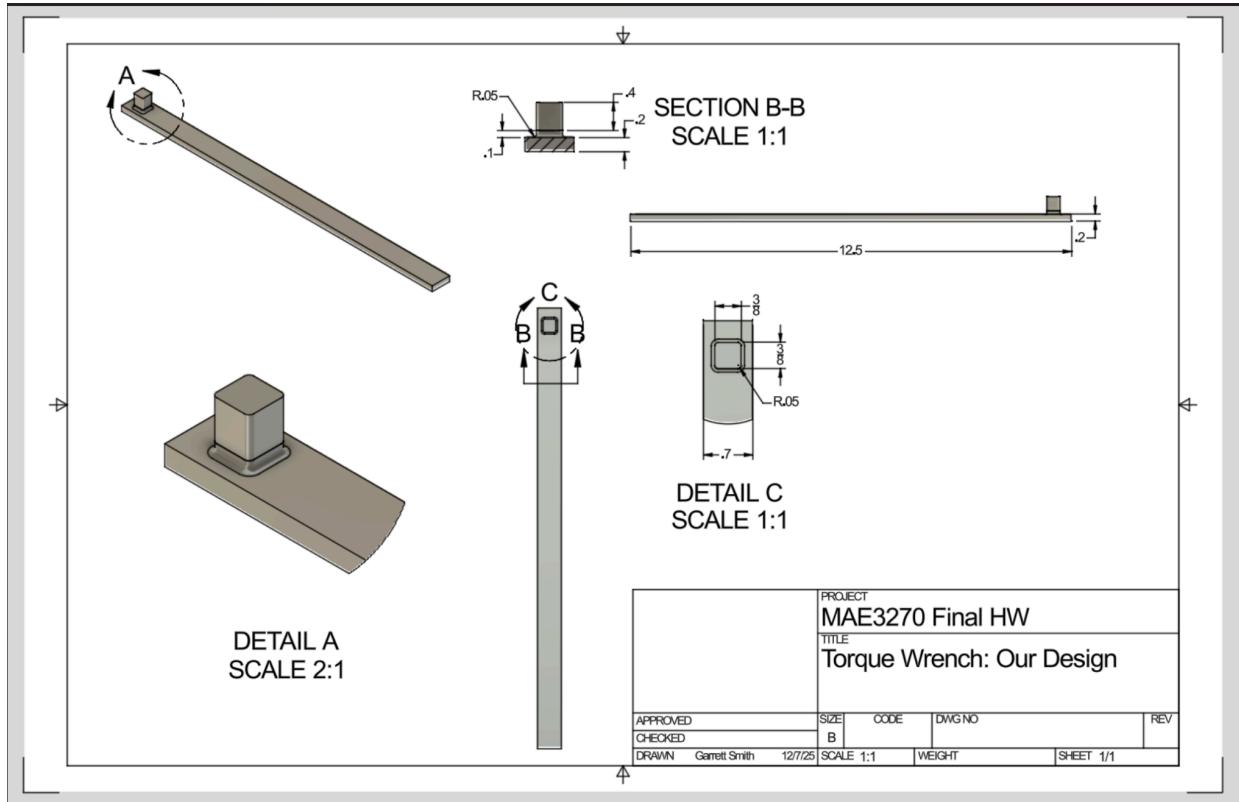


5.2 Your Design

5.2.1 Results

1. Image of CAD model



2. A description of our materials' relevant mechanical properties.

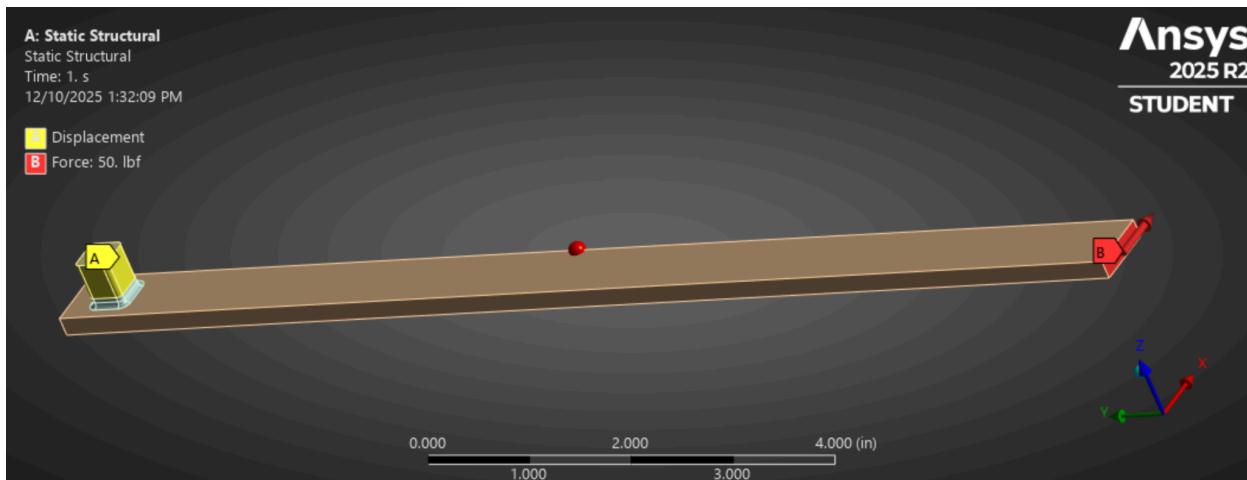
Typically used in the aerospace, defense, and high performance automotive industries, 300M is a highly resilient material with exceptionally high yield and fatigue strengths. A material choice of 300M for our wrench allows us to make the thickness dimensions relatively slim, allowing the