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FRC_BMW_E46_M3

FCM Elite Ride Harmonizer Spreadsheet, v2.0

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[BMW E46 M3 \(2000-2006\) FRC & Setup Comparison](#)

Press 'Reset' at bottom left to recover original settings

http://www.fatcatmotorsports.com/contact_elite.htm

FCM Elite Stage 3 testimonials (Ripple Red KBO)

SCCA Nationals trophy winner, Clint - Mazda

NASA track racer Percy - BMW E36 M3

A NOTE to YOU, the USER:

Enter values for your setup in **Blue cells** and observe the results. ANY blue value can be changed/over-written! RESET button at bottom left.

[For more instructions, watch: 'How to Use FCM Elite Ride Harmonizer FRC and Setup Comparison spreadsheet'](#)

EricSMG's M3forum thread 'Shock dynos, Fat Cat Motorsports and custom valved Bilsteins', has FCM Elite Stage 2 setup (with Ripple Reducer)

[Listen to Shaikh engage in an FCM Elite Project Consultation using a Ride Harmonizer spreadsheet](#)

FCM Elite Stage 3 testimonial from Anthony Zwain, NASA National Champion, owner of Edge Motorworks Mtn View, BMW specialist, previous user of JRZ, Koni, Moton, AST, etc.

"Hey Shaikh, I just got back from 2018 NASA championships at COTA, we had a successful time despite fighting through a few issues beyond our control. We swept the Podium in TT4 getting 1st-3rd and in ST-4 the race group placed 2nd-4th. All those cars were running your shocks set-up"

Standard rear spring location | Tubular or Solid Sway Bar inputs: For a Solid Bar, thickness = 0.5 * Outside Diameter; For a Tubular bar, thickness = wall thickness

Front Sway Bar Outside Diameter	Front Bar thickness (for solid = 1/2* OD)	Rear Sway Bar Outside Diameter	Rear Bar thickness (for solid = 1/2* OD)	Front spring lb/in	Rear Spring lb/in	Bump stop rate Front lb/in	Bump stop rate Rear lb/in	Bounce Frequency (Hz)		Ratio, Bounce Freq R/F	Flat Ride or Pitch?	Front Roll Couple (FRC) %	Total Roll Stiffness lb-ft/deg	Front Roll Stiffness	Rear Roll Stiffness	Bar ratio (bar stiff / total roll stiff) %	Spring ratio (spr stiff / total roll stiff) %		
									Front										Rear
	mm	mm	mm					mm											
30.2	4.18	21.5	10.75	616	784			2.62	2.26	0.86	PITCH	70.0%	4359	3032	1327	45.0%	55.0%	Cockroach M	
30.2	4.18	21.5	10.75	616	650	0	0	2.62	2.06	0.79	PITCH	72.8%	4187	3032	1155	46.9%	53.1%	Cockroach M	
30.2	4.18	21.5	10.75	550	650			2.48	2.06	0.83	PITCH	71.8%	4038	2883	1155	48.6%	51.4%	Cockroach M	
0.0	0.00	0.0	0.00	0	0			0.00	0.00	NaN	FLAT RID	NaN	0	0	0	NaN	NaN	E46 M3 CSL	
OE sways (mm)	Front bar length		Front arm length		Rear bar length		Rear arm length												
	830		302		580		230												

mm	mm	mm	mm	lb/in	lb/in	lb/in	lb/in	Front	Rear	R/F	%	lb-ft/deg			%	%	E46 M3 cou H&R Race sp H&R Race fr 425/850 spr
30.2	15.10	25.6	12.80	155	380			1.32	1.58	1.20 FLAT RID	75.0%	4459	3326	1133	81.2%	18.8%	
30.2	15.10	25.6	12.80	300	500			1.83	1.81	0.99 PITCH	74.3%	4940	3653	1287	73.3%	26.7%	
30.2	15.10	25.6	12.80	300	650			1.83	2.06	1.13 FLAT RID	71.6%	5133	3653	1480	70.6%	29.4%	
30.2	15.10	25.6	12.80	425	850			2.18	2.36	1.08 FLAT RID	69.8%	5672	3935	1736	63.9%	36.1%	
Turner sways (mm)	Front bar length		Front arm length		Rear bar length		Rear arm length										
	850		260		580		230										

