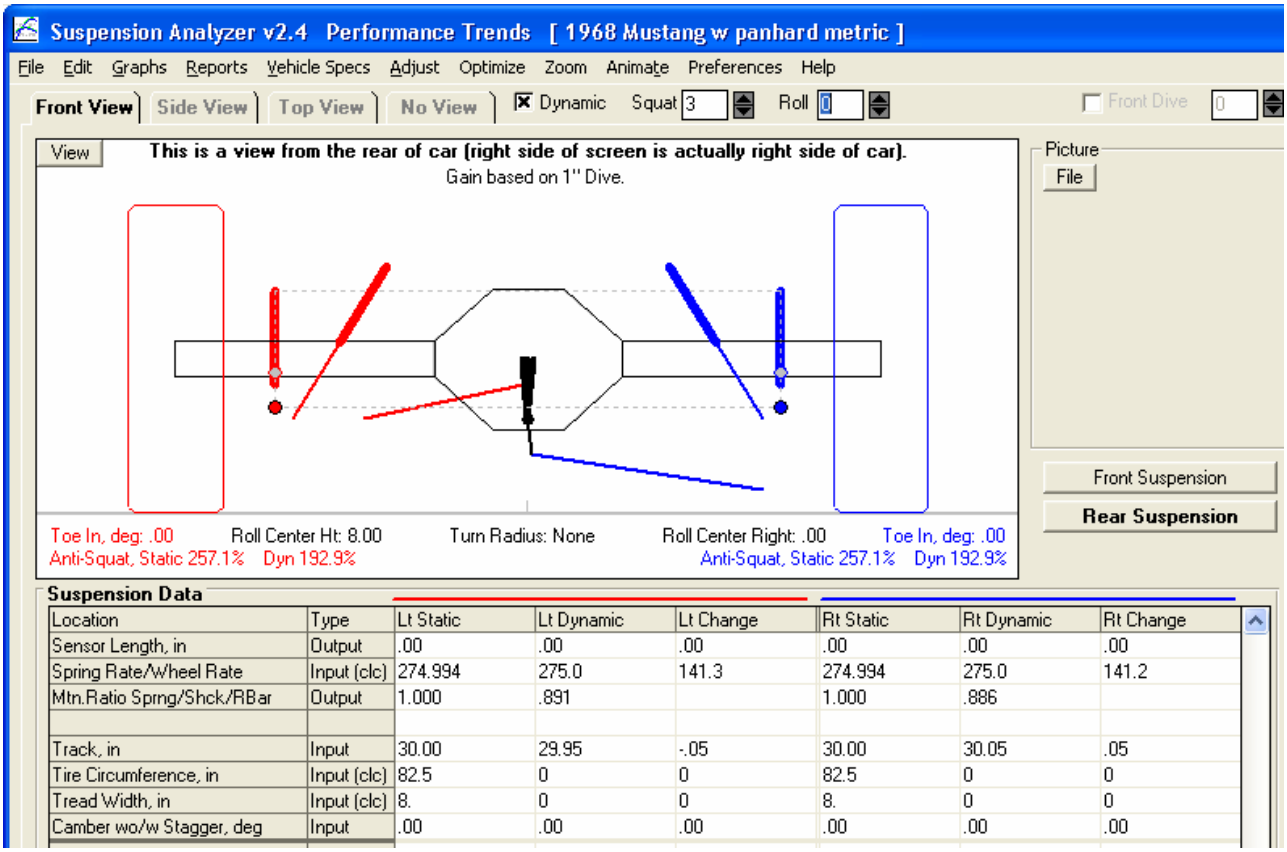


Figure A 6.36 Leaf Springs now allow for Lateral Locators, Panhard Bar or Watts Link



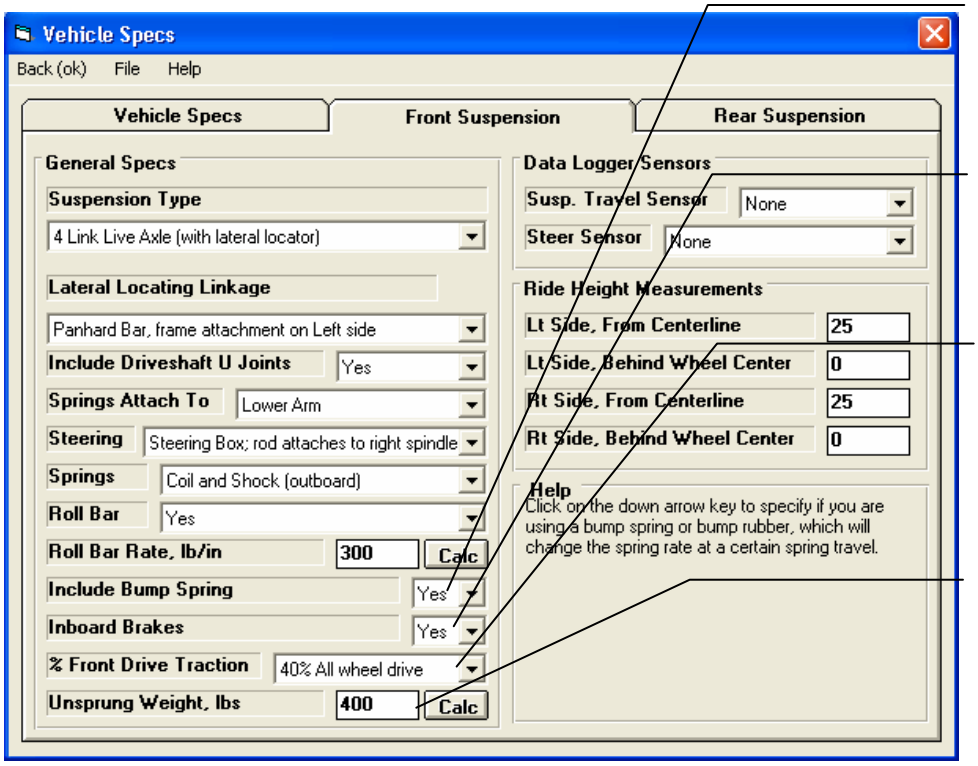
Choose this new “Leaf Spring (with lateral locator)” option for the “Lateral Locating Linkage” options to appear.





