

Steering_Tube_strength.xls		
By Alex Slocum 8 January 2024		
Inputs in BLACK , Outputs in RED		
Upper section 110 (ala Moechnig) Circular OD and ID tube		
OD (mm)	28.6	
ID (mm)	22.6	
ID/OD	0.79	
wall thickness (mm)	3.00	
Wall thickness/OD ratio	10.49%	
Moment of inertia I (mm^4)	20037	
I/radius	1401	
Design safety factor	3	
	6061-T6 AL	HSLA Steel
Yield strength	240	960
Allowable bending moment		
N-mm	336,279	1,345,116
lb-ft	2,975	11,901
Assumed typical distance steering tube where eminates from head tube to end of fork (in, mm)	16	406
Force in plane P to reach allowable moment		
N	827	3,310
lbf	186	744

Lower end 202 (ala '993) Circular outside at base, Elliptical inside at base						
Geometry	993 Fig. 9	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
OD (mm)	36.00	42.90	42.90	42.90	42.90	42.90
ID if round and same wall thickness as at top	30	36.9	36.9	36.9	36.9	36.9
Ratio OD lower end / Upper section	1.26	1.50	1.50	1.50	1.50	1.50
Major diameter/Minor diameter	1.20	1.14	1.57	1.30	1.25	1.00
Major axis	30.00	34.32	36.04	36.04	36.04	36.04
Ratio Major axis/OD	83.33%	80.00%	84.00%	84.00%	84.00%	84.00%
wall thickness (mm)	3.00	4.29	3.43	3.43	3.43	3.43
Wall thickness/OD ratio	8.3%	10.0%	8.0%	8.0%	8.0%	8.0%
Minor axis	25.00	30.03	22.95	27.72	28.83	36.04
Ratio Minor axis/OD	0.69	0.70	0.54	0.65	0.67	0.84
wall thickness (mm)	5.5	6.44	9.97	7.59	7.04	3.43
Wall thickness/OD ratio	15.3%	15.0%	23.2%	17.7%	16.4%	8.0%
Cross sectional areas						
Top Round tube at top (mm^2)	241	241	241	241	241	241
Base Circular outside, elliptical inside (mm^2)	429	636	796	661	630	426
compare to circular ID						
ID = major axis, area (mm^2)	311	520	426	426	426	426
ID = minor axes, area (mm^2)	527	737	1032	842	793	426
Wall thickness same as at top section, area (mm^2)	311	376	376	376	376	376
Moments of Inertia, maximum in plane P						
Top Round tube at top (mm^4)	20037	20037	20037	20037	20037	20037
Base Circular outside, elliptical inside (mm^4)	59438	120641	144874	128586	123882	83486
compare to circular ID						
ID = major axis, area (mm^4)	42687	98162	83486	83486	83486	83486
ID = minor axes, area (mm^4)	63273	126344	152640	137281	132358	83486
ID with top wall thickness (mm^4)	42687	75257	75257	75257	75257	75257
Structural efficiency (I/A) (mm^4/mm^2)						
Top Round tube at top (mm^2)	83	83	83	83	83	83
Base Circular outside, elliptical inside (mm^2)	139	190	182	195	197	196
compare to circular ID						
ID = major axis, area (mm^2)	137	189	196	196	196	196
ID = minor axes, area (mm^2)	120	171	148	163	167	196
ID with top wall thickness (mm^2)	137	200	200	200	200	200