Dave Pushka's Block Raiser (Pivoter) Calculations for variable geometry

Detector Block Weights and Dimensions and Loads to Table:

Weight of a block	312,979	pounds	156.5	tons (short)	
Nominal Thickness of a block	2053.6	millimeters	80.85	inches	
Nominal Thickness of a block					
Nominal H or W of a Block	15.7	m	618.110236	in	51.5091863 ft
Volume of Block	17,876	ft3			
Apparent Density of Empty Block	17.5	#/ft3			
Block loading on table when horizontal	117.96	#/square foot			

Geometry of Table Pivot:

Goal Distance from table top to pivot (vertical direction when table horizontal)	4	inches	positive means that the pivot is below the top surface of the table when the table is horizontal
Vertical Distance from pivot to block c.g when table is horizontal	44.425	inches	equals half the thickness of a block plus the goal distance from the table top to the pivot shown right above
Horizontal Distance from Pivot to block c.g. when table is horizontal (positive number is toward the forks)	0.000	inches	zero undicates that the pivot is right under the block c.g., positive means that the pivot is towards the forks
L_block = Distance from block c.g. to pivot, inches	44.425	inches	calculated by the square of the sum of the squares.
L_table = Distance from table c.g. to pivot, inches	32.25	inches	calculated by the square of the sum of the squares.

Moments Generated by the Block Weight on the Table When Vertical:

Moment from block weight about pivot when table is vertical	13,904,173	inch-pounds	1,159	kip-ft	
Theta0_Block is the initial angle above horizontal from the pivot to the block c.g.	1.571	radians	90.0	degrees	
Theta0_Table is the initial angle above horizontal from the pivot to the table c.g.	-1.571	radians	-90.0	degrees	
Moment from block weight on the table 'forks' when the block is vertical	12,652,255	inch-pounds	1,054	kip-ft	this is the maximum bending moment at the base of the 'forks' supporting the cantilevered block.

Moments as a Function of the table rotation (0=table horizontal):	Table Angle (top surface above horizontal) degrees	radians	Angle from table pivot to block c.g. (from horizontal) degrees	radians	Angle from table pivot to table c.g. (from horizontal) degrees	radians	Cosine of Angle to block c.g.	Cosine Angle to table c.g.	Block Weight pounds	Table Weight pounds	Block Distance to Pivot	Table Distance to Pivot	Moment Due to Block (cw = +) in-lbs	Moment Due to Table (cw = +) in-lbs	Sum of Moments from Block and Table (cw = +) in-lbs
Table Angle above horizontal (degrees and radians):	0	0	90	1.57	-90	-1.571	0.0000	0.0000	312,979	218,226	44.425	32.25	31	22	53
	15	0.2618	105	1.83	-75	-1.309	-0.2588	0.2588	312,979	218,226	44.425	32.25	-3,598,634	1,821,536	-1,777,098
	30	0.5236	120	2.09	-60	-1.047	-0.5000	0.5000	312,979	218,226	44.425	32.25	-6,952,059	3,518,916	-3,433,143
	45	0.7854	135	2.36	-45	-0.785	-0.7071	0.7071	312,979	218,226	44.425	32.25	-9,831,713	4,976,488	-4,855,225
	60	1.0472	150	2.62	-30	-0.524	-0.8660	0.8660	312,979	218,226	44.425	32.25	-12,041,351	6,094,920	-5,946,432
	75	1.3090	165	2.88	-15	-0.262	-0.9659	0.9659	312,979	218,226	44.425	32.25	-13,430,392	6,797,993	-6,632,399
	90	1.5708	180	3.14	0	0.000	-1.0000	1.0000	312,979	218,226	44.425	32.25	-13,904,173	7,037,794	-6,866,378
	90	1.5708	180	3.14	0	0.000	-1.0000	1.0000	0	218,226	0	32.25	0	7,037,794	7,037,794
	75	1.3090	165	2.88	-15	-0.262	-0.9659	0.9659	0	218,226	0	32.25	0	6,797,993	6,797,993
	60	1.0472	150	2.62	-30	-0.524	-0.8660	0.8660	0	218,226	0	32.25	0	6,094,920	6,094,920
	45	0.7854	135	2.36	-45	-0.785	-0.7071	0.7071	0	218,226	0	32.25	0	4,976,488	4,976,488
	30	0.5236	120	2.09	-60	-1.047	-0.5000	0.5000	0	218,226	0	32.25	0	3,518,916	3,518,916
	15	0.2618	105	1.83	-75	-1.309	-0.2588	0.2588	0	218,226	0	32.25	0	1,821,536	1,821,536
	0	0	90	1.57	-90	-1.571	0.0000	0.0000	0	218,226	0	32.25	0	22	22

