

# Product Improvement: Counter Top Brackets

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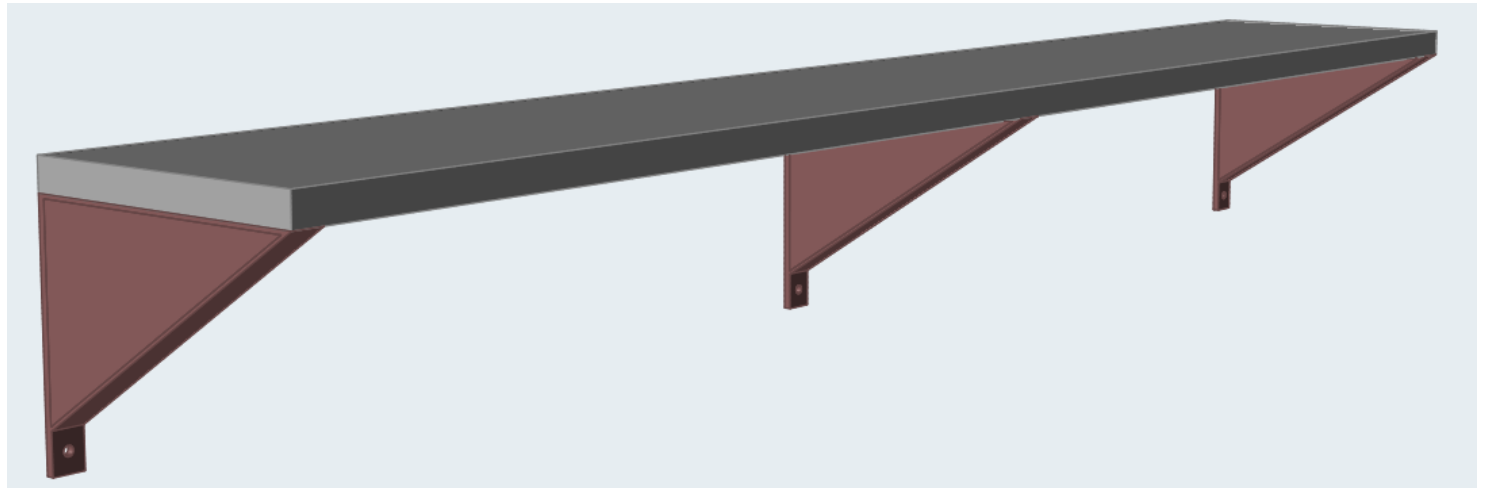
# Background

- Counter top in Westwood Apartments
  - Butcher block counter
  - 3 standard triangular shelf brackets
  - Can easily support 500+ pounds (2-3 people)
    - Over designed
  - Objective: reduce weight



# Methodology

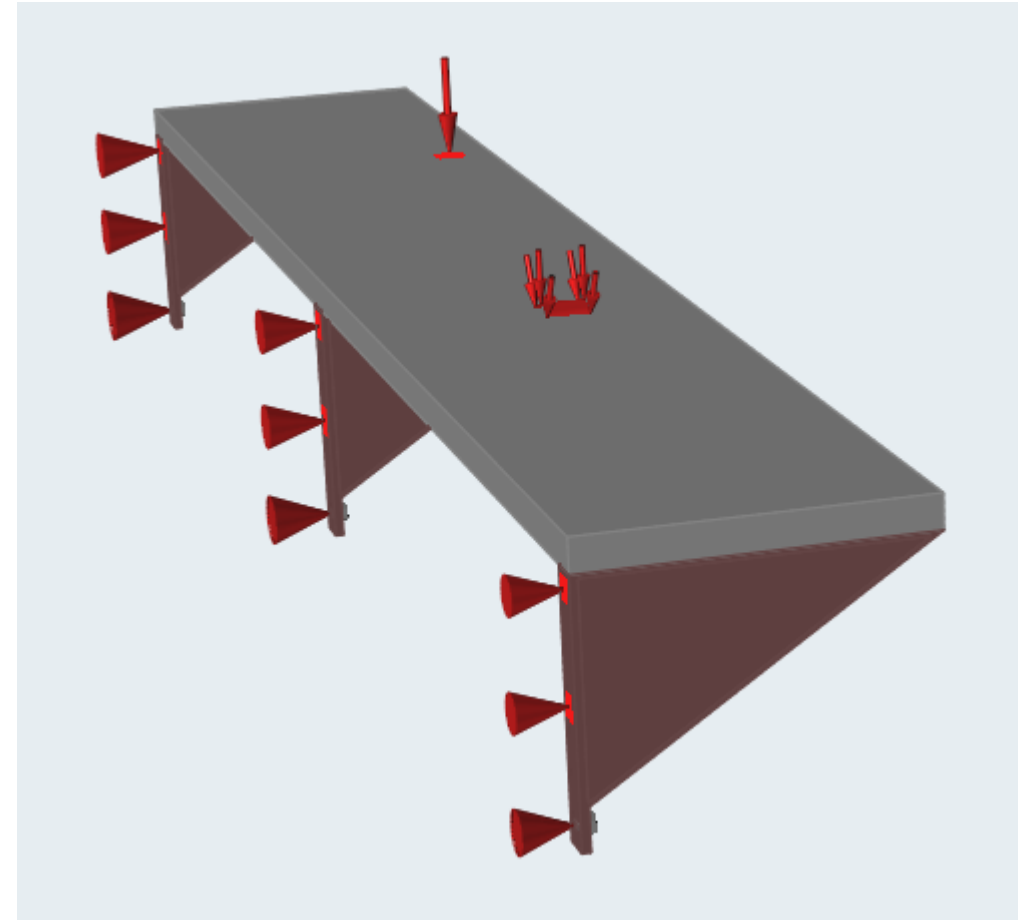
- Create counter top in Inspire
  - Geometry creation features
    - Lines
    - Rectangles
    - Circles
    - Intersections
    - Boolean subtract
    - Push/pull
    - Simplify
- Apply material properties
  - Brackets
    - Aluminum 6061
  - Counter top
    - Wood (custom material)
  - Bolts
    - Steel AISI 304