mm	mm	mm	mm	lb/in	lb/in	lb/in	lb/in	Front	Rear	R/F	%	lb-ft/deg			%	%	350/800 with 400/700 w/ 10speed, SC FCM Elite Sta	
32.4	4.78	21.5	10.75	350	800			1.98	2.29	1.16	FLAT RID	78.0%	6023	4675	1348	69.8%		30.2%
32.4	4.78	21.5	10.75	400	700			2.11	2.14	1.01	FLAT RID	80.0%	6007	4788	1219	70.0%		30.0%
32.4	4.78	0.0	0.00	450	1000			2.24	2.56	1.14	FLAT RID	79.6%	6184	4901	1283	62.8%		37.2%
32.4	4.78	21.5	10.75	425	850			2.18	2.36	1.08	FLAT RID	77.8%	6256	4845	1412	67.2%		32.8%
GC front sway (mm)	Front bar length		Front arm length		Rear bar length		Rear arm length											
	830		230		580		230											

Rear coil-over spring | Tubular or Solid Sway Bar inputs: For a Solid Bar, thickness = 0.5 * Outside Diameter; For a Tubular bar, thickness = wall thickness

Front Sway Bar Outside Diameter	Front Bar thickness (for solid = 1/2* OD)	Rear Sway Bar Outside Diameter	Rear Bar thickness (for solid = 1/2* OD)	Front spring	Rear Spring	Bump stop rate Front	Bump stop rate Rear	Bounce Frequency (Hz)		Ratio, Bounce Freq	Flat Ride or Pitch?	Front Roll Couple (FRC)	Total Roll Stiffness	Front Roll Stiffness	Rear Roll Stiffness	Bar ratio (bar stiff / total roll stiff)	Spring ratio (spr stiff / total roll stiff)	
mm	mm	mm	mm	lb/in	lb/in	lb/in	lb/in	Front	Rear	R/F		%		lb-ft/deg		%	%	
32.4	4.78	21.5	10.75	350	325			1.98	2.19	1.11	FLAT RID	79.1%	5935	4675	1260	70.9%	29.1%	
32.4	4.78	21.5	10.75	400	350			2.11	2.27	1.07	FLAT RID	78.6%	6120	4788	1332	68.7%	31.3%	
32.4	4.78	22.0	11.00	700	400			2.80	2.42	0.87	PITCH	78.7%	6972	5465	1507	60.8%	39.2%	Wow what r
Sway bar dims (mm)	Front bar length		Front arm length		Rear bar length		Rear arm length											
	830		230		580		230											

ADJUSTABLE SWAY BAR ARM (or ELBOW) LENGTH, Effect on Front Roll Couple % (FRC %). Keep spring rate & sway bar thickness constant, vary front and/or rear arm length to see F changes.

Front Sway Bar Outside Diameter	Front Bar thickness (for solid = 1/2* OD)	Rear Sway Bar Outside Diameter	Rear Bar thickness (for solid = 1/2* OD)	Front spring	Rear Spring	Input sway bar length (mm)		Input sway bar elbow length (mm)		Bump stop rate Front	Bump stop rate Rear	Bounce frequency (Hz)		Ratio, Bounce Freq (Hz)	Flat Ride or Pitch?	Front Roll Couple (FRC)	Total Roll Stiffness	Front roll stiffness	Rear roll stiffness
mm	mm	mm	mm	lb/in	lb/in	Front	Rear	Front	Rear	lb/in	lb/in	Front	Rear	R/F		%	lb-ft/deg		
23.5	11.75	21.5	10.75	155	380	850	580	290	225			1.32	1.58	1.20	FLAT RIDE	60.3%	2050	1227	
30.2	4.18	21.5	10.75	155	380	850	580	260	225			1.32	1.58	1.20	FLAT RIDE	75.7%	3335	2512	
30.2	15.10	25.6	12.80	155	380	850	580	302	242			1.32	1.58	1.20	FLAT RIDE	70.9%	3626	2555	
30.2	15.10	21.5	10.80	300	650	850	580	260	230			1.83	2.06	1.13	FLAT RIDE	76.3%	4808	3653	
32.4	4.78	21.5	10.75	300	650	830	570	230	230			1.83	2.06	1.13	FLAT RIDE	80.0%	5723	4562	
32.4	4.78	21.5	10.75	400	800	830	570	230	230			2.11	2.29	1.08	FLAT RIDE	78.3%	6141	4788	
32.4	4.78	0.0	0.00	450	850	830	570	230	230			2.24	2.36	1.05	FLAT RIDE	82.1%	5991	4901	

