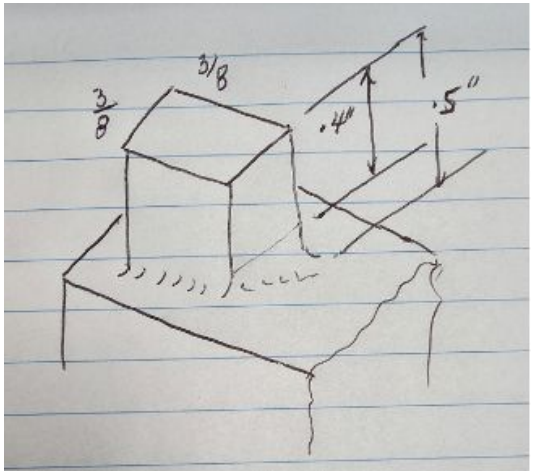
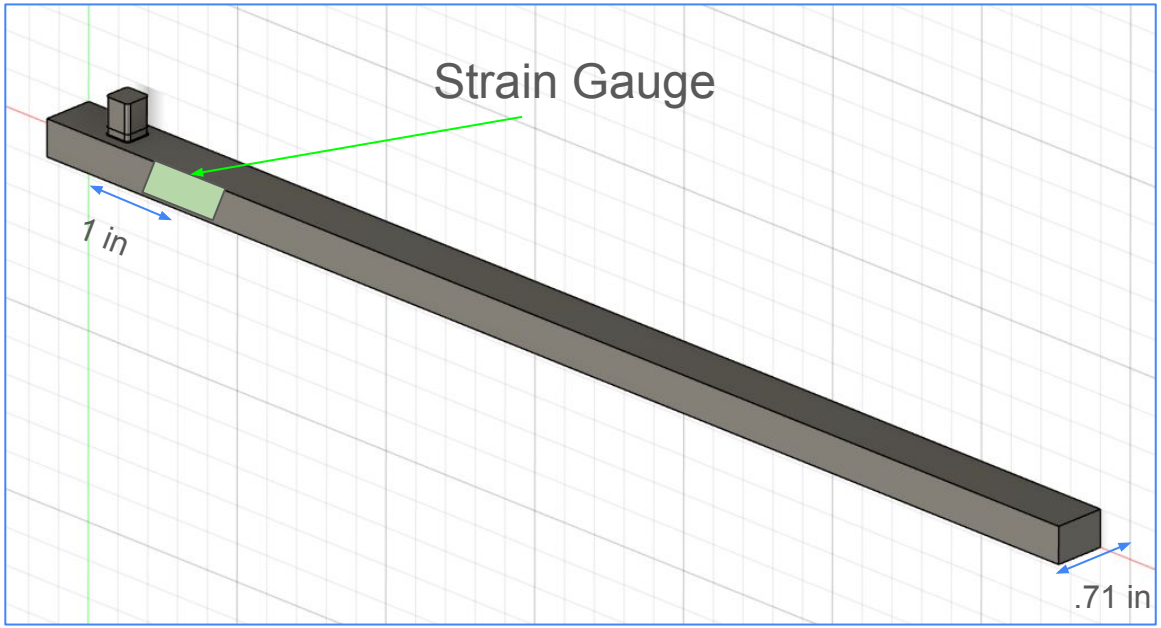
Torque Wrench Design