Forces on a Cylinder Resulting from the above Moments:

Horizontal Location of Cylinder Top w.r.t Table Pivot	-72.0001	inches	positive is towards the forks
Vertical Location of Cylinder Top w.r.t. Table Pivot	-72	inches	positive is up
Horizontal Location of Cylinder Bottom w.r.t Table Pivot	-72	inches	positive is towards the forks
Vertical Location of Cylinder Bottom w.r.t. Table Pivot	-167.0001	inches	positive is up
Closed Length of the cylinder	95	inches	
Radius from Table Pivot to top of cylinder point	101.82	inches	
Initial Angle above horizontal from Table Pivot to top of cylinder point	-0.785	radians	
Initial Angle above horizontal from Table Pivot to top of cylinder point	-45.00003979	degrees	
Length of the 'ground' link from table pivot to stationary cylinder end pivot at the bottom of the cylinder	181.9	inches	
Fixed Angle above horizontal from Table Pivot to bottom of cylinder end pivot, Theta	-66.67731577	degrees	
Initial Angle between the 'ground' link and the line (r) from the table pivot to the top of the cylinder, Lambda	21.67727598	degrees	

Table Angle above horizontal (degrees and radians):	Table Angle (top surface above horizontal) degrees	Sum of Moments from Block and Table (cw = +) in-lbs	Vertical Component of Cylinder Extension inches	Horizontal Component of Cylinder Extension inches	Cylinder Extension	Cylinder Angle c.w. from vertical degrees	Vertical Lever Arm to Cylinder Top inches	Horizontal Lever Arm to Cylinder Top inches	Hydraulic Cylinder Force (- = tension, + = Compression) pounds	Hydraulic Cylinder Force (- = tension, + = Compression) tons
On the way Up:	0	53	0.00	0.00	0	0.000	72.00	72.00	1	0.0
(with block Load)	15	-1,777,098	21.09	16.18	27	7.648	50.91	88.18	-18,871	-9.4
	30	-3,433,143	45.65	26.35	53	10.278	26.35	98.35	-33,831	-16.9
	45	-4,855,225	72.00	29.82	78	9.931	0.00	101.82	-48,408	-24.2
	60	-5,946,432	98.35	26.35	102	7.695	-26.35	98.35	-63,301	-31.7
	75	-6,632,399	122.91	16.18	124	4.238	-50.91	88.18	-78,790	-39.4
	90	-6,866,378	144.00	0.00	144	0.000	-72.00	72.00	-95,366	-47.7
On the way down:	90	7,037,794	144.00	0.00	144	0.000	-72.00	72.00	97,747	48.9
(without block load)	75	6,797,993	122.91	16.18	124	4.238	-50.91	88.18	80,757	40.4
	60	6,094,920	98.35	26.35	102	7.695	-26.35	98.35	64,881	32.4
	45	4,976,488	72.00	29.82	78	9.931	0.00	101.82	49,617	24.8
	30	3,518,916	45.65	26.35	53	10.278	26.35	98.35	34,677	17.3
	15	1,821,536	21.09	16.18	27	7.648	50.91	88.18	19,342	9.7
	0	22	0.00	0.00	0	0.000	72.00	72.00	0	0.0

Dave Pushka's Block Raiser (Pivoter) calculations for the top table made from plate steel:

