

# Lehman Rolling Pivot Geometry Error Study

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- Rev. 0    7/11/2008
- Rev. 1    7/11/2008    added twist calculations
- Rev. 2    7/12/2008    added beam w/ flat plate rolling on pivot
- Rev. 3    7/19/08 Chris/Chas formula tests, add sqs/offset beam len calc
- Rev. 4    7/24/08 corr my labels and added some cell refs
- Rev. 5    8/7/08 add locus calcs
- lower pivot rev 0    chg lower pivot to use Chapman eqn.
- Rev.6    9/3/08 Simplify spreadsheet to final proof

**given::**  
 len L = PC  
 angle d = angle of PC to EF in radians  
 X=Y=zero=pt J  
 J = K at angle d = 0

Equations of point P:  
**Y= -[R + L\*Cos(d)]**  
**X= R\*d +L\*Sin(d)**

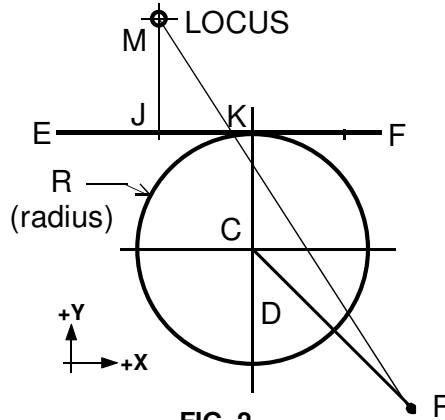


FIG. 2  
45°

Name	Input Values
dia	0.250
beam	10.000
locus	0.1259
Derived Values	
radius	0.125000 Dia/2
LocRadius	10.250900 beam+radius+locus

Beam Len CP  
value in Y from pt J

Some solutions:

dia	0.250	2.250
beam	10.000	10.000
locus	0.1259	1.2458

ERROR (uin)

-3      -19

(bob will rise with error -- more stable)

## Ball rolling on plate (fig. 2 above)

Locus Angle (ajMP)	Locus X	Locus Y	Y Diff of prolate-locus	Beam X (P)	Beam Y (P)	Ang D (radians)	Ang D degrees	Roll Y (travel sub)(in.)
-0.17778	-1.812796	-9.963437	0.000000	-1.812796	-9.963437	-0.1800	-10.313240	0.045000
0.00000	0.000000	-10.125000	0.000000	0.000000	-10.125000	0.0000	0	0.000000
-0.17778	-1.812796	-9.963437	0.000000	-1.812796	-9.963437	-0.1800	-10.3132403	0.045000
-0.16790	-1.713073	-9.980847	-0.000001	-1.713073	-9.980848	-0.1700	-9.74028252	0.042500
-0.15803	-1.613182	-9.997271	-0.000002	-1.613182	-9.997273	-0.1600	-9.16732472	0.040000
-0.14815	-1.513131	-10.012709	-0.000002	-1.513131	-10.012711	-0.1500	-8.59436693	0.037500
-0.13828	-1.412931	-10.027157	-0.000002	-1.412931	-10.027160	-0.1400	-8.02140913	0.035000
-0.12840	-1.312591	-10.040616	-0.000003	-1.312591	-10.040619	-0.1300	-7.44845134	0.032500
-0.11852	-1.212122	-10.053084	-0.000003	-1.212122	-10.053086	-0.1200	-6.87549354	0.030000
-0.10865	-1.111533	-10.064559	-0.000002	-1.111533	-10.064561	-0.1100	-6.30253575	0.027500
-0.09877	-1.010834	-10.075039	-0.000002	-1.010834	-10.075042	-0.1000	-5.72957795	0.025000
-0.08889	-0.910035	-10.084525	-0.000002	-0.910035	-10.084527	-0.0900	-5.15662016	0.022500
-0.07902	-0.809147	-10.093015	-0.000002	-0.809147	-10.093017	-0.0800	-4.58366236	0.020000
-0.06914	-0.708178	-10.100509	-0.000001	-0.708178	-10.100510	-0.0700	-4.01070457	0.017500
-0.05926	-0.607140	-10.107004	-0.000001	-0.607140	-10.107005	-0.0600	-3.43774677	0.015000
-0.04939	-0.506042	-10.112502	-0.000001	-0.506042	-10.112503	-0.0500	-2.86478898	0.012500
-0.03951	-0.404893	-10.117001	0.000000	-0.404893	-10.117001	-0.0400	-2.29183118	0.010000
-0.02963	-0.303705	-10.120500	0.000000	-0.303705	-10.120500	-0.0300	-1.71887339	0.007500
-0.01975	-0.202487	-10.123000	0.000000	-0.202487	-10.123000	-0.0200	-1.14591559	0.005000
-0.00988	-0.101248	-10.124500	0.000000	-0.101248	-10.124500	-0.0100	-0.5729578	0.002500
0.00000	0.000000	-10.125000	0.000000	0.000000	-10.125000	0.0000	0	0.000000