Cable Design Project

Problem:

- The task is to design a cable that will support a 60 ton vehicle. The cable is 25 foot long and can have an elastic deformation of no more than 10%. Using the Modulus of Elasticity for various metals design a cable. Use standard cable diameter sizes listed below (units are inch):

Introduction:

- Calculations
- Construct and complete graphs
- Complete the analysis’s
- Construct Report

Diameters

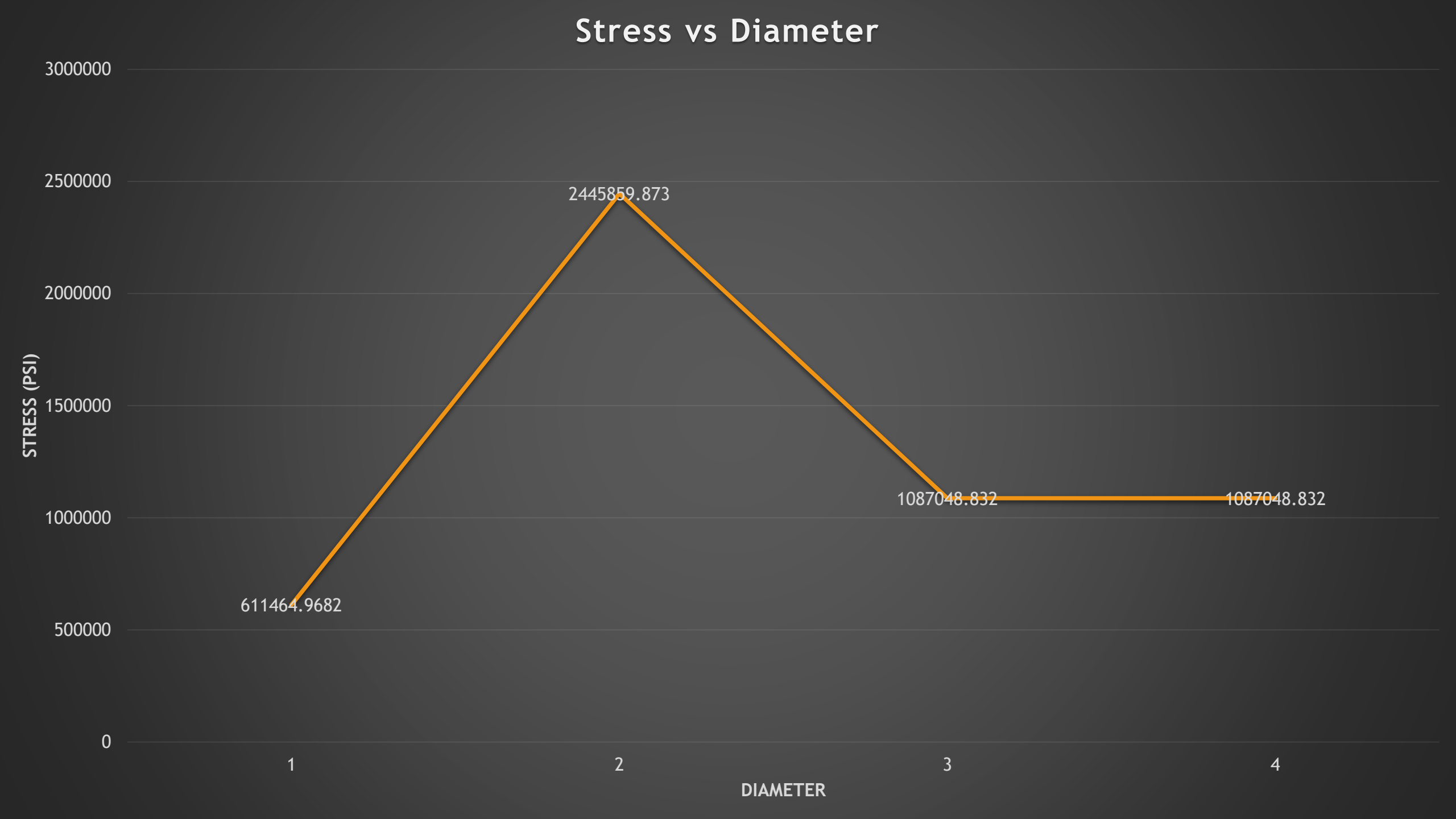
	Elasticity (psi)	load (lbs)	stress (psi)	Area (in^2)	Min. diameter
2014-T6 Aluminum	10,000,000	120,000	1000000	0.12	0.390981127
1045 Steel	30,000,000	120,000	3000000	0.04	0.225733059
Copper	15,000,000	120,000	1500000	0.08	0.319234754
Titanium Ti-6Al-4V (Grade 5), Annealed	12,000,000	120,000	1200000	0.1	0.356915305