Location	Type	Lt Static	Lt Dynamic	Lt Change	Rt Static	Rt Dynamic	Rt Change
Sensor Length, in	Output	.00	.00	.00	.00	.00	.00
Spring Rate/Wheel Rate	Input (clc)	274.994	275.0	141.3	274.994	275.0	141.2
Mtn.Ratio Sprng/Shck/RBar	Output	1.000	.891		1.000	.886	
Track, in	Input	30.00	29.95	-.05	30.00	30.05	.05
Tire Circumference, in	Input (clc)	82.5	0	0	82.5	0	0
Tread Width, in	Input (clc)	8.	0	0	8.	0	0
Camber wo/w Stagger, deg	Input	.00	.00	.00	.00	.00	.00

Figure A 6.37 More Inputs for Vehicle Specs



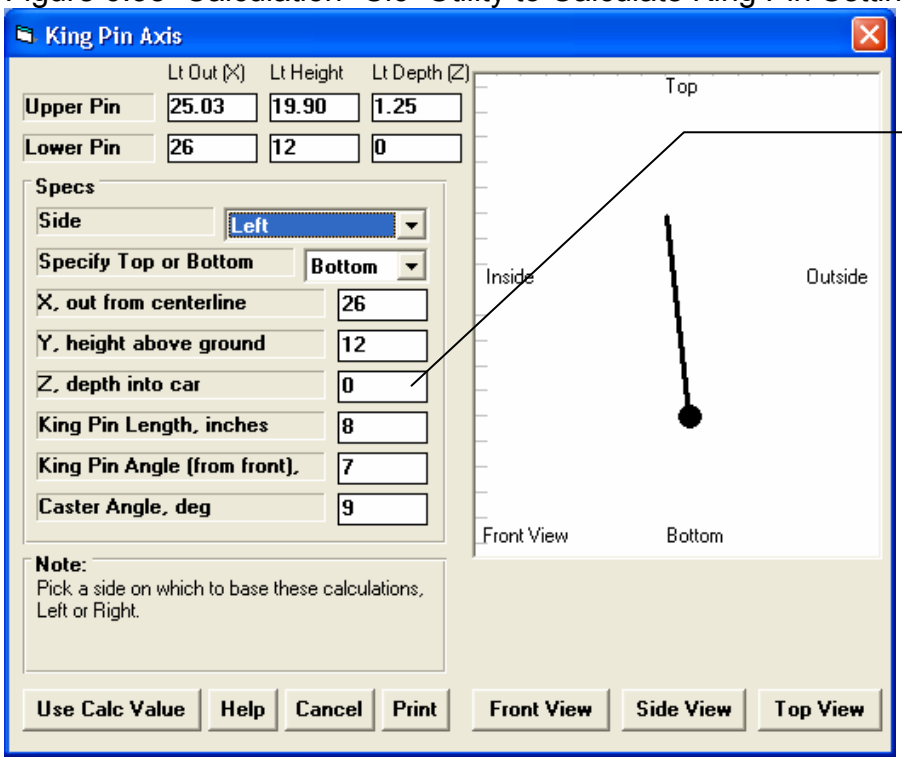
Bump Springs as described in Fig 6.40.

Inboard vs Outboard brakes will affect Anti-Dive calculations.

% Front Drive Traction will affect Anti-Lift calculations.

Unsprung weight will affect Natural Frequency and some handling calculations. Click on the "Calc" button to calculate from other inputs.

Figure 6.38 Calculation "Clc" Utility to Calculate King Pin Settings from Angles



Choose a side, then enter inputs to see the king pin angle being drawn. The large "dot" is showing the "Specify Top or Bottom" end of the king pin. Click on the "View" buttons at the bottom to see the king pin from different angles. King Pin Length is not very critical, as it is mostly used for the drawing. The critical thing for the calculations are the angles you have entered.

