4 Bar Linkage Calculator v4.0

= Mess with these cells

Rear Suspension Data Entry & Results Summary

One or Two Upper Links?	2
None or One Panhard Bar?	1

Rear Wheel Travel	z
Up Travel (bump)	7.00"
Down Travel (droop)	-9.00"

Rear Upper Links	x	y	z
Frame End	30.00"	20.00"	25.00"
Axle End	0.00"	3.00"	26.00"
True Length (3-d)	34.50"	88.2% of lower	
2-d Length (side view)	30.02"	79.4% of lower	

Rear Upper Link Force if Forward Acceleration is 1.00 g g		
Force at 7.00" in Up Travel	5,974 lb	(Tension)
Force at 3.50" in Up Travel	4,825 lb	(Tension)
Force at Static Ride Height	3,920 lb	(Tension)
Force at -4.50" in Down Travel	2,842 lb	(Tension)
Force at -9.00" in Down Travel	1,682 lb	(Tension)

Rear Lower Links	x	y	z
Frame End	40.00"	15.00"	22.75"
Axle End	3.00"	25.00"	15.00"
True Length (3-d)	39.10"	113.4% of upper	
2-d Length (side view)	37.80"	125.9% of upper	

Rear Lower Link Force if Forward Acceleration is 1.00 g g		
Force at 7.00" in Up Travel	-7,569 lb	(Compression)
Force at 3.50" in Up Travel	-6,732 lb	(Compression)
Force at Static Ride Height	-5,908 lb	(Compression)
Force at -4.50" in Down Travel	-4,773 lb	(Compression)
Force at -9.00" in Down Travel	-3,529 lb	(Compression)

Rear Panhard Bar	x	y	z
Frame End	-8.00"	24.00"	23.00"
Axle End	-8.00"	-24.00"	23.00"
True Length (3-d)	48.00"		
2-d Length (rear view)	48.00"		

Panhard Bar Force if Transverse Acceleration is 1.00 g g		
Force at 7.00" in Up Travel	5,087 lb	(Tension or Comp)
Force at 3.50" in Up Travel	5,021 lb	(Tension or Comp)
Force at Static Ride Height	5,000 lb	(Tension or Comp)
Force at -4.50" in Down Travel	5,034 lb	(Tension or Comp)
Force at -9.00" in Down Travel	5,141 lb	(Tension or Comp)

Panhard Bar – Axle Transverse Displacement with Travel		
Displ. at 7.00" in Up Travel	-0.82"	(Shift to Left)
Displ. at 3.50" in Up Travel	-0.20"	(Shift to Left)
Displ. at Static Ride Height	0.00"	
Displ. at -4.50" in Down Travel	-0.33"	(Shift to Left)
Disp. at -9.00" in Down Travel	-1.32"	(Shift to Left)

Rear Roll Center Height	z
At 7.00" in Up Travel	27.21"
At 3.50" in Up Travel	25.50"
Static Ride Height	23.23"
At -4.50" in Down Travel	21.80"
At -9.00" in Down Travel	19.53"

Side View Instant Center	x	z
At 7.00" in Up Travel	37.91"	22.71"
At 3.50" in Up Travel	42.43"	23.02"
Static Ride Height	45.97"	24.47"
At -4.50" in Down Travel	56.52"	28.41"
At -9.00" in Down Travel	67.42"	36.30"

Rear Roll Axis Inclination		
At 7.00" in Up Travel	-1.98°	(Roll Understeer)
At 3.50" in Up Travel	2.16°	(Roll Oversteer)
Static Ride Height	1.66°	(Roll Oversteer)
At -4.50" in Down Travel	11.66°	(Roll Oversteer)
At -9.00" in Down Travel	17.33°	(Roll Oversteer)

Rear Anti-Squat (Accel)	
At 7.00" in Up Travel	112.7%
At 3.50" in Up Travel	102.1%
Static Ride Height	100.1%
At -4.50" in Down Travel	94.6%
At -9.00" in Down Travel	101.3%

Rear Anti-Lift (Braking)	
At 7.00" in Up Travel	79.6%
At 3.50" in Up Travel	72.1%
Static Ride Height	70.7%
At -4.50" in Down Travel	66.8%
At -9.00" in Down Travel	71.5%