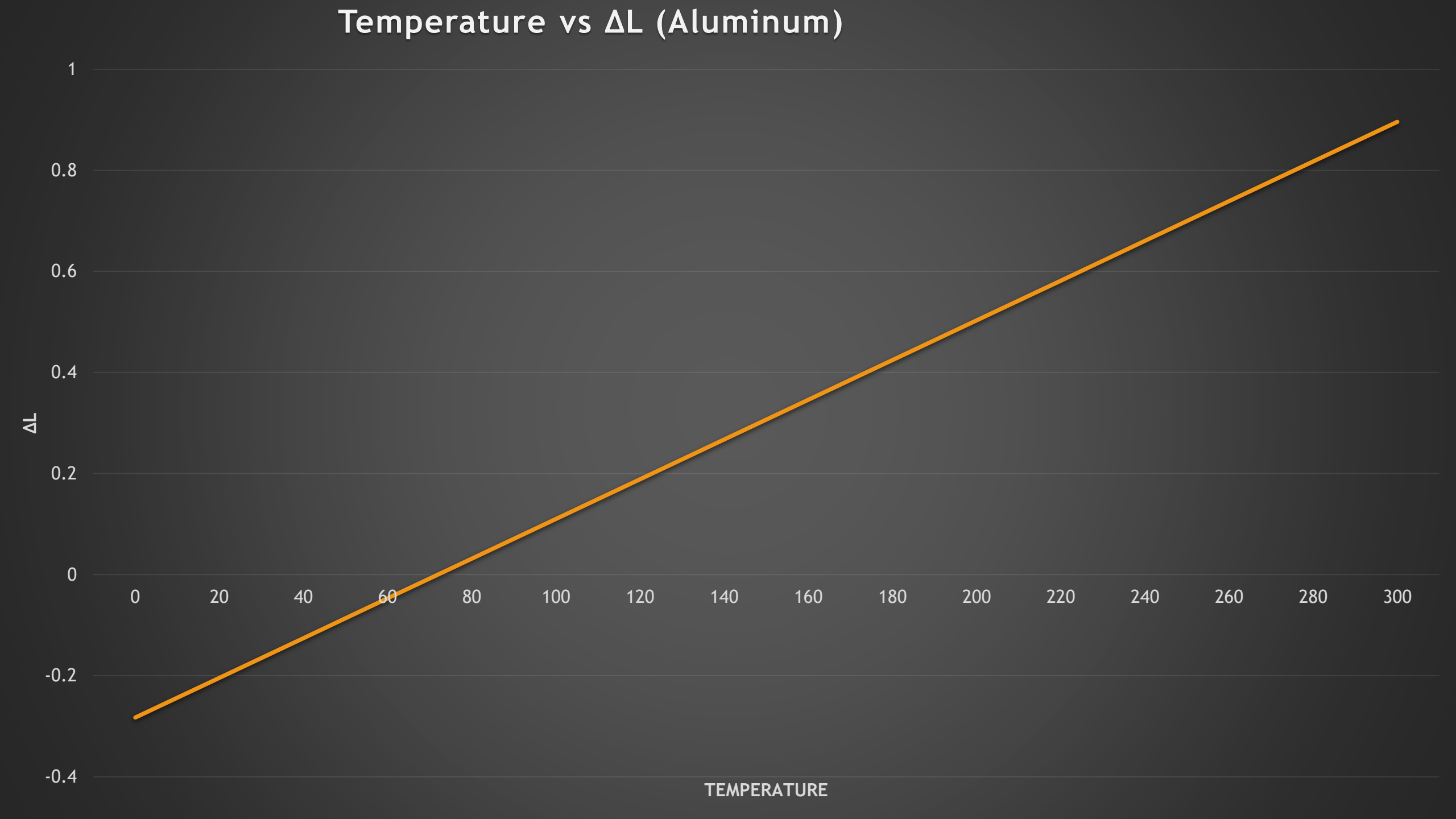
Capability	60	tons
Weight	120,000	lbs
Length	25	ft
Allowable Stretch	10%	
Max Length	27.5	ft
Strain	0.1	