Initial Guesses:		
Assumed weight of table	300,000	pounds
Required Distance from pivot to table c.g. if the table is to balance the block when the block is vertical	46.3	inches
Required thickness of table assuming homgenous	100.7	inches
Table Dimensions and Thicknesses:		
Thickness of Table Top Plates	0.25	inches
Thickness of table bottom plates	0.25	inches
Thickness of table vertical shear webs	0.25	inches
No. of shear webs in the beam direction	26	
No. of shear webs perpendicular to the beam direction	26	
Distance between shear webs in beam direction	1.981	feet
Distance between shear webs perpendicular to the beam direction	1.981	feet
Thickness of table shear plates in the vertical direction when horizontal	6	feet
Weight of Table Top in pounds per square foot	10.208	pounds per square foot
Weight of Table Bottom in pounds per square foot	10.208	pounds per square foot
Weight of shear webs in pounds per square foot	10.208	pounds per square foot
Table Weight:		
Weight of Table Top in pounds	27,085	pounds
Weight of Table Bottom in pounds	27,085	pounds
Weight of Table shear webs in pounds	164,057	pounds
Weight Sub Total	218,226	pounds
Assumed Number of Table Pieces for Shipping	6	
Table Piece Width, feet	8.585	feet
Table Piece Weight, pounds	36,371	pounds
Table C.G.		
Distance from Table Top Surface to Top Plate c.g.	0.125	inches
Distance from Table Top Surface to Bottom Plate c.g.	72.375	inches
Distance from Table Top Surface to Shear Plate c.g.	36.25	inches
Table Top Contribution to c.g.	3,386	inch pounds
Table Bottom Contribution to c.g	1,960,256	inch pounds
Table Shear Contributions to c.g.	5,947,057	inch pounds
Sub Total of Contributions to c.g	7,910,699	inch pounds
Sum of Contributions divided by weight	36.250	inches

Moments Generated by Table Weight about Pivot When Vertical:

Goal Distance from table top to pivot (vertical direction when table horizontal)	4	inches
Distance from Table Pivot to c.g.	32.250	inches
Moment Generated by Table Weight about Pivot when table is vertical:	7,037,794	inch-pounds
Moment Generated by Table Weight about Pivot when table is vertical:	586	kip-ft

Sum of Moments about Table Pivot When Vertical:

Moment Generated by Table Weight about Pivot when table is vertical:	7,037,794	inch-pounds
Moment from block weight about pivot when table is vertical	(13,904,173)	inch-pounds
Moment Sum when table is vertical:	(6,866,378)	inch-pounds
Moment Sum when table is vertical:	(572,198)	foot-pounds

This means that the table provides more of a moment about the pivot than the complete block does. This moment tends to make the loaded table move to the horizontal position.

Assumed Distance from Pivot to Cylinder Connection in the horizontal Direction, feet	6	feet
Number of Cylinders acting together	2	
Initial Cylinder Load when loaded table is horizontal		pounds

Moment of Inertia for the Table:
Top and Bottom Plates:

Follow sketch of un-equal rectangles
on AISC 9th Ed. ASD Pg. 6-19

b = b1 = table width in inches = b9*12	618.1	inches
t = top plate thickness = b26	0.25	inches
t1 = bottom plate thickness = b27	0.25	inches
d1 = shear plate depth = b33	72.0	inches
A = b*t + b1 * t1	309.1	in^2
c = ((0.5*b*t^3) + (b1*t1*(d-0.5*t1))/A	36.25	inches
y = c - t/2	36.13	inches
d =	72.50	inches
c1 = d - c	36.38	inches
y1 = c1 -(t1/2)	36.25	inches
I =((b*t^3)/12) + b*t*(y^2) + ((b1*t1^3)/12) + b1*t1*(y1^2)	404,721	inches^4

Web Plates:

bw = Web thickness, inches	0.25	inches
dw = Web depth, inches	72	inches
Iw - moment of inertia for one web	7776	inches^4
Number of webs:	26	
Iw total, I for all the webs combined	202,176	inches^4
Aweb = the area of one web, inches^2	18	inches^2
Aweb total = the area of all webs combined, inches^2	468	inches^2

Combining the Top and Bottom
Plates and the Webs:

dna = distance from the n.a of the top & bttm to the n.a of the web	0	inches
Moment of inertia of the web about the n.a. of the top and bottom plates = Iw total +dna^2*Aweb total	202,176	inches^4
Icomb = I (top&bttm) + I web (w.r.t. top & bttm n.a)	606,897	inches^4
y = dimension from n.a to extream fiber = c, inches	36.25	inches

Bending Stresses on the Table when horizontal:

Let the beam direction be called 'x'
Let the direction perpendicular to the beam be called 'y'

In the x direction, the uniform load is from both the block and the table weight.