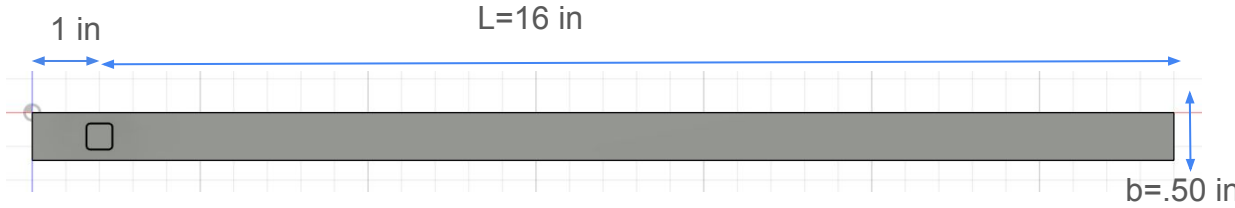
Jordan Vogel

CAD Model



Close up of Drive





Material Selection: Ti-24-Al-11Nb

Elastic Modulus (psi) : 13.1 E6

Poisson’s Ratio: 0.35

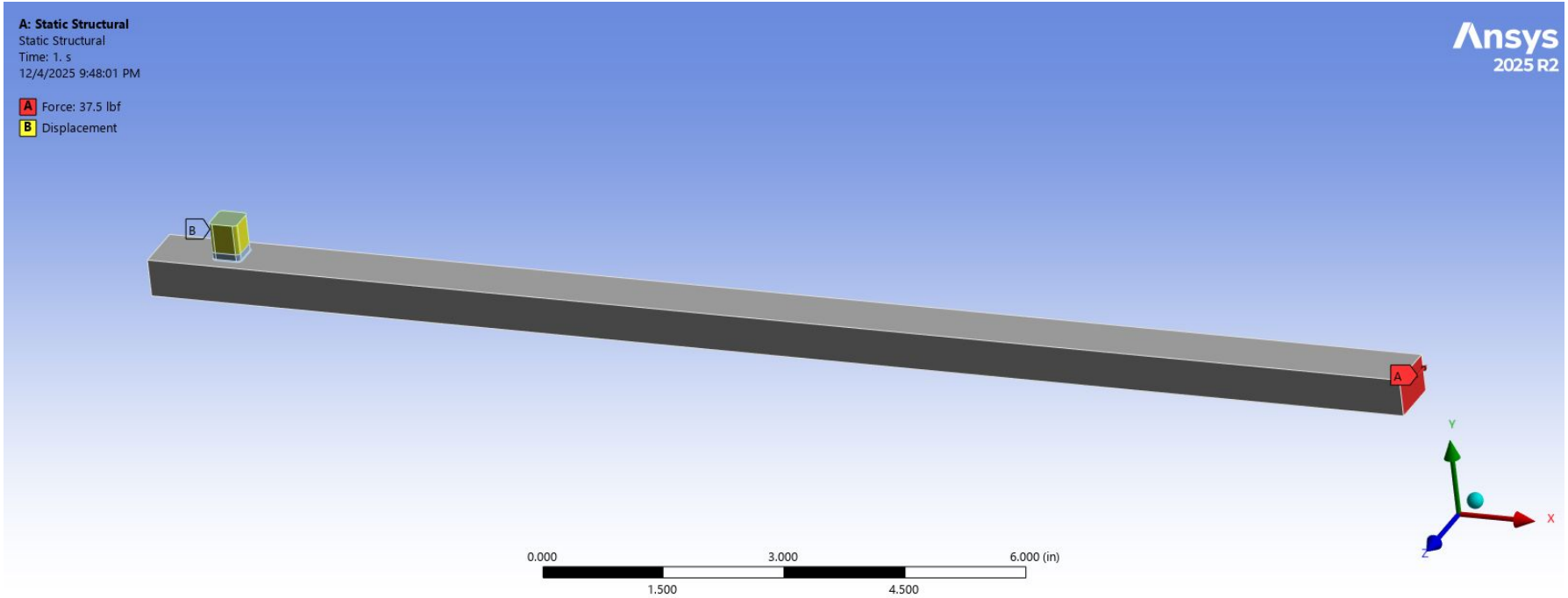
Tensile Yield Strength (psi): 80.3 E3

Fracture Toughness (psi* sqrt(in)): 12.7 E3