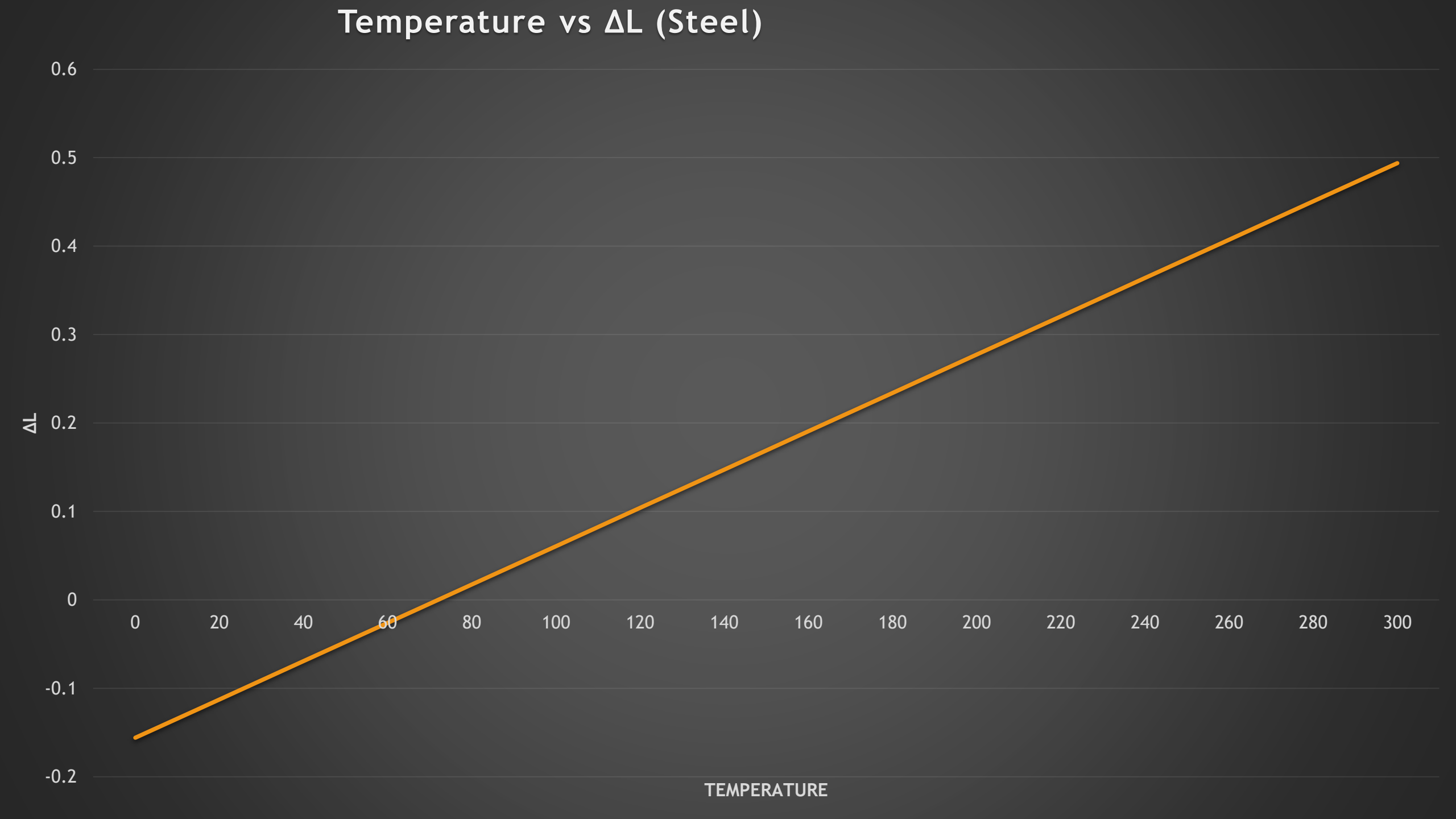
Stress Calculations

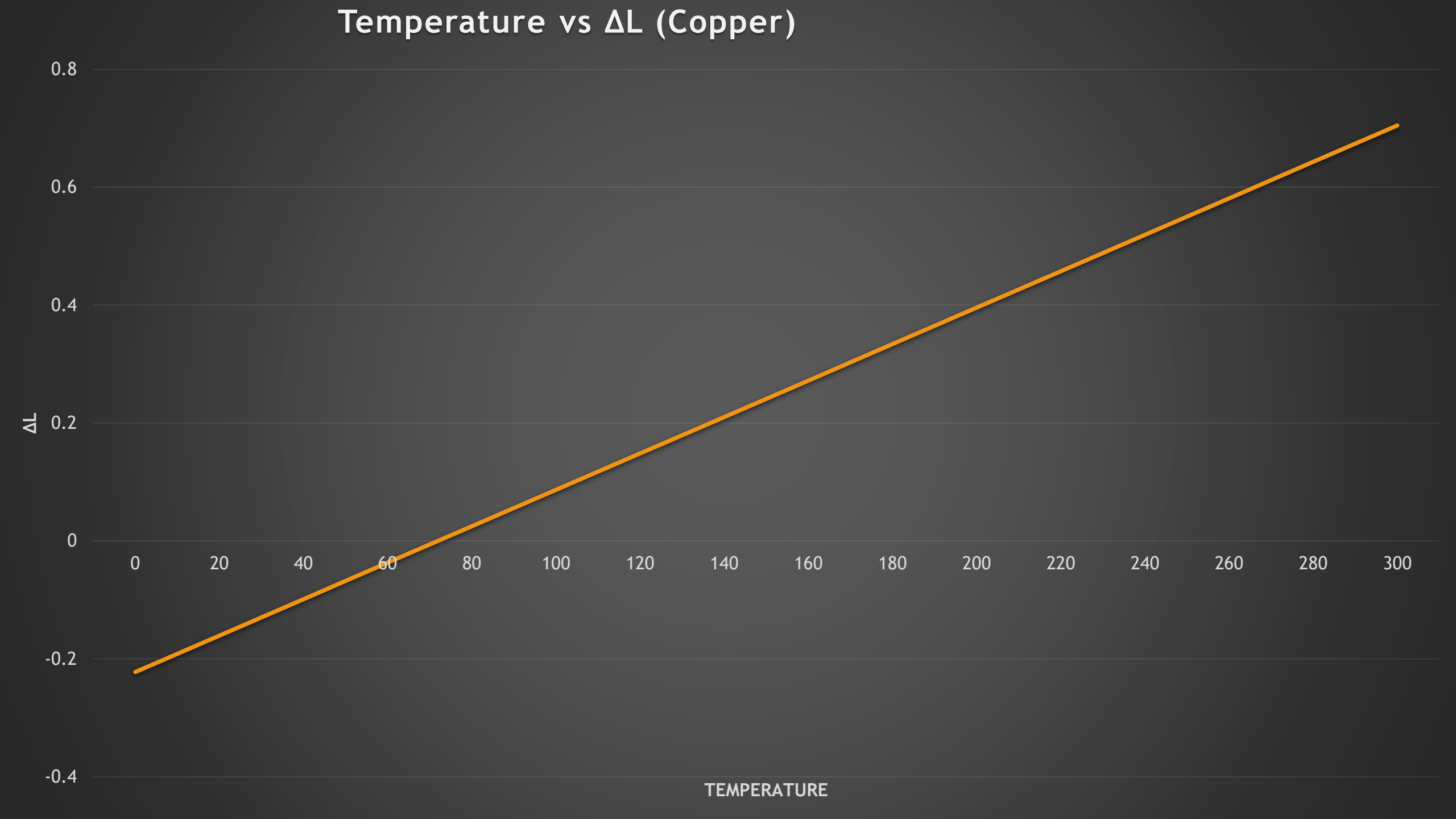
Capability	60	tons
Weight	120,000	lbs
Length	25	ft
Allowable Stretch	10%	
Max Length	27.5	ft
Strain	0.1	