Block weight	312,979	pounds	
Table Weight	218,226	pounds	
Sum of Block and Table weights:	531,206	pounds	
Area of Table (based on L x W from above)	2653.2	ft2	
Uniform Load on Table	200.21	pounds per square foot	
Uniform Load on Table per unit Length	10,313	pounds per foot	
Bending Moment on Table	3,420,246	foot-pounds	Moment, M = uniform load, w, * ((the table length/2)^2)/2
Bending Moment on Table	41,042,953	inch-pounds	
Bending Moment on Table	41,043	kip-in	

Bending Moments about 'y':
One simple support at the center of the table, cantilevered up stream and downstream directions.
M=(w*L^2) / 8 where
Bending stress, Sigma = My/I

Bending Moment on Table	41,042,953	inch-pounds
Distance to extreme fiber, y (inches)	36.25	inches
Moment of Inertia, combined table section, Icomb	606,897	inches^4
Bending Stress, sigma, (psi)	2,451	psi

Deflection of Tablewhen Horizontal:

In the beam direction, x where the table is cantilevered, the deflection of the far end is: delta1 = w*l^4/(8EI)

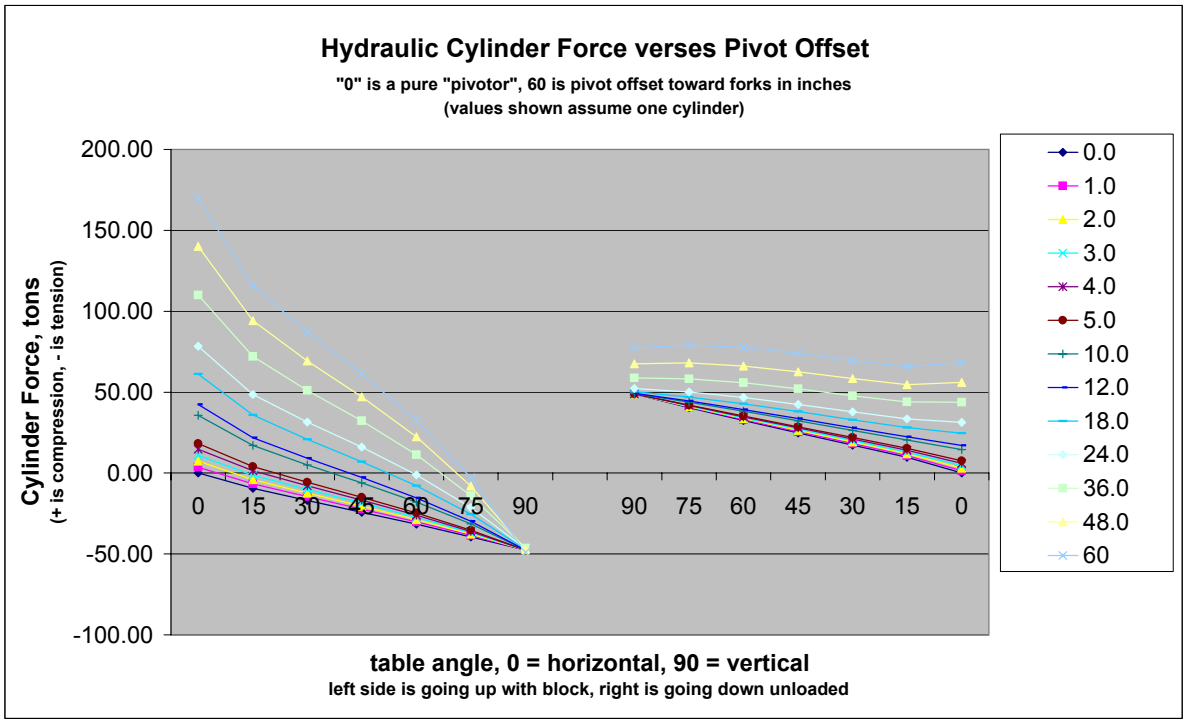
w = uniform distributed load	10,313	pounds per foot	859.40	pounds per inch
l = length = the length of the cantilever = half the table length	309.1	inches		
Young's Modulus, E (psi)	29,000,000	psi		
Moment of Inertia, combined table section, Icomb	531,206	inches^4		
delta1 =	0.0636	inches		
Fraction of the deflection due to the block loads	0.59			
Magnitude of the deflection due to the block loads	0.0375	inches		

If a support were added to the ends of the table to change the beam from cantilevered to the loading shown on AISC 9th Edition Page 2-299, Case 12, In the beam direction, the deflection of the far end is: delta1 = w*l^4/(185EI)

w = uniform distributed load	10,313	pounds per foot	859	pounds per inch
l = length = the length of the cantilever = half the table length	309.1	inches^4		
Young's Modulus, E (psi)	29,000,000	psi		
Moment of Inertia, combined table section, Icomb	531,206	inches^4		
delta1 =	0.00275	inches		
Fraction of the deflection due to the block loads	0.59			
Magnitude of the deflection due to the block loads	0.00162	inches		