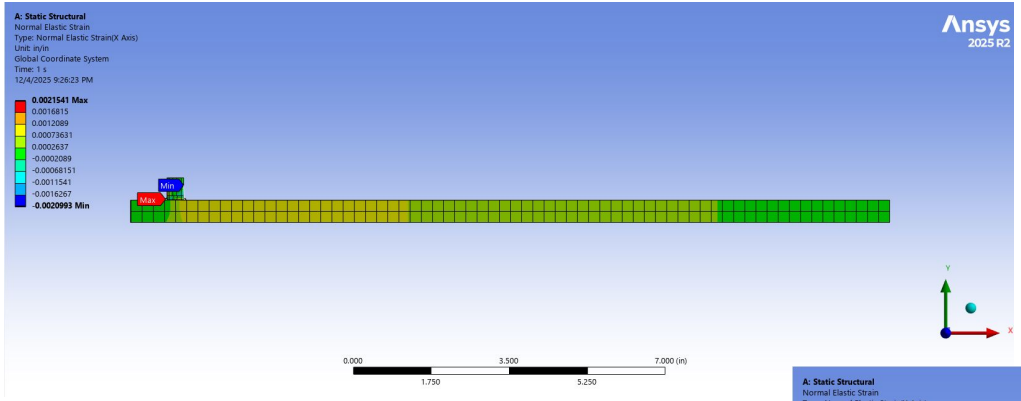
Fatigue Strength (psi): 64 E3

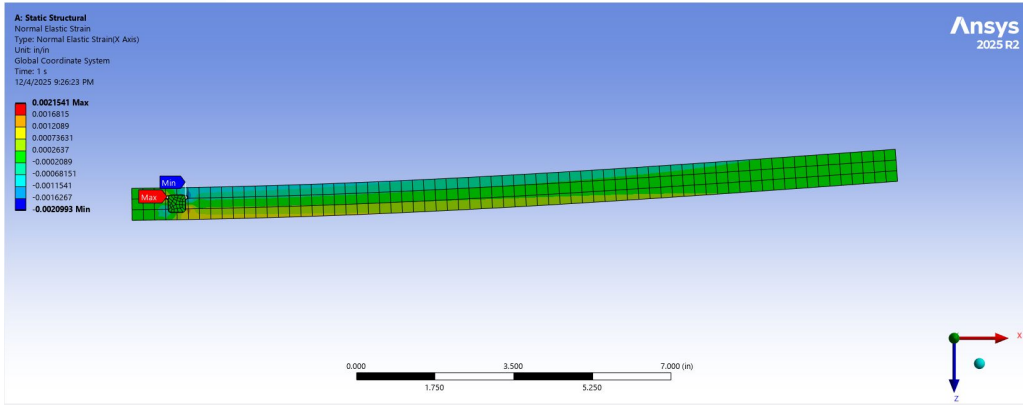
Titanium was chosen since it has a high yield strength, but still deforms enough to have proper sensitivity in this specific application of a torque wrench.