torque wrench to be used on bolts in tight spaces. However, the dimensions do not compromise performance with our geometry producing a normal stress of about 64ksi, which is only about 28% of the yield limit of 230 ksi.

Material Name	300-M High Carbon Steel
young's modulus (psi)	29e6

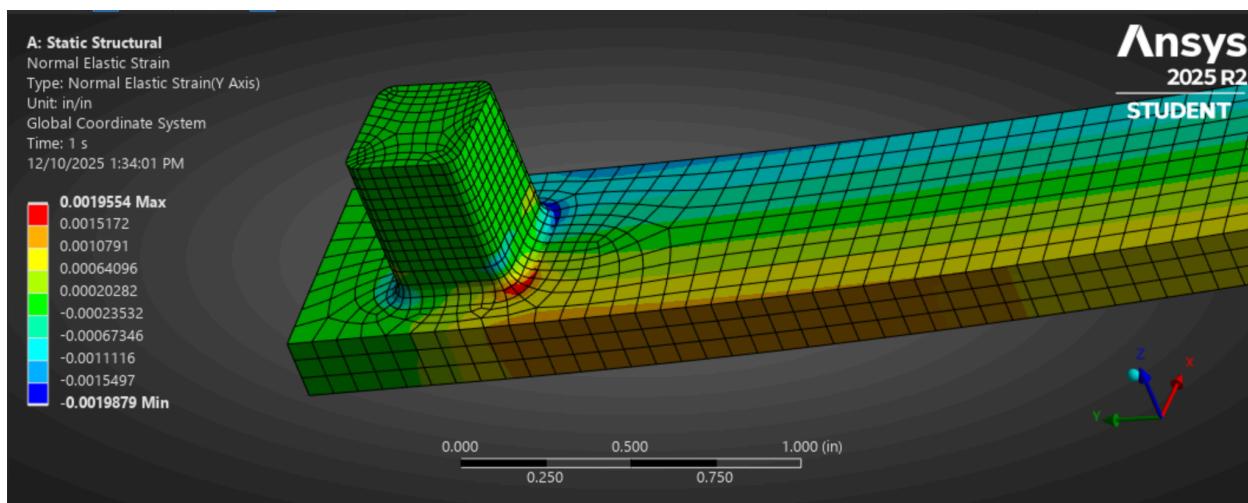
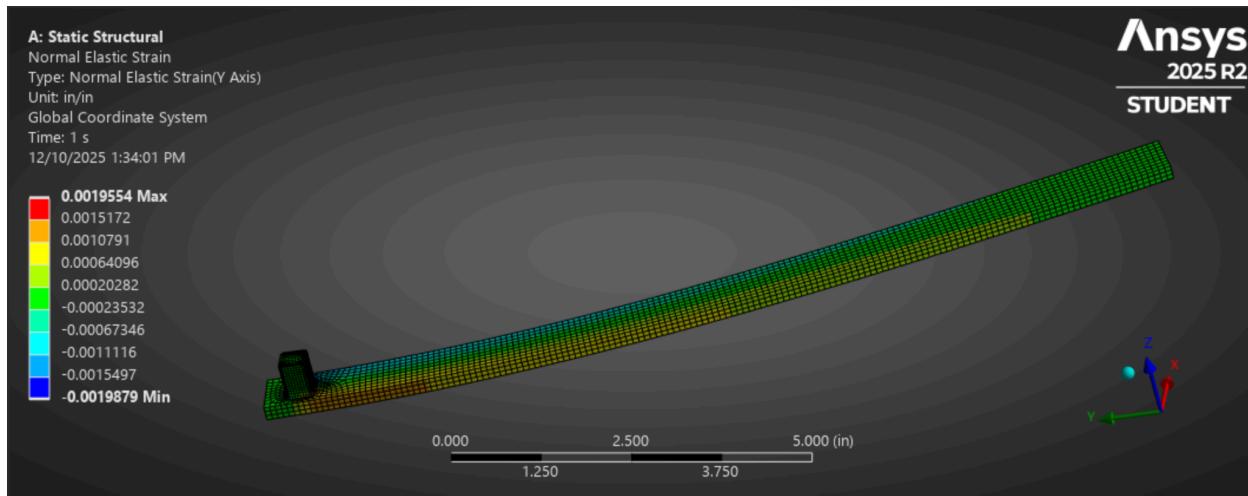
poisson's ratio	0.32
yield strength (psi)	230e3
fracture toughness (psi \sqrt{in})	45e3
fatigue strength at 10^6 cycles (psi)	125e3