Analysis of the Pivot Position and the resulting Hydraulic Cylinder Loads:

Horizontal Distance from Pivot to block c.g. when table is horizontal (positive number is toward the forks)		0.000 inches	0.0 inches	1.0 inches	2.0 inches	3.0 inches	4.0 inches	5.0 inches	10.0 inches	12.0 inches	18.0 inches	24.0 inches	36.0 inches	48.0 inches	60 inches
Table Angle above horizontal (degrees and radians):	Table Angle (top surface above horizontal) degrees	Hydraulic Cylinder Force (- = tension, + = Compression) tons	Hydraulic Cylinder Force (- = tension, + = Compression) tons	Hydraulic Cylinder Force (- = tension, + = Compression) tons	Hydraulic Cylinder Force (- = tension, + = Compression) tons	Hydraulic Cylinder Force (- = tension, + = Compression) tons	Hydraulic Cylinder Force (- = tension, + = Compression) tons	Hydraulic Cylinder Force (- = tension, + = Compression) tons	Hydraulic Cylinder Force (- = tension, + = Compression) tons	Hydraulic Cylinder Force (- = tension, + = Compression) tons	Hydraulic Cylinder Force (- = tension, + = Compression) tons	Hydraulic Cylinder Force (- = tension, + = Compression) tons	Hydraulic Cylinder Force (- = tension, + = Compression) tons	Hydraulic Cylinder Force (- = tension, + = Compression) tons	Hydraulic Cylinder Force (- = tension, + = Compression) tons
On the way Up:	0	0.0	0.00	3.69	7.37	11.03	14.68	18.29	35.76	42.41	61.15	78.34	109.97	140.08	169.88
(with block Load)	15	-9.4	-9.44	-6.71	-3.99	-1.29	1.40	4.07	16.99	21.91	35.81	48.59	72.02	94.11	115.76
	30	-16.9	-16.92	-14.65	-12.39	-10.14	-7.90	-5.68	5.08	9.19	20.82	31.53	51.10	69.34	87.00
	45	-24.2	-24.20	-22.33	-20.46	-18.60	-16.75	-14.92	-6.01	-2.61	7.07	16.01	32.25	47.16	61.35
	60	-31.7	-31.65	-30.24	-28.83	-27.42	-26.02	-24.64	-17.90	-15.30	-7.91	-1.05	11.32	22.37	32.57
	75	-39.4	-39.39	-38.58	-37.76	-36.95	-36.14	-35.34	-31.42	-29.89	-25.47	-21.33	-14.01	-7.96	-2.89
	90	-47.7	-47.68	-47.68	-47.68	-47.68	-47.68	-47.68	-47.61	-47.54	-47.22	-46.81	-46.43	-47.17	-49.01
On the way down:	90	48.9	48.87	48.87	48.87	48.88	48.88	48.89	49.06	49.24	50.31	52.31	58.74	67.43	77.46
(without block load)	75	40.4	40.38	40.71	41.05	41.38	41.72	42.05	43.75	44.48	47.00	50.13	58.22	68.10	79.10
	60	32.4	32.44	33.02	33.60	34.18	34.75	35.32	38.13	39.26	42.79	46.69	55.76	66.21	77.57
	45	24.8	24.81	25.58	26.34	27.11	27.87	28.62	32.28	33.71	37.99	42.40	52.03	62.64	73.96
	30	17.3	17.34	18.27	19.20	20.12	21.04	21.95	26.33	28.02	32.92	37.75	47.72	58.31	69.41
	15	9.7	9.67	10.79	11.91	13.01	14.12	15.21	20.44	22.42	28.06	33.41	43.94	54.68	65.72
	0	0.0	0.00	1.51	3.03	4.53	6.02	7.49	14.53	17.17	24.52	31.23	43.75	55.97	68.23