Rear Pinion Angle Change	
At 7.00" in Up Travel	10.05°
At 3.50" in Up Travel	4.74°
At -4.50" in Down Travel	-5.33°
At -9.00" in Down Travel	-9.89°

30	25	36.19
40	22.75	40.90
	34.50	36.19
	39.10	40.90

Vehicle Spec's Data Entry

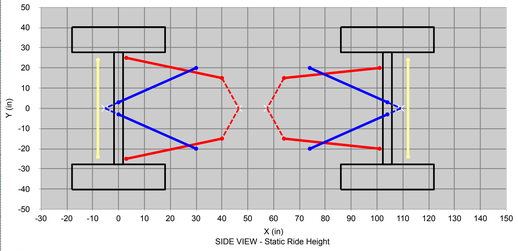
Wheelbase	104.00"
Front Drive Bias	0.50
Front Brake Bias	0.65
Rear Track Width	68.00"
Front Track Width	68.00"
Tire Width	12.50"
Tire Diameter	36.00"
Tire Rolling Radius	17.00"
Axle Tube Diameter	3.50"
Vehicle Mass	5,000 lb
Rear Unsprung Mass	800 lb
Front Unsprung Mass	700 lb
Vehicle CG Height	25.94"
Acceleration	1.00 g
Transverse Acceleration	1.00 g

Vehicle Results Summary

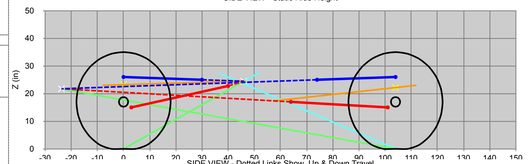
Sprung Mass Center of Gravity	
Height (static ride height)	29.77"
Above Rear Roll Center	6.54"
Above Front Roll Center	7.60"
Anti-Squat CG Height	27.64"
Anti-Dive CG Height	27.40"

Body Roll Axis Angle	-0.58°	(Roll Oversteer - loose)

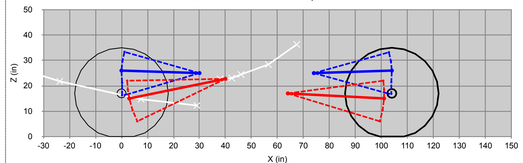
TOP VIEW



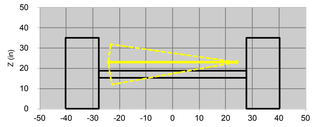
SIDE VIEW - Static Ride Height



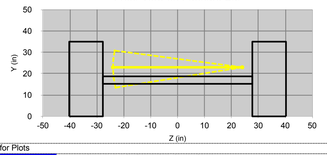
SIDE VIEW - Dotted Links Show Up & Down Travel



Rear View on Panhard Bar



Front View on Panhard Bar



Color Legend for Plots	
Solid Dark Blue Lines	Upper Links at static ride height in all views
Solid Red Lines	Lower Links at static ride height in all views
Solid Yellow Lines	Panhard Bar at static ride height in all views (if used)
Dashed Dark Blue Lines	Projection of Upper Links to Instant Center in Top/Side View – Static Ride Height Upper Links at travel limits in side view showing up and down travel
Dashed Red Lines	Projection of Lower Links to Instant Center in Top/Side View – Static Ride Height Lower Links at travel limits in side view showing up and down travel
Dashed Yellow Lines	Panhard Bar at travel limits in rear and front views (if used)
Thin Solid Black Lines	Rear or front tire and axle at static ride height in all views
Thin Solid Light Blue Lines	100% Anti-Squat (left), and 100% Anti-Dive (right) at static ride height
Thin Solid Green Lines	Resultant Force from tire patch to chassis at instant center, Accelerating (left) Braking (right). Compare slope of green to light blue for amount of anti-squat/dive
Thin Solid Orange Lines	Suspension Roll Axis – passes through roll center at vertical plane through axle
Yellow X	Roll Centre at static ride height in side view
White X	Top or Side View Instant Centre of suspension links at static ride height Side View Instant Centre of suspension links as wheels travel up (bump) and down (droop). Depending on link geometry, IC's may not fall in the area of view

Front Suspension Data Entry & Results Summary

One or Two Upper Links?	2
None or One Panhard Bar?	1

Front Wheel Travel	z
Up Travel (bump)	7.00"
Down Travel (droop)	-9.00"