Properties of Outline Row 3: 300-M High Carbon Steel			
	A	B	C
1	Property	Value	Unit
2	<input checked="" type="checkbox"/> Material Field Variables	<input type="button" value="Table"/>	
3	<input checked="" type="checkbox"/> Isotropic Elasticity		
4	Derive from	Youn...	<input type="button"/>
5	Young's Modulus	2.9E+07	psi
6	Poisson's Ratio	0.32	
7	Bulk Modulus	1.8514E+11	Pa
8	Shear Modulus	7.5738E+10	Pa

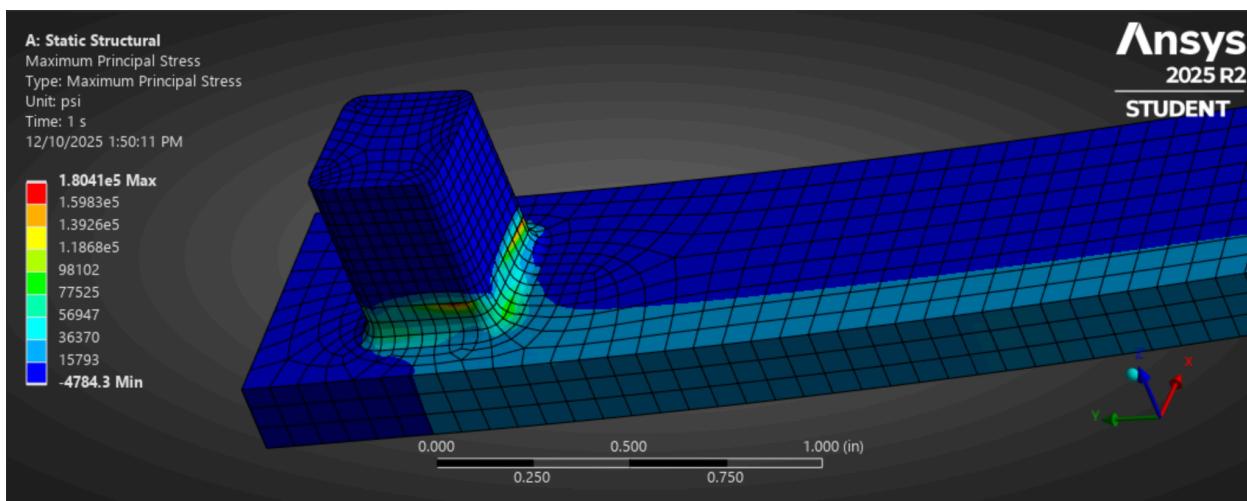
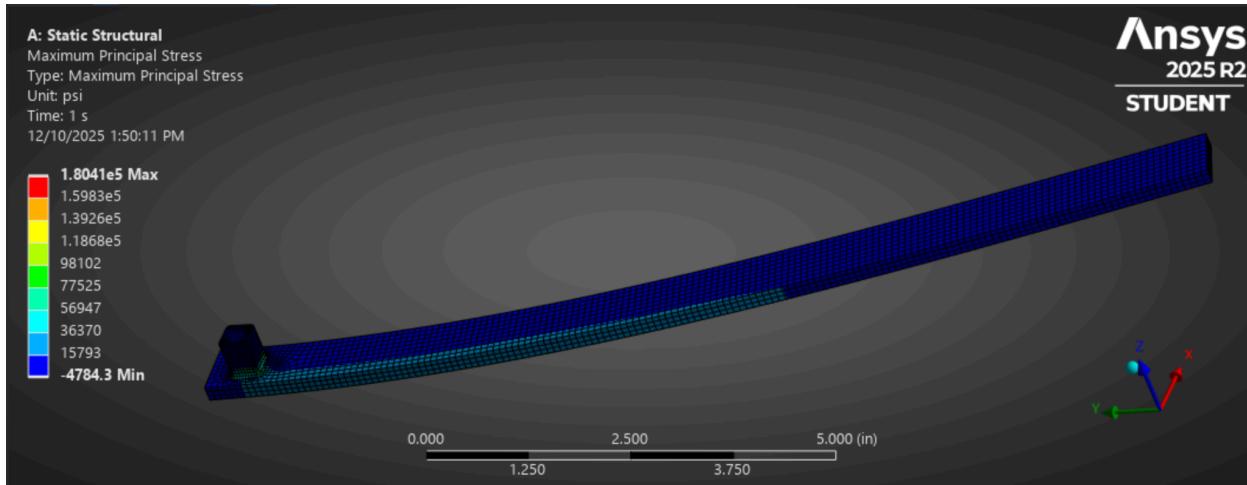
3. Diagram communicating how loads and boundary conditions were applied to the FEM model.