(holes plugged to create design space)

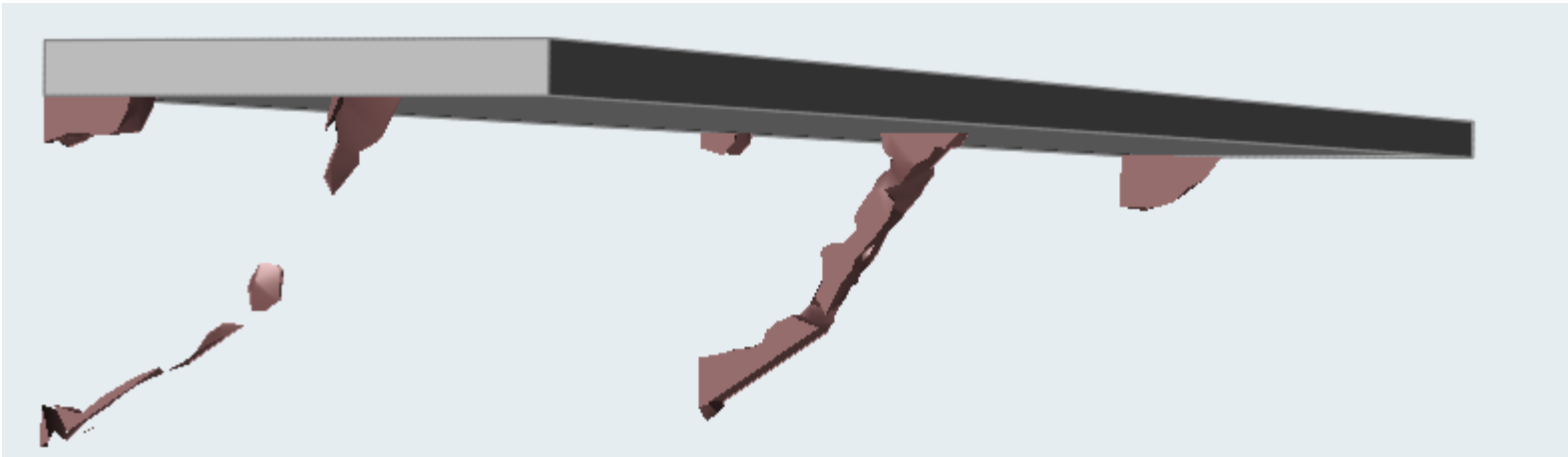
# Methodology (cont.)

- Apply supports
  - Brackets are bolted to and supported by the wall
- Apply loads
  - Pressure load (0.1 psi)
    - Over the entire top surface
    - The counter is randomly loaded by objects
  - Point load (500 lbf)
    - Simulate the weight of several people
    - Worst case scenario
- Apply contact
  - Between counter top and supports
  - Bounded contact



# Optimization

- Optimization methods
  - Minimize mass
    - 1.2 safety factor
    - Did not yield good results
  - Maximize stiffness
    - 20% of original mass
    - Yielded good results



Maximize stiffness

Run Optimization

Name: Counter

Type: Topology

Objective: Maximize Stiffness

Mass Targets: % of Total Design Space Volume

☒ 5 10 15 20 25 30 35 40 45 50%  
☐ 30

Frequency Constraints

☒ None  
☐ Maximize frequencies  
☐ Minimum: 20 Hz Apply to lowest 10 modes  
Use supports from load case: No Supports

Thickness Constraints

☒ Minimum: 0.015 m  
☐ Maximum: 0.024367 m

Speed/Accuracy

Contacts

☒ Sliding only  
☐ Sliding with separation

Gravity

Load Cases

Restore Export Run Close

# Results

- Weight was slightly reduced (but not significantly)
- Min safety factor increased
- Max displacement decreased
- Max stress decreased



Compare Factor of Safety							
Run	Load Case	Min Factor of Safety	Max Displacement	Max Percent of Yield	Max von Mises Stress	Mass Total	
Counter Max Stiffness Mass 20% (7)	Load Case 1	21.1	3.859e-004 m	4.73%	1.142e+007 Pa	2.567e+001 kg	
Counter (4)	Load Case 1	10.6	5.212e-004 m	9.39%	2.266e+007 Pa	2.610e+001 kg	

- Overall, the weight was slightly reduced and the product became stronger

# Final Product

- Further reduce weight by eliminating unconnected or small masses

