

Step 5: Rank materials based upon function f_2 – strength basis

Requirements

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

Use [spreadsheet](#) to determine rankings

Selection Table - strength basis (check deflection)

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	4.57E-05	9.34	8	4.57E-05	6.01	2
AISI 4340 steel	8.87E-03	159971	3	2.22E-05	4.53	7	6.65E-05	8.75	3
7075-T6 aluminum	3.03E-03	68020	6	1.16E-05	2.38	4	6.98E-05	9.17	4
Ti-6Al-4V	5.05E-03	171864	45	1.22E-05	2.49	5	5.49E-04	72.13	7
Polycarbonate	1.35E-03	8992	5	1.42E-05	2.90	6	7.11E-05	9.34	5
Loblolly pine	5.73E-04	12763	1.5	5.07E-06	1.04	2	7.60E-06	1.00	1
GFRP	2.25E-03	55112	10	9.57E-06	1.96	3	9.57E-05	12.58	6
CFRP	1.80E-03	134880	200	4.89E-06	1.00	1	9.78E-04	128.67	8

Material	Q	Combined Rank	Depth, h (in)	Modulus (psi)	Deflection (in)	Stress (psi)	Safety Factor	Check Deflection
AISI 1020 steel	15.35	6	0.655	29441624	2.00	25139	1.50	NG
AISI 4340 steel	13.28	4	0.318	30021755	17.15	106647	1.50	NG
7075-T6 aluminum	11.55	2	0.488	10297317	13.86	45347	1.50	NG
Ti-6Al-4V	74.63	7	0.307	16968818	33.78	114576	1.50	NG
Polycarbonate	12.25	3	1.342	348078	19.71	5995	1.50	NG
Loblolly pine	2.04	1	1.127	1783901	6.50	8509	1.50	NG
GFRP	14.54	5	0.542	3045685	34.18	36742	1.50	NG
CFRP	129.67	8	0.347	11022480	36.16	89920	1.50	NG