Figure A 6.39 Applying Pitch to Suspension Movement

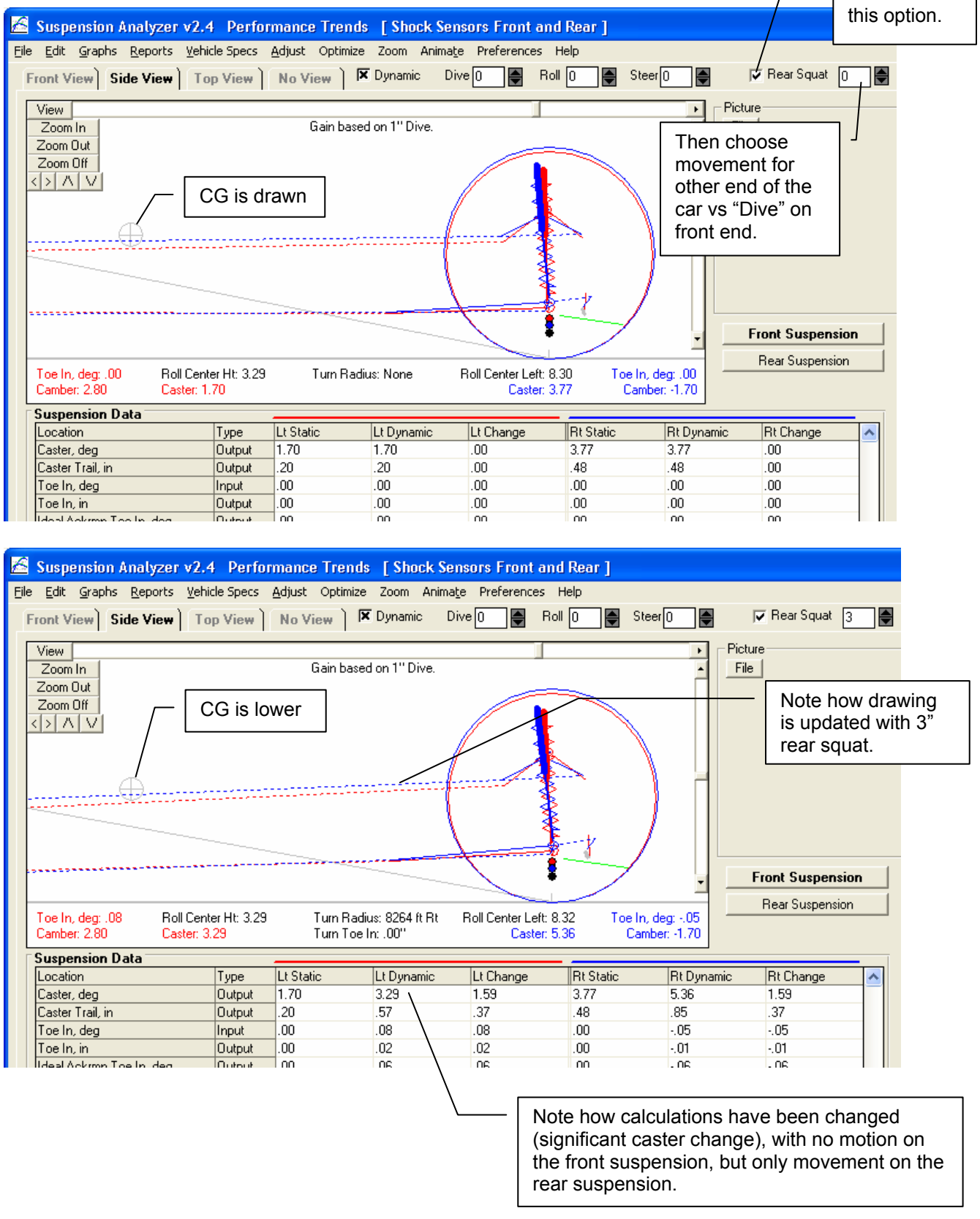
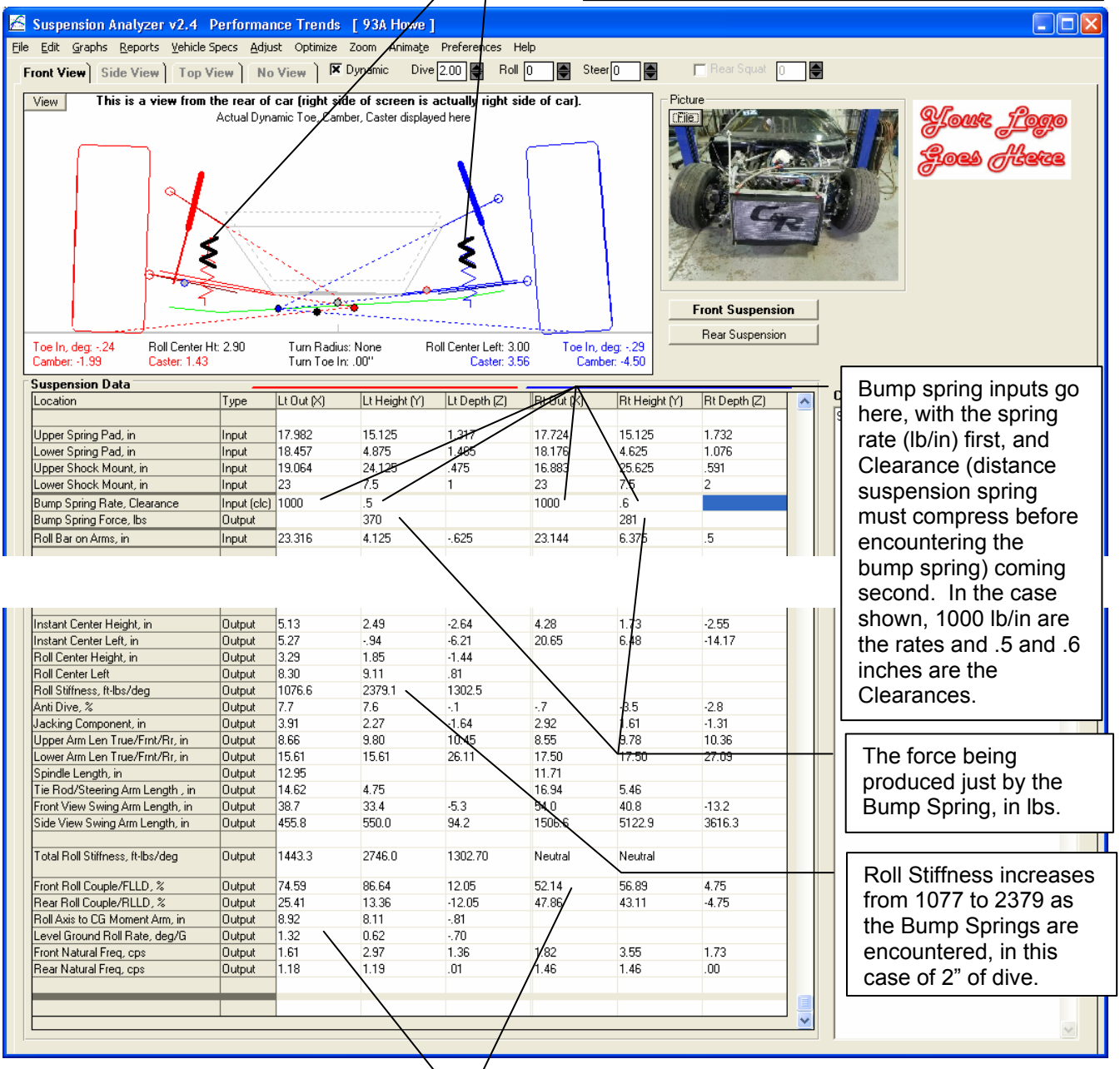


Figure 6.40 New Inputs of Bump Springs

If you are using Bump Springs, heavier black coils are drawn on the top of the springs.



Location	Type	Lt Out (X)	Lt Height (Y)	Lt Depth (Z)	Rt Out (X)	Rt Height (Y)	Rt Depth (Z)
Upper Spring Pad, in	Input	17.982	15.125	1.317	17.724	15.125	1.732
Lower Spring Pad, in	Input	18.457	4.875	1.485	18.176	4.625	1.076
Upper Shock Mount, in	Input	19.064	24.125	.475	16.883	25.625	.591
Lower Shock Mount, in	Input	23	7.5	1	23	7.5	2
Bump Spring Rate, Clearance	Input (clc)	1000	.5		1000	.6	
Bump Spring Force, lbs	Output		370			281	
Roll Bar on Arms, in	Input	23.316	4.125	-.625	23.144	6.375	.5
Instant Center Height, in	Output	5.13	2.49	-2.64	4.28	1.73	-2.55
Instant Center Left, in	Output	5.27	-.94	-6.21	20.65	6.48	-14.17
Roll Center Height, in	Output	3.29	1.85	-1.44			
Roll Center Left	Output	8.30	9.11	.81			
Roll Stiffness, ft-lbs/deg	Output	1076.6	2379.1	1302.5			
Anti Dive, %	Output	7.7	7.6	-.1	-.7	-3.5	-2.8
Jacking Component, in	Output	3.91	2.27	-1.64	2.92	1.61	-1.31
Upper Arm Len True/Frnt/Rr, in	Output	8.66	9.80	10.45	8.55	9.78	10.36
Lower Arm Len True/Frnt/Rr, in	Output	15.61	15.61	26.11	17.50	17.50	27.09
Spindle Length, in	Output	12.95			11.71		
Tie Rod/Steering Arm Length , in	Output	14.62	4.75		16.94	5.46	
Front View Swing Arm Length, in	Output	38.7	33.4	-5.3	54.0	40.8	-13.2
Side View Swing Arm Length, in	Output	455.8	550.0	94.2	1506.6	5122.9	3616.3
Total Roll Stiffness, ft-lbs/deg	Output	1443.3	2746.0	1302.70	Neutral	Neutral	
Front Roll Couple/FLLD, %	Output	74.59	86.64	12.05	52.14	56.89	4.75
Rear Roll Couple/RLLD, %	Output	25.41	13.36	-12.05	47.86	43.11	-4.75
Roll Axis to CG Moment Arm, in	Output	8.92	8.11	-.81			
Level Ground Roll Rate, deg/G	Output	1.32	0.62	-.70			
Front Natural Freq, cps	Output	1.61	2.97	1.36	1.82	3.55	1.73
Rear Natural Freq, cps	Output	1.18	1.19	.01	1.46	1.46	.00