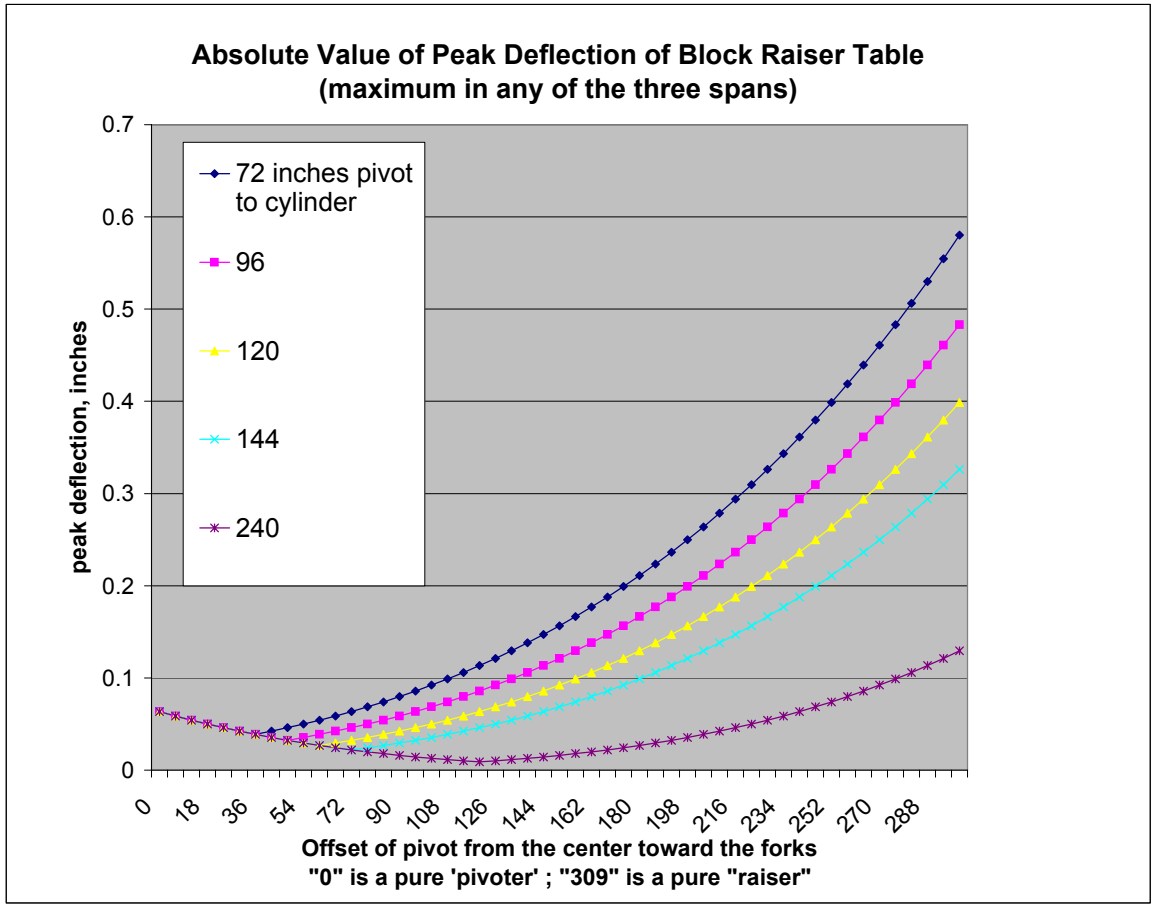

Hydraulic Cylinder Force verses Pivot Offset
"0" is a pure "pivotor", 60 is pivot offset toward forks in inches
(values shown assume one cylinder)
Cylinder Force, tons
(+ is compression, - is tension)
200.00
150.00
100.00
50.00
0.00
-50.00
-100.00
0 15 30 45 60 75 90
90 75 60 45 30 15 0
0.0
1.0
2.0
3.0
4.0
5.0
10.0
12.0
18.0
24.0
36.0
48.0
60
table angle, 0 = horizontal, 90 = vertical
left side is going up with block, right is going down unloaded

Analysis of the Pivot Position and the resulting Table Stresses and Deflections::

Consider the case where the table is horizontal, supported by the pivot and the hydraulic cylinder:

w = uniform distributed load	10,313	pounds per foot	859	pounds per inch
l = length = the length of the cantileve	309	inches		
Young's Modulus, E (psi)	29,000,000	psi		
Use the moment of inertia (Icomb) calculated above:	531,206	inches^4		
Horizontal Location of Cylinder Bottom w.r.t Table Pivot	-72	inches	positive is towards the forks	

