

Step 5B: Rank materials based upon function f_2 – deflection basis

Requirements

L (in) =	96
P (lb) =	300
b (in) =	4
X =	1.5
v (in) =	1

Use [spreadsheet](#) to determine rankings

Selection Table - deflection basis (check strength)

Material	Density (slug/in ³)	Strength (psi)	Cost Index	f2 for mass	Norm Mass	Mass Rank	f2 for cost	Norm Cost	Cost Rank
AISI 1020 steel	8.87E-03	37708	1	2.87E-05	6.08	8	2.87E-05	4.06	2
AISI 4340 steel	8.87E-03	159971	3	2.85E-05	6.04	7	8.56E-05	12.09	4
7075-T6 aluminum	3.03E-03	68020	6	1.39E-05	2.95	4	8.36E-05	11.81	3
Ti-6Al-4V	5.05E-03	171864	45	1.97E-05	4.16	6	8.85E-04	124.93	7
Polycarbonate	1.35E-03	8992	5	1.92E-05	4.06	5	9.58E-05	13.52	5
Loblolly pine	5.73E-04	12763	1.5	4.72E-06	1.00	1	7.08E-06	1.00	1
GFRP	2.25E-03	55112	10	1.55E-05	3.28	3	1.55E-04	21.87	6
CFRP	1.80E-03	134880	200	8.07E-06	1.71	2	1.61E-03	227.96	8

Material	Q	Combined Rank	Depth, h (in)	Modulus (psi)	Deflection (in)	Stress (psi)	Safety Factor	Check Strength
AISI 1020 steel	10.14	2	0.826	29441624	1.00	15831	2.38	OK
AISI 4340 steel	18.13	5	0.821	30021755	1.00	16039	9.97	OK
7075-T6 aluminum	14.76	3	1.172	10297317	1.00	7859	8.66	OK
Ti-6Al-4V	129.10	7	0.992	16968818	1.00	10964	15.67	OK
Polycarbonate	17.58	4	3.626	348078	1.00	822	10.94	OK
Loblolly pine	2.00	1	2.103	1783901	1.00	2442	5.23	OK
GFRP	25.16	6	1.759	3045685	1.00	3489	15.80	OK
CFRP	229.67	8	1.146	11022480	1.00	8224	16.40	OK