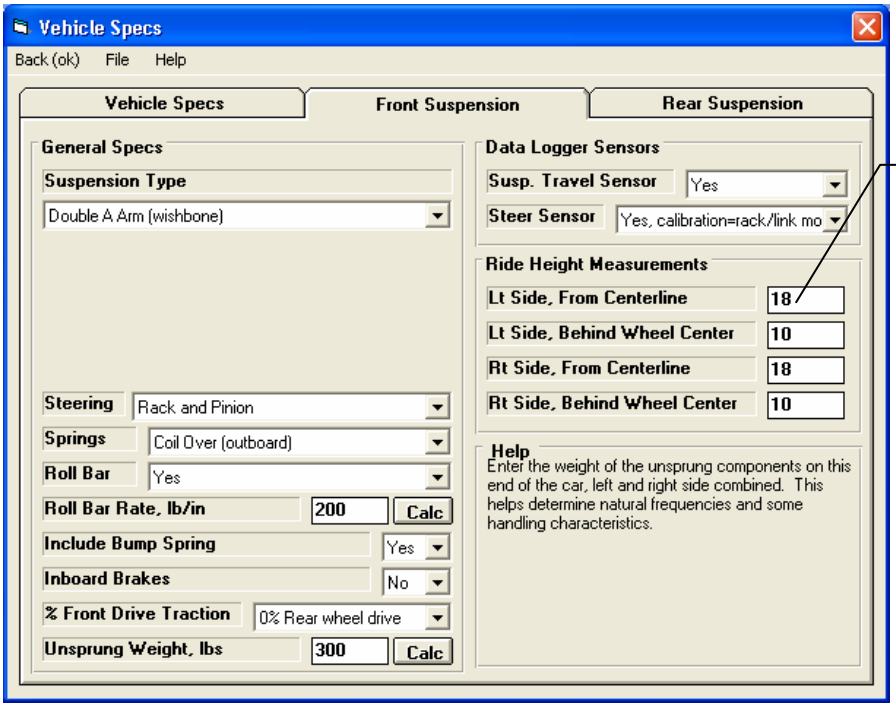
Bump spring inputs go here, with the spring rate (lb/in) first, and Clearance (distance suspension spring must compress before encountering the bump spring) coming second. In the case shown, 1000 lb/in are the rates and .5 and .6 inches are the Clearances.

The force being produced just by the Bump Spring, in lbs.

Roll Stiffness increases from 1077 to 2379 as the Bump Springs are encountered, in this case of 2" of dive.

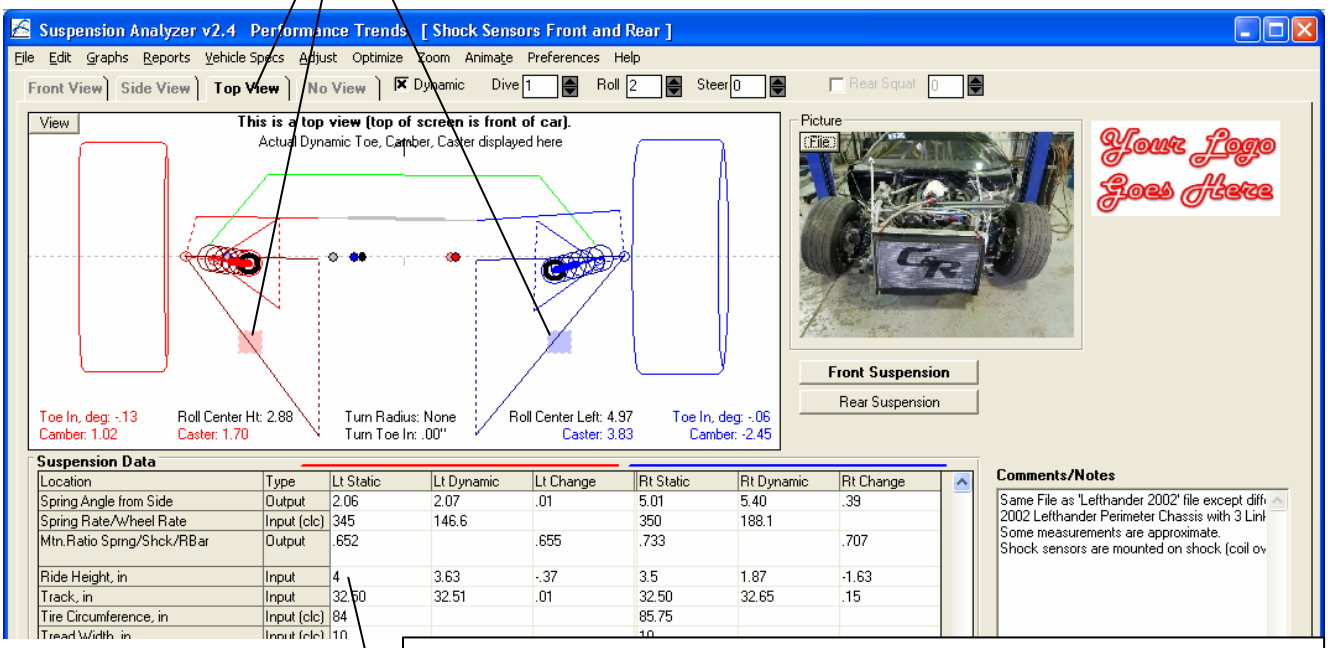
The change in many other handling ratings are shown here, with the static rating at static ride height shown first, then the new rating at the new dynamic condition (in this case 2" dive), and then the amount of change. For example, the FLLD% changed from 52.14% to 56.89% with 2" of dive, a 4.75% change. But the "rating" is still considered "Neutral" for both.

Figure 6.41 New Inputs of Ride Height



In Vehicle specs, the location where Ride Height is measured can be entered here.

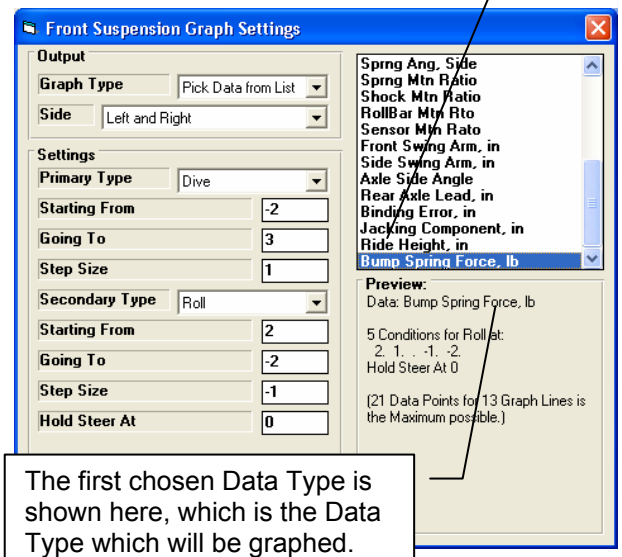
In “Top View”, the location where Ride Height is measured (as entered in the screen shown above) is shown by a light red and light blue box.