Racer's Edge , utilize corner weights and tune spring rates to obtain matching left and right bounce frequencies! All rows use sway bar data from below

Front Sway Bar Outside Diameter	Front Bar thickness (for solid = 1/2* OD)	Rear Sway Bar Outside Diameter	Rear Bar thickness (for solid = 1/2* OD)	Corner weights (w/driver), LF/RF top, LR/RR bot		Total weight	Front weight	Rear weight	Cross weight, (LR+RF) / total	Spring rates, LF/RF top, LR/RR bot		Bounce Freqs, LF/RF top, LR/RR bot		Bounce Freq Ratio		L-FRC	R-FRC	Max bump force 30 ips
mm	mm	mm	mm	lb		lb	%	%	%	lb / in		Hz		Left side	Right side	%	%	lb-f
26.0	13.00	21.5	10.75	885	830	3320	51.7%	48.3%	50.0%	300	300	1.80	1.87	1.14	1.14	62.9%	62.9%	339
Setup 1: standard rear spring				830	775					650	650	2.05	2.14					422
30.2	15.10	21.5	10.75	885	830	3320	51.7%	48.3%	50.0%	400	368	2.08	2.07	1.02	1.03	72.6%	73.2%	339
Setup 2: standard rear spring				830	775					700	650	2.13	2.14					422
26.0	13.00	21.5	10.75	885	830	3320	51.7%	48.3%	50.0%	400	375	2.08	2.09	1.09	1.08	74.0%	74.3%	339
Setup 3: coil-over rear spring				830	775					350	325	2.26	2.27					422

30.2	15.10	21.5	10.75	885	830	3320	51.7%	48.3%	50.0%	450	425	2.21	2.23	1.09	1.09	80.0%	80.4%	339
Setup 4: coil-over rear spring				830	775					400	375	2.42	2.43					422

Total loaded vehicle weight (lb)

Curb weight (lb)	3238
Driver & passenger weight (lb)	140
Total loaded weight (lb)	3378

Nominal curb weights (lb)

M3 Coupe	3415
M3 Convertible	3838
M3 CSL	3075

Front Sway Bar (mm) - see table below

Bar length	Arm length
830	302

Rear Sway Bar (mm) - see table below

Bar length	Arm length
580	230

Weight dist (%)	Sprung weight (lb)	Unsprung weight (lb)	Tire weight (lb)	Wheel weight (lb)	Est. or meas'd weight of susp. components (lb)	NOTE: Unsprung weight is tire weight + 50% of total suspension weight. If direct measurements are not available, taking 10% of the corner weight is a reasonable assumption.
Front 51.1	Front 772	Front 91	Front 27	Front 19	Front 45	
Rear 48.9	Rear 735	Rear 91	Rear 27	Rear 19	Rear 45	