4. Normal strain contours (in the strain gauge direction) from FEM

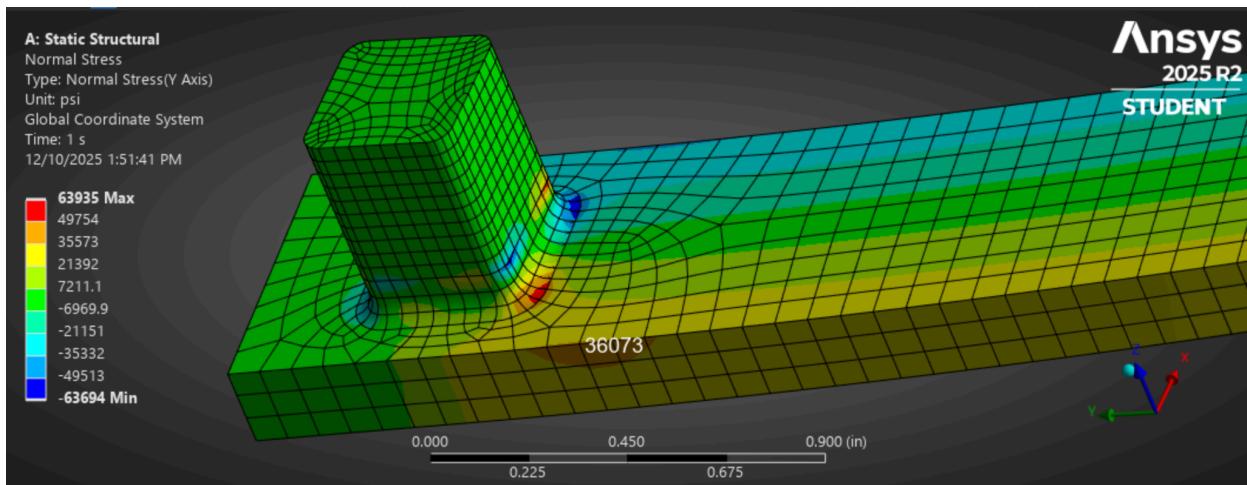


5. Contour plot of maximum principal stress from FEM

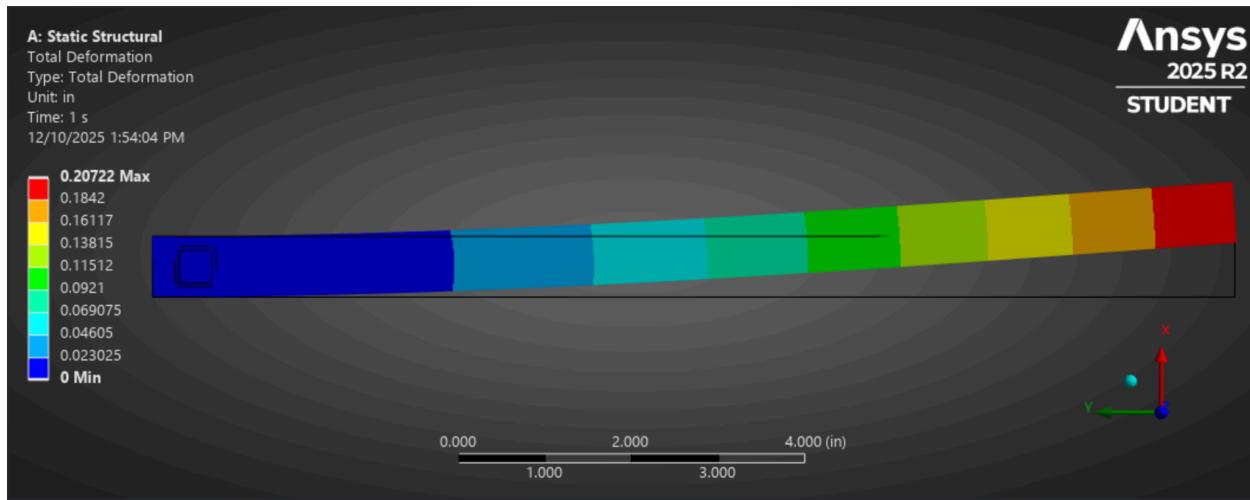


6. Summarize results from FEM calculation showing maximum normal stress (anywhere), load point deflection, strains at the strain gauge locations

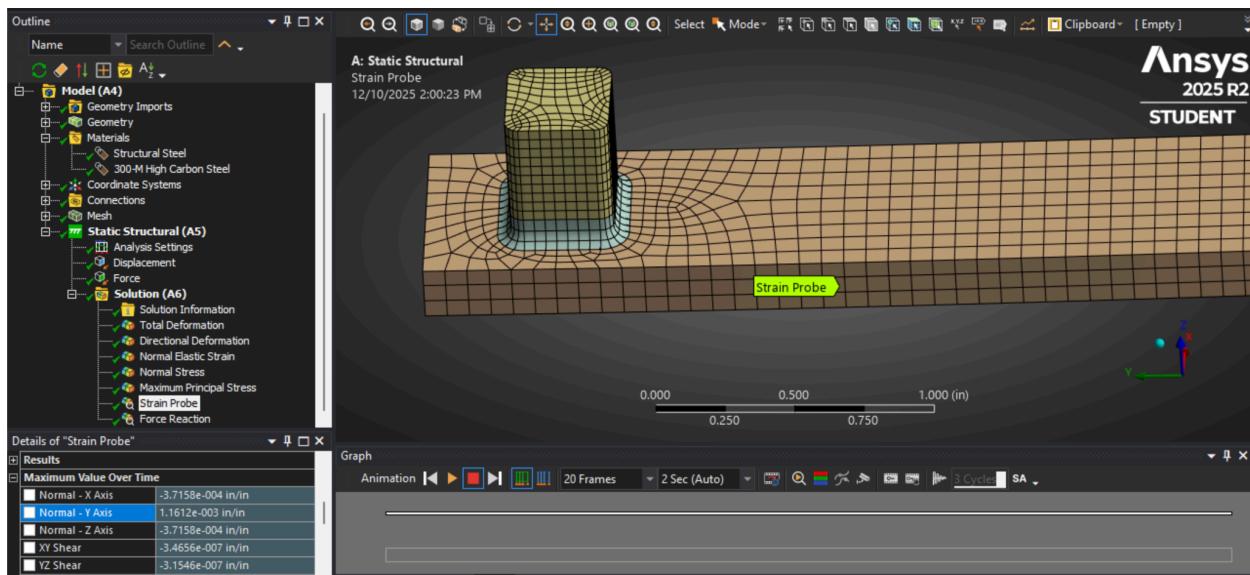
maximum normal stress (anywhere): 63935 psi



load point deflection: 0.20277in



strains at the strain gauge locations: 1161 ($\mu\epsilon$)



7. Torque wrench sensitivity in mV/V using strains from the FEM analysis

1.16 mV/V at 600 in-lbf using half bridge

8. Strain gauge selected

VISHAY- C2A series strain gages- 062LW

C2A-06-062LW-350

GAGE LISTINGS						
GAGE PATTERN Shown at 1X.	GAGE LENGTH in [mm]	OVERALL LENGTH in [mm]	GRID WIDTH in [mm]	OVERALL WIDTH in [mm]	GAGE DESIGNATION	RES. IN OHMS
062LW 	0.062 [1.52]	0.175 [4.45]	0.050 [1.27]	0.080 [2.03]	C2A-XX-062LW-120 C2A-XX-062LW-350	120 ±0.6% 350 ±0.6%
Widely used general-purpose linear gage.						

This strain gauge fits comfortably on the dimensions of our CAD and has a fatigue life of 10^5 cycles at ± 1700 microstrain and 10^6 cycles at ± 1500 microstrain. Our FEM calculated a strain of 1161 microstrain at the strain gauge, which would insinuate a fatigue life larger than the provided range, making it more than sufficient.