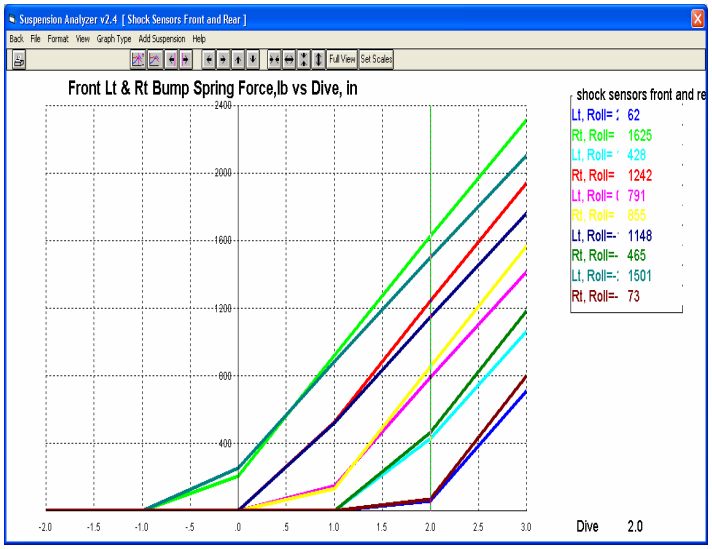


You will enter the Static Ride Height (typically the clearance between the ground and the vehicle’s frame) in the first column. Then the new Dynamic Ride Height (clearance) is displayed in the second column, with the difference in the third. In this case, the Left side Ride Height changed from 4 to 3.63 with 1” of dive and 2 deg of roll, a change of -.37 inches.

Figure 6.42 New Data Type Options for Graphs and Reports

Three new Data Type options for graphs and reports appear on the bottom of this list.

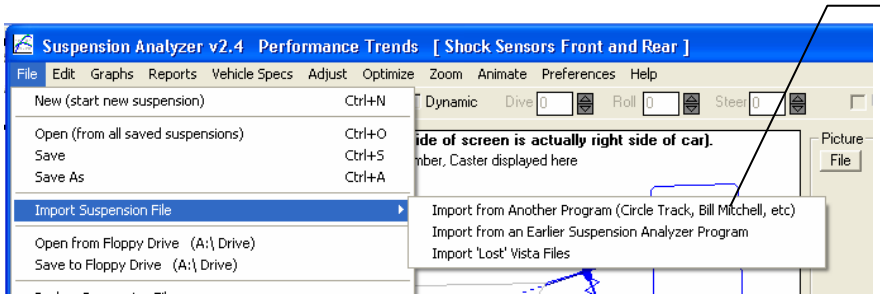


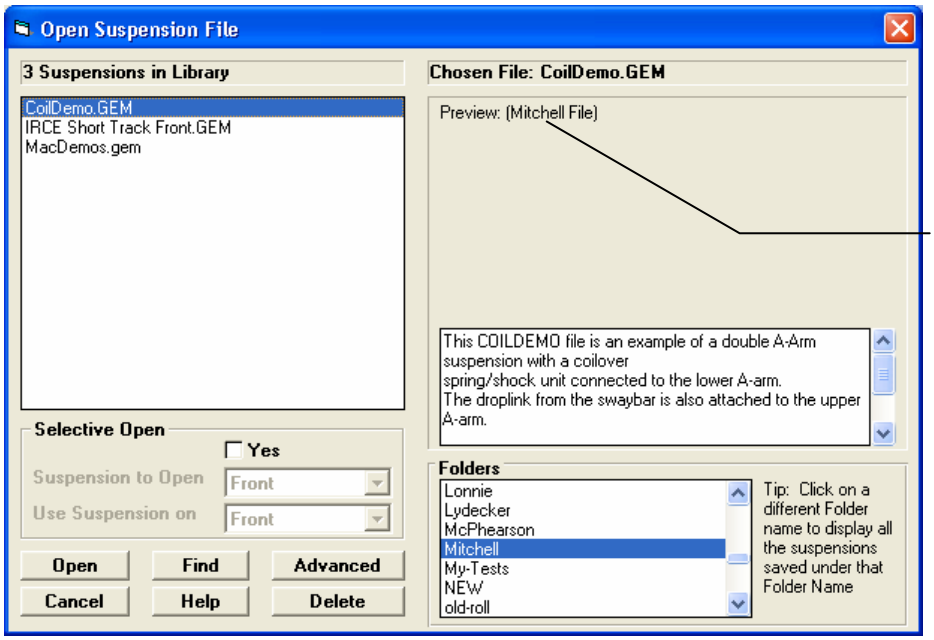


The first chosen Data Type is shown here, which is the Data Type which will be graphed.

Figure 6.43 New Option of Importing Bill Mitchell Win Geo Files

You can click on "Open" or "Import" to bring up the Open Suspension File screen shown below. Then locate and click on the Bill Mitchell file, typically with a .GEM file extension.





If the Suspension Analyzer recognizes the file as Bill Mitchell, it will be displayed here as "Mitchell File".