Loads and Boundary Conditions

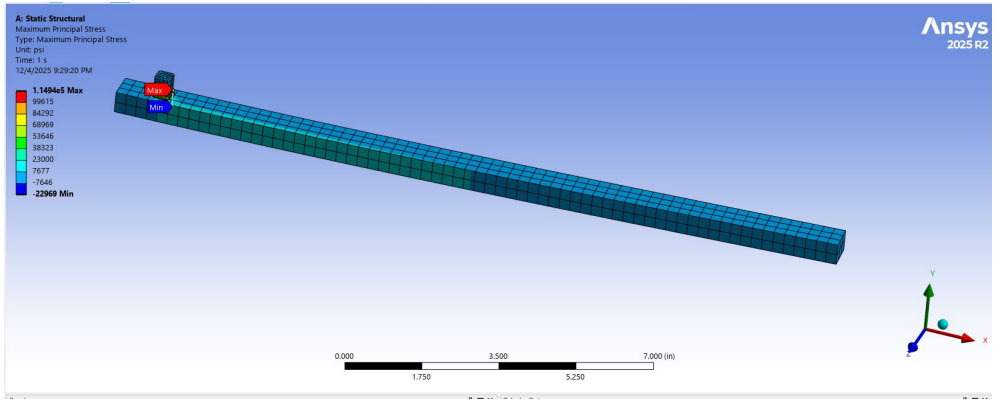


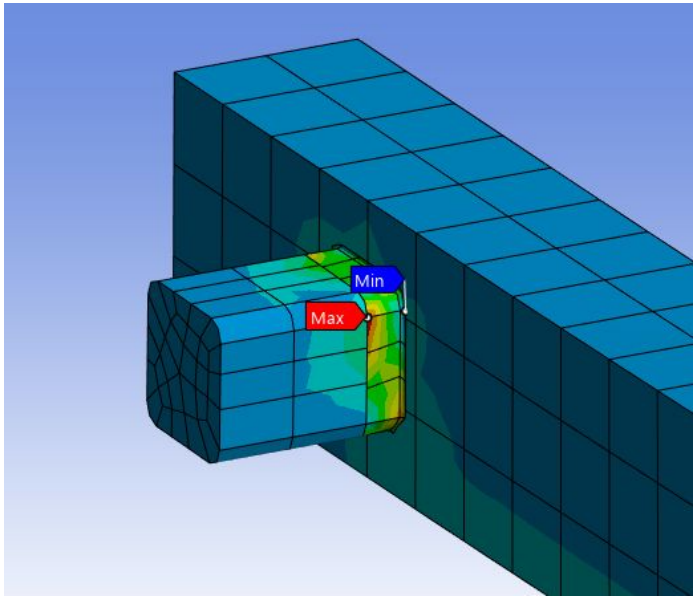
Normal Strain Contours





Maximum Principal Stress





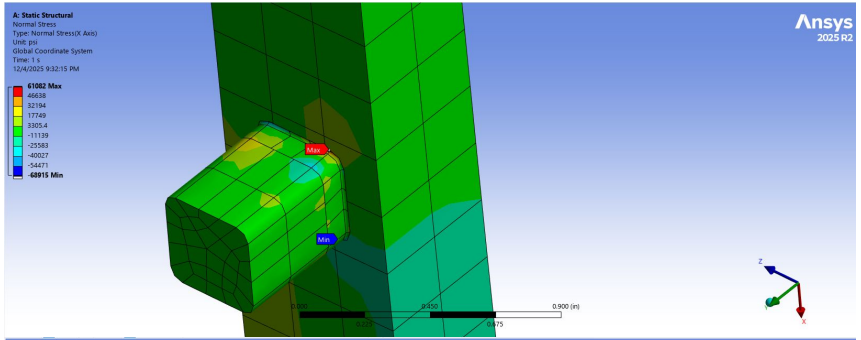
Results

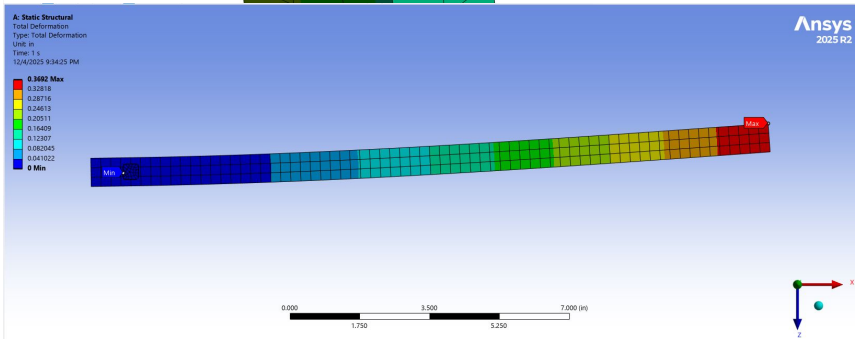
Max. Normal Stress : 61082 psi

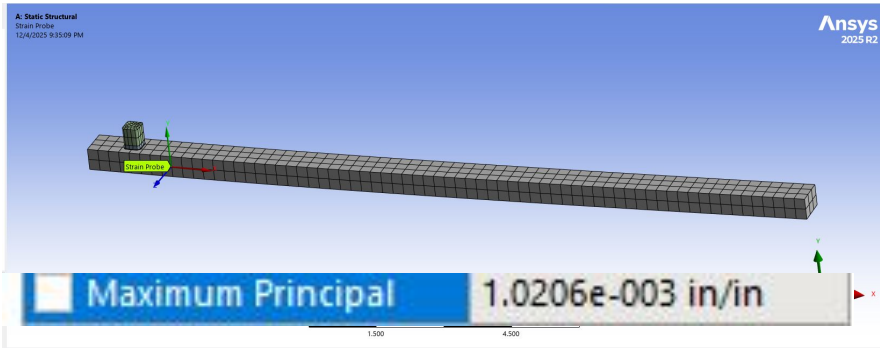
Deflection at Load Point: 0.3292 in

Strain at Strain Gauge: 1021 microstrain

Torque Wrench Sensitivity: 1.021 mV/V







Picking a Strain Gauge

Size Requirements: Must be smaller than .5” x 2”

Sensitivity Requirements: Strain range ~ 1000 microstrain or 0.1%

Select: **LWK-06-W250D-350 from DigiKey**

Strain Range is **0.5%** (5000 microstrain)

a) Not ideal, but the smallest available at DigiKey

Size is **.620” x .170”**

b) Well within the allowable size