Pivot Offset from the center of the table toward the forks: (inches)	Length of cantilever on the fork end (inches)	Length of center span between pivot and cylinder (inches)	Length of cantilever on the end away from the forks (inches)	Moment in the fork end cantilever (M = wl^2/2) (in-pounds)	Moment in the cantilever on the end away from the forks (M = wl^2/2) (in-pounds)	Moment in the center span between pivot and cylinder M=(w(l^2)/8)-(m1+M2)/2 + ((M1-M2)^2)/2wl^2 (kip-in)	wl^2/8	(M1+M2)/2	((M1-M2)^2)/(2*w*l^2)		Deflection at the fork end cantilever (delta = wl^4/8EI) (inches)	Deflection in the center span between pivot and cylinder Delta= (inches)	Deflection of the cantilever on the end away from the forks (M = wl^2/2) (inches)
0	309	72	237	41,042,953	24,147,123	0	556,893	32,595,038	32,038,145	0	0.064	-0.0014	0.022
6	303	72	243	39,464,806	25,384,947	-9,619,272	556,893	32,424,876	22,248,712	-9,619,272	0.059	-0.0013	0.024
12	297	72	249	37,917,597	26,653,710	-17,489,585	556,893	32,285,653	14,239,176	-17,489,585	0.054	-0.0013	0.027
18	291	72	255	36,401,326	27,953,411	-23,610,939	556,893	32,177,368	8,009,536	-23,610,939	0.050	-0.0013	0.030
24	285	72	261	34,915,994	29,284,051	-27,983,335	556,893	32,100,022	3,559,794	-27,983,335	0.046	-0.0013	0.032
30	279	72	267	33,461,600	30,645,629	-30,606,773	556,893	32,053,614	889,948	-30,606,773	0.042	-0.0013	0.035
36	273	72	273	32,038,145	32,038,145	-31,481,252	556,893	32,038,145	0	-31,481,252	0.039	-0.0013	0.039
42	267	72	279	30,645,629	33,461,600	-30,606,773	556,893	32,053,614	889,948	-30,606,773	0.035	-0.0013	0.042
48	261	72	285	29,284,051	34,915,994	-27,983,335	556,893	32,100,022	3,559,794	-27,983,335	0.032	-0.0013	0.046
54	255	72	291	27,953,411	36,401,326	-23,610,939	556,893	32,177,368	8,009,536	-23,610,939	0.030	-0.0013	0.050
60	249	72	297	26,653,710	37,917,597	-17,489,585	556,893	32,285,653	14,239,176	-17,489,585	0.027	-0.0013	0.054
66	243	72	303	25,384,947	39,464,806	-9,619,272	556,893	32,424,876	22,248,712	-9,619,272	0.024	-0.0013	0.059
72	237	72	309	24,147,123	41,042,953	0	556,893	32,595,038	32,038,145	0	0.022	-0.0014	0.064
78	231	72	315	22,940,237	42,652,039	11,368,230	556,893	32,796,138	43,607,475	11,368,230	0.020	-0.0014	0.069
84	225	72	321	21,764,290	44,292,064	24,485,418	556,893	33,028,177	56,956,703	24,485,418	0.018	-0.0014	0.074
90	219	72	327	20,619,282	45,963,027	39,351,565	556,893	33,291,154	72,085,827	39,351,565	0.016	-0.0014	0.080
96	213	72	333	19,505,212	47,664,929	55,966,671	556,893	33,585,070	88,994,848	55,966,671	0.014	-0.0014	0.086
102	207	72	339	18,422,080	49,397,769	74,330,735	556,893	33,909,924	107,683,766	74,330,735	0.013	-0.0014	0.092
108	201	72	345	17,369,887	51,161,547	94,443,757	556,893	34,265,717	128,152,581	94,443,757	0.011	-0.0014	0.099
114	195	72	351	16,348,632	52,956,264	116,305,738	556,893	34,652,448	150,401,293	116,305,738	0.010	-0.0014	0.106
120	189	72	357	15,358,316	54,781,920	139,916,677	556,893	35,070,118	174,429,902	139,916,677	0.009	-0.0015	0.113
126	183	72	363	14,398,938	56,638,514	165,276,574	556,893	35,518,726	200,238,408	165,276,574	0.008	-0.0015	0.121
132	177	72	369	13,470,499	58,526,047	192,385,431	556,893	35,998,273	227,826,811	192,385,431	0.007	-0.0015	0.129
138	171	72	375	12,572,999	60,444,518	221,243,245	556,893	36,508,758	257,195,110	221,243,245	0.006	-0.0015	0.138