Front Upper Links	x	x'	y	z
Frame End	74.00"	-30.00"	20.00"	25.00"
Axle End	104.00"	0.00"	3.00"	26.00"
True Length (3-d)	34.50"	92.3% of lower		
2-d Length (side view)	30.02"	81.0% of lower		

Front Upper Link Force if Braking Acceleration is -1.00 g g		
At 7.00" in Up Travel	6,041 lb	(Tension)
At 3.50" in Up Travel	4,872 lb	(Tension)
Static Ride Height	3,920 lb	(Tension)
At -4.50" in Down Travel	2,780 lb	(Tension)
At -9.00" in Down Travel	1,605 lb	(Tension)

Front Lower Links	x	x'	y	z
Frame End	64.00"	-40.00"	15.00"	17.00"
Axle End	101.00"	-3.00"	20.00"	15.00"
True Length (3-d)	37.39"	108.4% of upper		
2-d Length (side view)	37.05"	123.4% of upper		

Front Lower Link Force if Braking Acceleration is -1.00 g g		
At 7.00" in Up Travel	-7,863 lb	(Compression)
At 3.50" in Up Travel	-6,810 lb	(Compression)
Static Ride Height	-5,885 lb	(Compression)
At -4.50" in Down Travel	-4,756 lb	(Compression)
At -9.00" in Down Travel	-3,623 lb	(Compression)

Front Panhard Bar	x	x'	y	z
Frame End	112.00"	8.00"	24.00"	23.00"
Axle End	112.00"	8.00"	-24.00"	23.00"
True Length (3-d)	48.00"			
2-d Length (front view)	48.00"			

Panhard Bar Force if Transverse Acceleration is 1.00 g g		
Force at 7.00" in Up Travel	5,068 lb	(Tension or Comp)
Force at 3.50" in Up Travel	5,016 lb	(Tension or Comp)
Force at Static Ride Height	5,000 lb	(Tension or Comp)
Force at -4.50" in Down Travel	5,026 lb	(Tension or Comp)
Force at -9.00" in Down Travel	5,103 lb	(Tension or Comp)

Panhard Bar – Axle Transverse Displacement with Travel		
Displ. at 7.00" in Up Travel	-0.65"	(Shift to Left)
Displ. at 3.50" in Up Travel	-0.16"	(Shift to Left)
Displ. at Static Ride Height	0.00"	
Displ. at -4.50" in Down Travel	-0.24"	(Shift to Left)
Disp. at -9.00" in Down Travel	-0.97"	(Shift to Left)

Front Roll Center Height	z
At 7.00" in Up Travel	25.76"
At 3.50" in Up Travel	24.32"
Static Ride Height	22.17"
At -4.50" in Down Travel	21.37"
At -9.00" in Down Travel	19.67"

Side View Instant Center	x	z
At 7.00" in Up Travel	29.03"	12.24"
At 3.50" in Up Travel	7.55"	14.71"
At Static Ride Height	-23.73"	21.74"
At -4.50" in Down Travel	-95.75"	45.47"
At -9.00" in Down Travel	-312.42"	134.02"

Front Roll Axis Inclination		
At 7.00" inches Up Travel	8.99°	(Roll Oversteer)
At 3.50" in Up Travel	4.47°	(Roll Oversteer)
At Static Ride Height	5.91°	(Roll Oversteer)
At -4.50" in Down Travel	-5.78°	(Roll Understeer)
At -9.00" inches Down Travel	-11.72°	(Roll Understeer)

Front Anti-Dive (Braking)	
At 7.00" in Up Travel	40.3%
At 3.50" in Up Travel	37.6%
At Static Ride Height	42.0%
At -4.50" in Down Travel	56.2%
At -9.00" in Down Travel	79.4%

Front Anti-Lift (Accel)	
At 7.00" in Up Travel	30.7%
At 3.50" in Up Travel	28.7%
At Static Ride Height	32.0%
At -4.50" in Down Travel	42.8%
At -9.00" in Down Travel	60.5%

Front Pinion Angle Change	
At 7.00" inches Up Travel	4.33°
At 3.50" in Up Travel	1.87°
At -4.50" in Down Travel	-1.68°
At -9.00" inches Down Travel	-2.65°