Vehicle track (in)	
Front 59.4	
Rear 60	
Wheelbase 107.5	

Spring motion ratios	
Front 0.938	
Rear, OE 0.63	
Rear, c/o 1.15	

Shock motion ratios	
Front 0.938	
Rear 1.15	

Sway bar motion ratios	
Front 0.938	
Rear 0.44	

E46 front bars	OD	Thk	Bar length	Arm length
M3 coupe front	26	13.00	835	290
CSL front	30.8	4.18	835	290
M3 convertible fr	27	13.50	835	290
Turner fr, stiff	30.2	15.10	850	260
Turner fr, med	30.2	15.10	850	281
Turner fr, soft	30.2	15.10	850	302
GC Race fr, soft	32.4	4.78	830	250
GC Race fr, med	32.4	4.78	830	230
GC Race fr, stiff	32.4	4.78	830	214
ECS / Eibach, stiff	27	13.50	830	260
ECS / Eibach, soft	27	13.50	830	280
Hotchkiss fr, stiff	30.2	4.18	830	260
Hotchkiss fr, med	30.2	4.18	830	280
Hotchkiss fr, soft	30.2	4.18	830	302
H&R fr, stiff	30.2	15.10	830	260
H&R fr, soft	30.2	15.10	830	305
330i Sport fr	24	12.00	830	290
330Ci front	23.5	11.75	830	290

Flat Ride calculator based on target road speed:

Target road speed (mph)	80
Target rear ride frequency (Hz)	1.90
FCM recd front ride freq (Hz)	1.70
Flat Ride freq ratio (rear / front)	1.12

Ideal corner weight calculator - enter current weights in BLUE for expected weights @ 50% cross:

Current corner weights (lb)					
LF	876	862	RF		
LR	833	806	RR		
Total wt	3377	Front wt%	51.5%		
Cross wt%	50.2%	Left wt%	50.6%		
Cross wt	1695	Delta (lb)	6.5		
Expected weights @ 50% cross (RF+LR / Total wt)					
LF	879	859	RF		
LR	830	809	RR		
Total wt	3377	Front wt%	51.5%		
Cross wt%	50.0%	Left wt%	50.6%		

Comments and NAM3 Suspension links

[Everything about Fat Cat Motorsports Suspension by duracellttu](#)

[7/2/24 - Thanks to @cobra for providing precise rear damper and spring motion ratio values](#)

Unit Converter

Deg F	Deg C	lb	kg	in	mm
180.0	82.2	3.0	1.4	1.0	25.4
Deg C	Deg F	kg	lb	mm	in

Front spring perch height change for new spring rate (lb/in) and length (in) to keep current ride height

Current front spring rate (lb/in)	0
Current front spring length (in)	6

E46 rear bars	OD	Thk	Bar length	Arm length
M3 coupe/vert rr	21.5	10.75	580	230
CSL rear	22.5	11.25	580	230
Turner rr, stiff	25.6	12.80	580	230

5.0	41.0	3.0	6.6	519.0	20.4
kg-(force)	N	lb	kPa	psi	bar
1.0	9.8	2.2	153.0	7.5	0.5
N	kg-(force)	lb	psi	kPa	bar
10.0	1.0	2.2	1.0	108.2	0.1
lb	kg-(force)	N	bar	psi	kPa
1.0	0.5	4.5	1.0	14.5	201.2
kg/mm	N/mm	lb/in	toe (in)	wheel dia	toe (deg)
8.0	78.4	447.0	0.059	17	0.199
N/mm	kg-f/mm	lb/in	toe (deg)	wheel dia	toe (in)
100	10.2	570.2	0.200	17	0.059
lb/in	kg-f/mm	N/mm			
174	3.1	30.5			

Current spring deflection (in)	NaN
Current spring loaded height (in)	NaN
New front spring rate (lb/in)	0
New front spring length (in)	0
New spring deflection (in)	NaN
New spring loaded height (in)	NaN
Change in spring perch position to keep current height (in)	NaN

Turner rr, soft	25.6	12.80	580	260
GC Race rear	32.4	2.10	570	230
<u>NOTE1: 7/2/24 - Updated rear shock & spring MR from @cobra (thanks!)</u> <u>NOTE2: only FRONT non-M sway bars fit the M3</u> GC Race front, 1.275" OD, L thk = 0.188", M thk = 0.155" GC Race rear, 1.275" OD, S thk = 0.083", SS thk = 0.062"				