144	165	72	381	11,706,437	62,393,927	251,850,018	556,893	37,050,182	288,343,307	251,850,018	0.005	-0.0015	0.147
150	159	72	387	10,870,813	64,374,275	284,205,750	556,893	37,622,544	321,271,401	284,205,750	0.004	-0.0016	0.157
156	153	72	393	10,066,128	66,385,562	318,310,440	556,893	38,225,845	355,979,391	318,310,440	0.004	-0.0016	0.166
162	147	72	399	9,292,381	68,427,787	354,164,088	556,893	38,860,084	392,467,279	354,164,088	0.003	-0.0016	0.177
168	141	72	405	8,549,573	70,500,950	391,766,695	556,893	39,525,262	430,735,064	391,766,695	0.003	-0.0016	0.188
174	135	72	411	7,837,703	72,605,052	431,118,260	556,893	40,221,378	470,782,745	431,118,260	0.002	-0.0017	0.199
180	129	72	417	7,156,772	74,740,093	472,218,784	556,893	40,948,433	512,610,324	472,218,784	0.002	-0.0017	0.211
186	123	72	423	6,506,779	76,906,072	515,068,266	556,893	41,706,426	556,217,799	515,068,266	0.002	-0.0017	0.223
192	117	72	429	5,887,725	79,102,990	559,666,707	556,893	42,495,357	601,605,172	559,666,707	0.001	-0.0018	0.236
198	111	72	435	5,299,610	81,330,846	606,014,106	556,893	43,315,228	648,772,441	606,014,106	0.001	-0.0018	0.250
204	105	72	441	4,742,432	83,589,640	654,110,464	556,893	44,166,036	697,719,607	654,110,464	0.001	-0.0018	0.264
210	99	72	447	4,216,194	85,879,373	703,955,780	556,893	45,047,783	748,446,670	703,955,780	0.001	-0.0019	0.279
216	93	72	453	3,720,894	88,200,045	755,550,055	556,893	45,960,469	800,953,631	755,550,055	0.001	-0.0019	0.294
222	87	72	459	3,256,532	90,551,655	808,893,288	556,893	46,904,093	855,240,488	808,893,288	0.000	-0.0020	0.310
228	81	72	465	2,823,109	92,934,203	863,985,479	556,893	47,878,656	911,307,242	863,985,479	0.000	-0.0020	0.326
234	75	72	471	2,420,624	95,347,690	920,826,629	556,893	48,884,157	969,153,893	920,826,629	0.000	-0.0020	0.343
240	69	72	477	2,049,078	97,792,116	979,416,737	556,893	49,920,597	1,028,780,441	979,416,737	0.000	-0.0021	0.361
246	63	72	483	1,708,470	100,267,480	1,039,755,804	556,893	50,987,975	1,090,186,886	1,039,755,804	0.000	-0.0021	0.380
252	57	72	489	1,398,801	102,773,782	1,101,843,830	556,893	52,086,292	1,153,373,228	1,101,843,830	0.000	-0.0022	0.399
258	51	72	495	1,120,070	105,311,023	1,165,680,813	556,893	53,215,547	1,218,339,467	1,165,680,813	0.000	-0.0022	0.419
264	45	72	501	872,278	107,879,203	1,231,266,756	556,893	54,375,741	1,285,085,603	1,231,266,756	0.000	-0.0023	0.440
270	39	72	507	655,424	110,478,321	1,298,601,656	556,893	55,566,873	1,353,611,636	1,298,601,656	0.000	-0.0023	0.461
276	33	72	513	469,509	113,108,377	1,367,685,515	556,893	56,788,943	1,423,917,566	1,367,685,515	0.000	-0.0024	0.483
282	27	72	519	314,533	115,769,372	1,438,518,333	556,893	58,041,952	1,496,003,392	1,438,518,333	0.000	-0.0024	0.506
288	21	72	525	190,494	118,461,306	1,511,100,109	556,893	59,325,900	1,569,869,116	1,511,100,109	0.000	-0.0025	0.530
294	15	72	531	97,395	121,184,178	1,585,430,844	556,893	60,640,786	1,645,514,737	1,585,430,844	0.000	-0.0025	0.555
300	9	72	537	35,233	123,937,988	1,661,510,537	556,893	61,986,611	1,722,940,255	1,661,510,537	0.000	-0.0026	0.580


Absolute Value of Peak Deflection of Block Raiser Table
(maximum in any of the three spans)
peak deflection, inches
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
72 inches pivot to cylinder
96
120
144
240
0
18
36
54
72
90
108
126
144
162
180
198
216
234
252
270
288
Offset of pivot from the center toward the forks
"0" is a pure 'pivoter' ; "309" is a pure "raiser"