Figure 6.44 New Preference Settings for Emailing Results

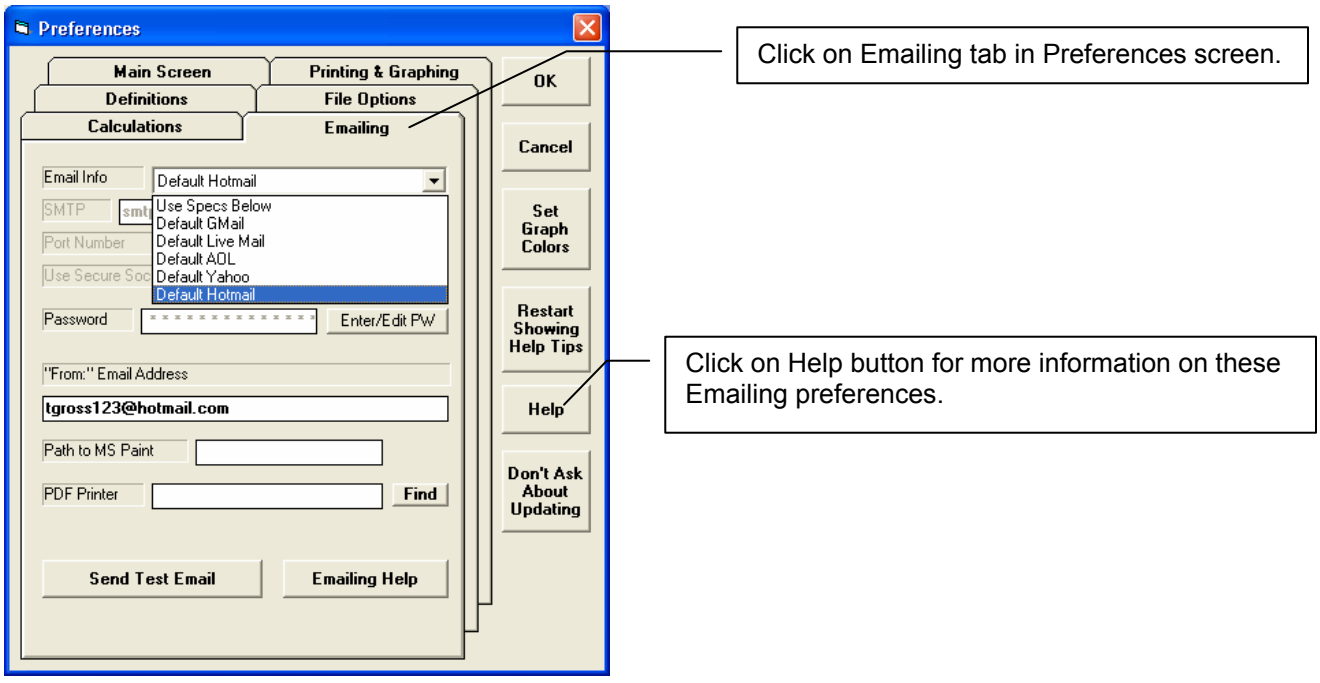


Figure 6.45 Program Now Remembers Inputs Used for Calculation "Clc" Utility Screens