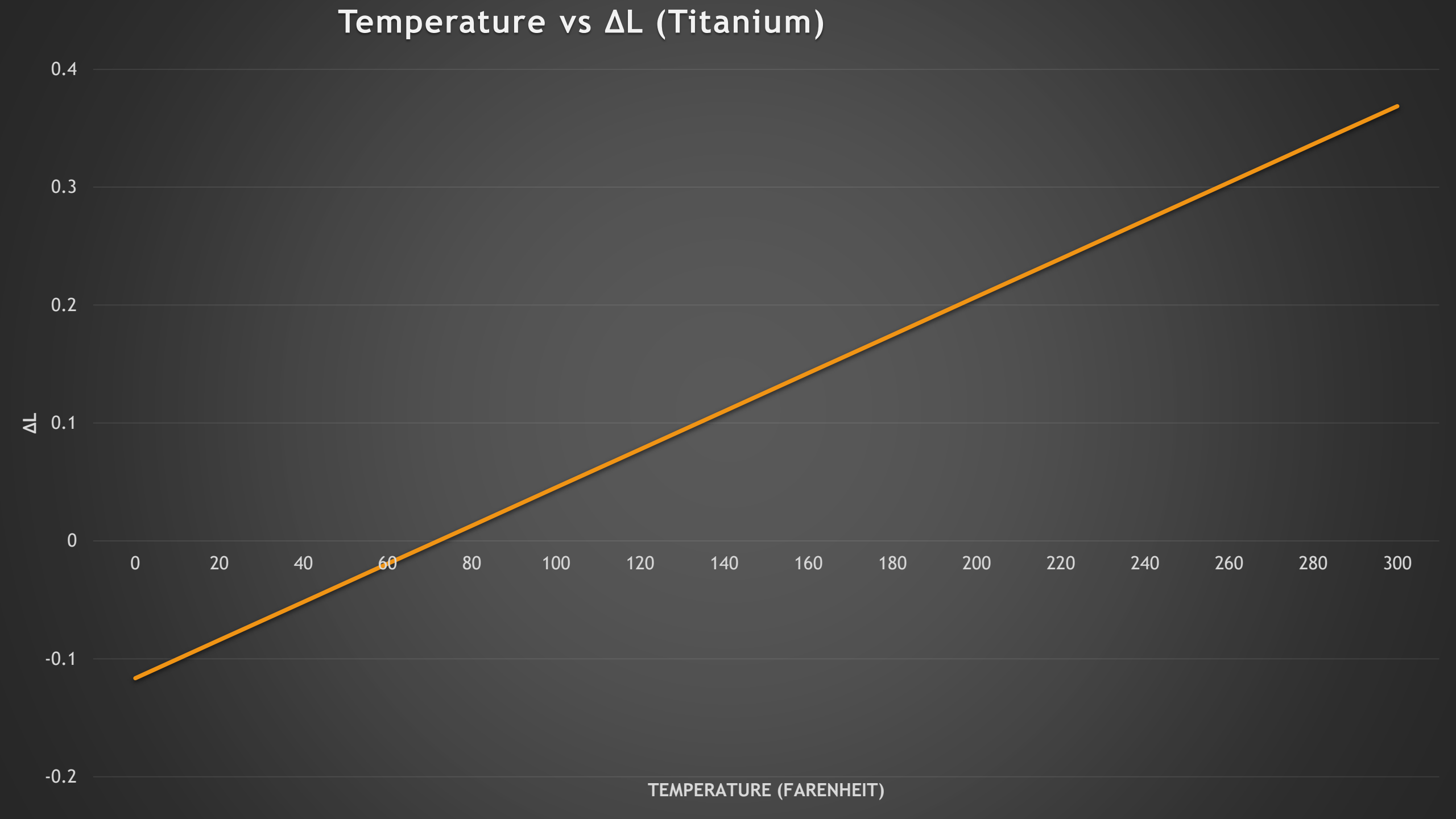
	Diameters	CSA (in^2)	Stress(psi)	Poisson's ratio	Strain	mod. of elasticity of new diameters	Lateral Stress
Aluminum	0.50	0.19625	611465	0.32	0.032	6114649.682	195668.7898
Steel	0.25	0.049063	2445860	0.3	0.03	24458598.73	733757.9618
Copper	0.38	0.110391	1087049	0.34	0.034	10870488.32	369596.603
Titanium	0.38	0.110391	1087049	0.32	0.032	10870488.32	347855.6263


Stress vs Diameter
3000000
2500000
2000000
1500000
1000000
500000
0
STRESS (PSI)
2445859.873
1087048.832
1087048.832
611464.9682
1
2
3
4
DIAMETER


Temperature vs ΔL (Aluminum)
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
ΔL
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
TEMPERATURE