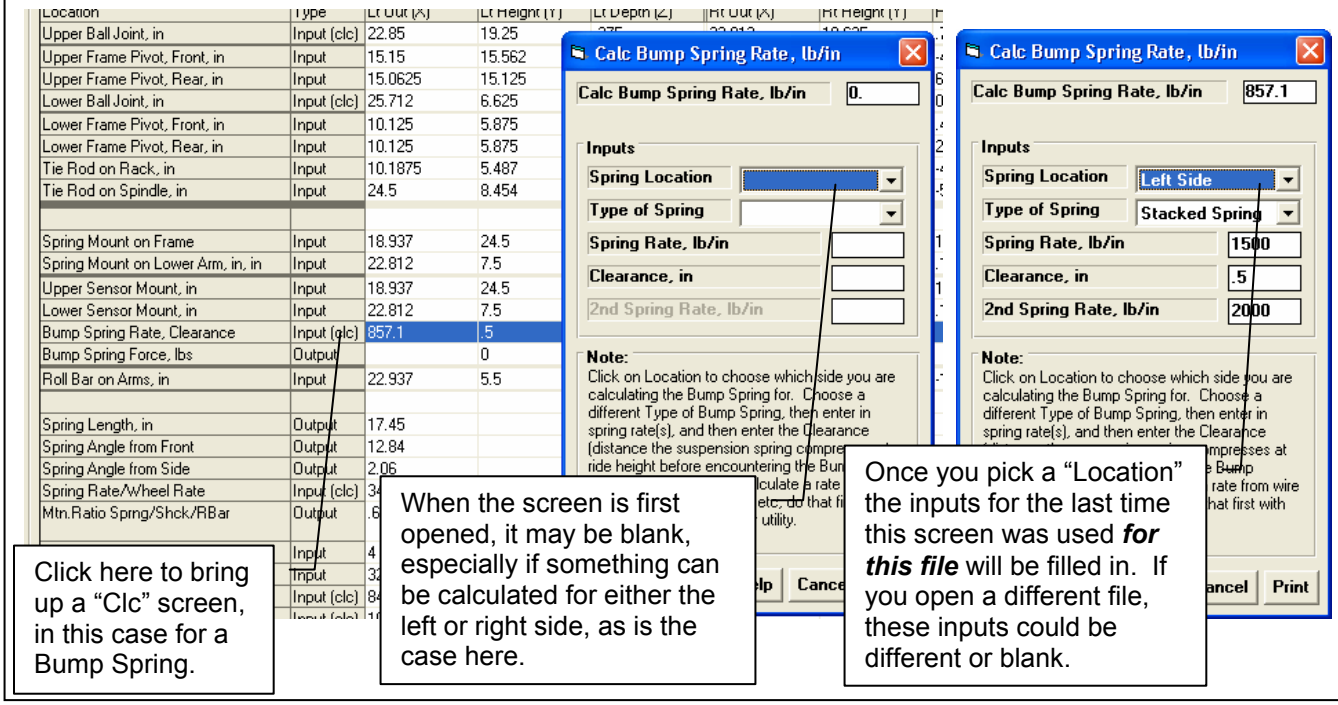


Figure A 6.46 Horizontal Cursors

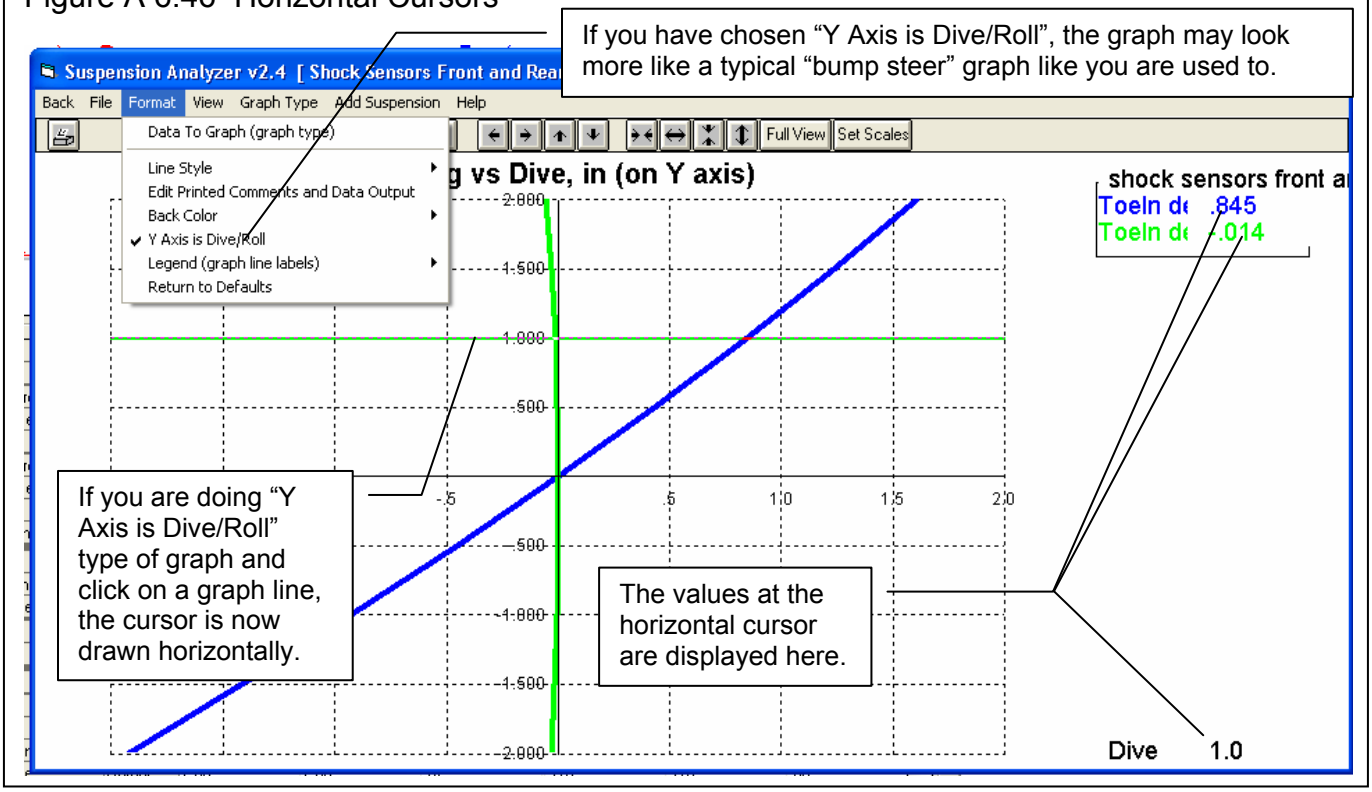
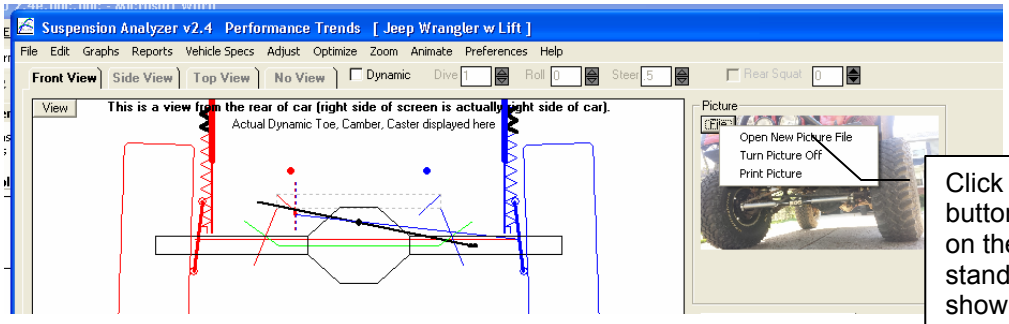
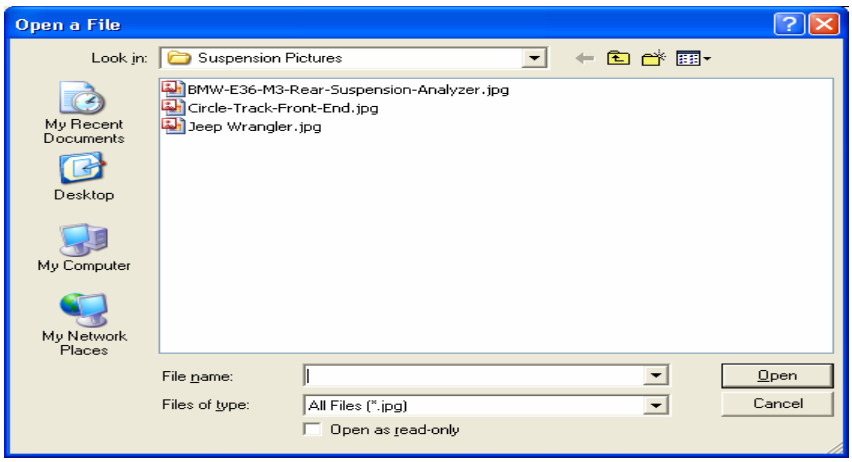


Figure A 6.47 Picture Files

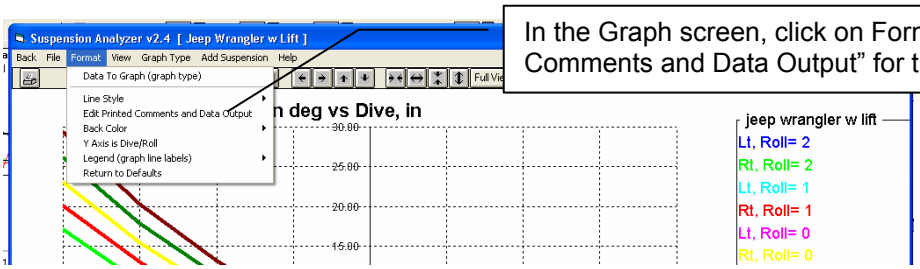




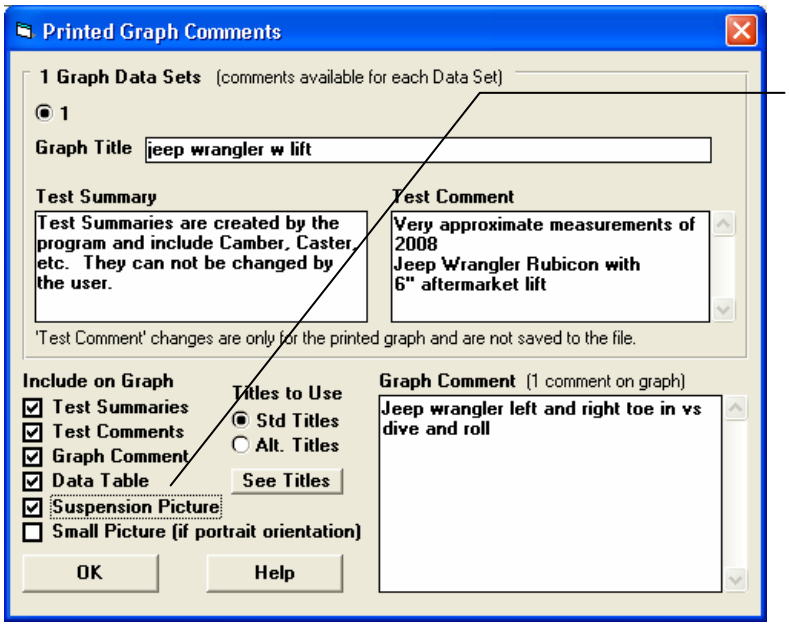
Click on the Picture File button for these options. Click on the Open option for the standard “Open a File” screen shown below. There you can browse to any place on your computer to pick a picture file.