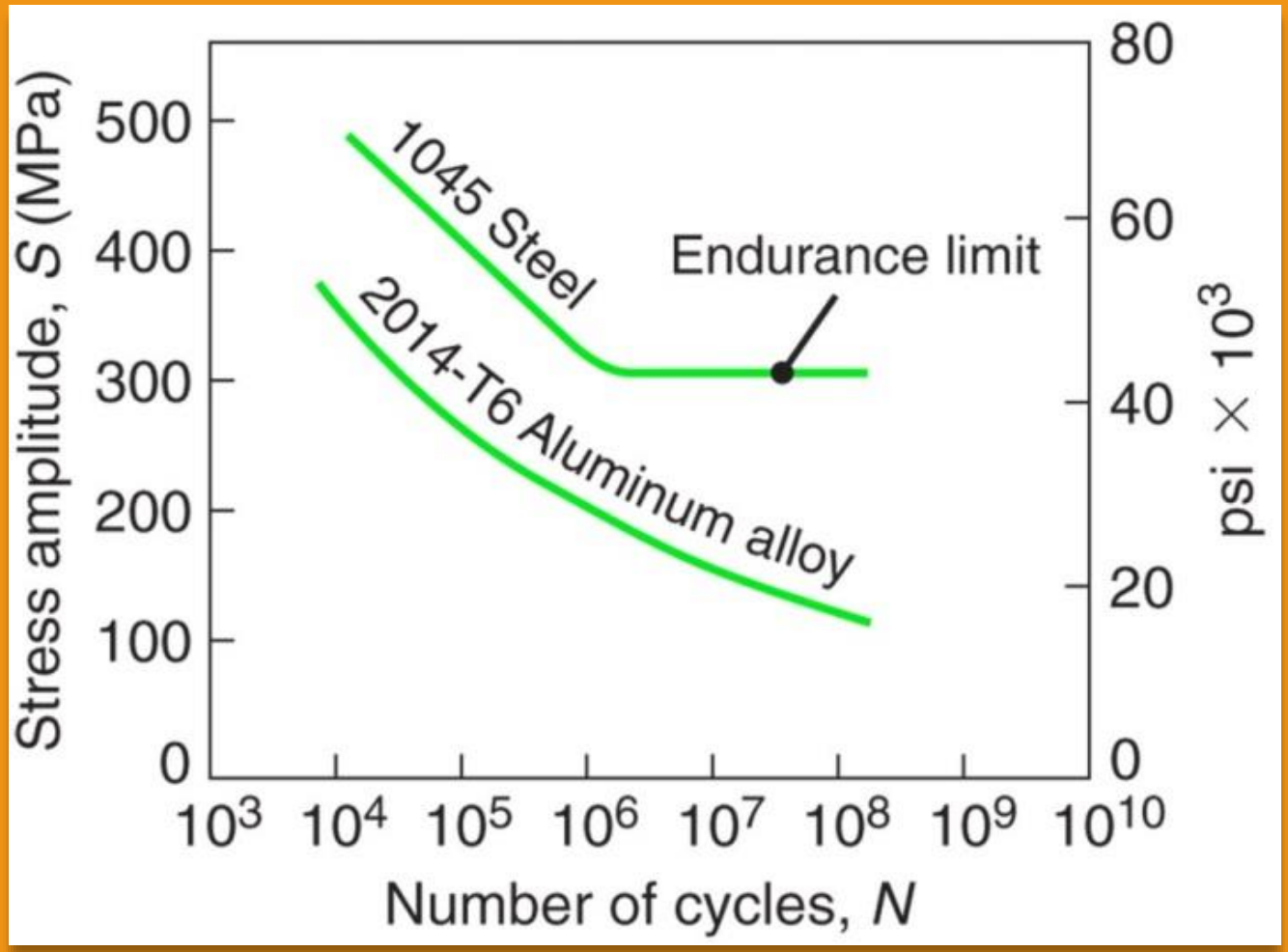

Temperature vs ΔL (Steel)
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
ΔL
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
TEMPERATURE


Temperature vs ΔL (Copper)
0.8
0.6
0.4
0.2
0
-0.2
-0.4
ΔL
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
TEMPERATURE


Temperature vs ΔL (Titanium)
0.4
0.3
0.2
0.1
0
-0.1
-0.2
ΔL
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
TEMPERATURE (FARENHEIT)

Fatigue Analysis

- Aluminum 10^5 cycles.
- Steel 10^6 cycles.



Conclusion: Why I selected steel.

- Stress Capacity
- Ability to not warp, bend, break, or deform
- Withstanding temperatures
- Strength
- Density
- Ductility
- Dependability