NOTE: The only thing saved in the suspension file is the ***location and name*** of the picture file, not the actual file. So, if you copy a suspension file to a different computer and the picture file is not also copied and placed in the same folder on the new computer, it will not appear on the new computer.

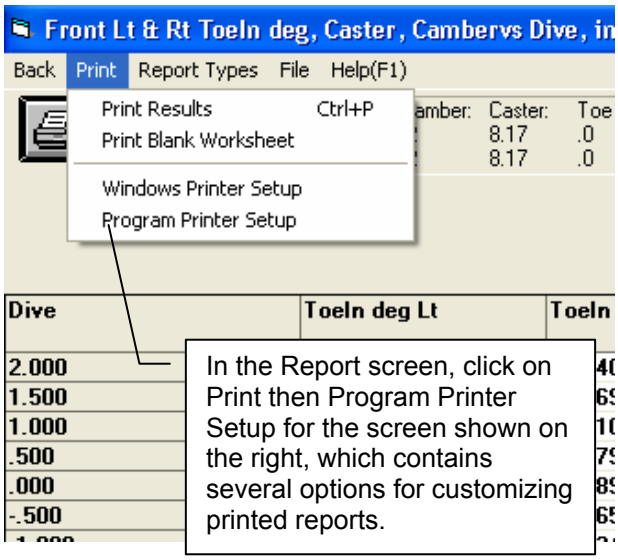
Figure 6.48 New Options for Printing Graphs and Reports



In the Graph screen, click on Format, then "Edit Printed Comments and Data Output" for the options screen shown below.



This screen contains many options for customizing and adding information to your printed graphs. See Fig 6.49.



In the Report screen, click on Print then Program Printer Setup for the screen shown on the right, which contains several options for customizing printed reports.

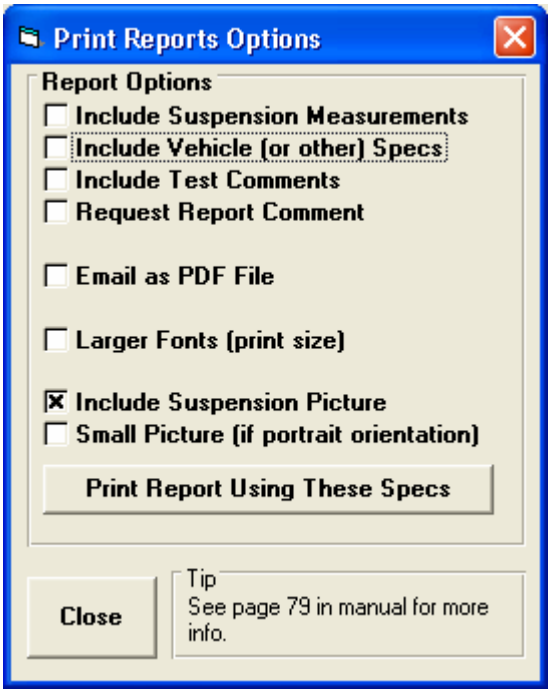


Figure 6.49 New Options on a Graph Printout

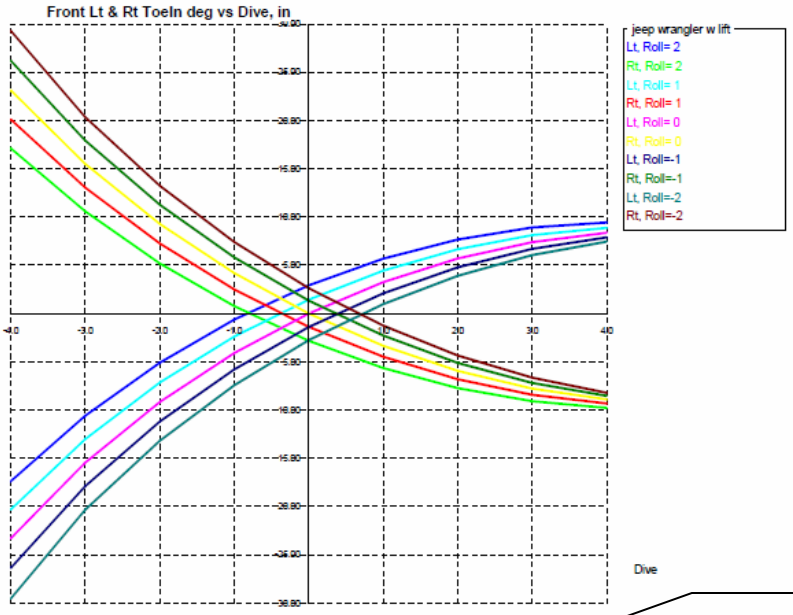
Suspension picture file included on the graph printout.

Your Logo Goes Here

Suspension Analyzer v2.4 B
Susp: Jeep Wrangler w Lift
Calculated Results

Your name / company name can go here. See Preferences.
Performance Trends (C) 2016

This Graph Printed:
3:41 pm 04-30-17
Page: 1



Graph Comment

Jeep wrangler left and right toe in vs dive and roll

Your Logo Goes Here

Suspension Analyzer v2.4 B
Susp: Jeep Wrangler w Lift
Calculated Results

Your name / company name can go here. See Preferences.
Performance Trends (C) 2016

This Graph Printed:
3:54 pm 04-30-17
Page: 2

Test Summary

Suspension Summary and Comments for: jeep wrangler w lift

Std Conds:	Camber:	Caster:	Toe In:	Track:	Graph Conditions:
Right:	-2	8.17	.0	32	Hold Steer = .000
Left:	-2	8.17	.0	32	

Test Comment

Very approximate measurements of 2008 Jeep Wrangler Rubicon with 6" aftermarket lift

Data Table

Dive	-3.000	-2.000	-1.000	.000	1.000	2.000	3.000
Lt, Roll= 2	-10.609	-5.109	-.644	2.925	5.678	7.663	8.911
Rt, Roll= 2	10.591	5.203	.768	-2.827	-5.648	-7.731	-9.102
Lt, Roll= 1	-13.030	-7.159	-2.391	1.443	4.440	6.657	8.129
Rt, Roll= 1	13.056	7.269	2.501	-1.388	-4.477	-6.811	-8.417
Lt, Roll= 0	-15.455	-9.188	-4.105	.000	3.244	5.694	7.392
Rt, Roll= 0	15.499	9.294	4.185	.000	-3.357	-5.940	-7.782
Lt, Roll=-1	-17.891	-11.199	-5.788	-1.404	2.090	4.774	6.697
Rt, Roll=-1	17.927	11.280	5.822	1.338	-2.288	-5.120	-7.196
Lt, Roll=-2	-20.345	-13.194	-7.439	-2.771	.976	3.896	6.045
Rt, Roll=-2	20.345	13.232	7.413	2.626	-1.268	-4.348	-6.657