California State University, Long Beach
Mechanical and Aerospace Engineering

MAE490A Project: Extendable Skateboard

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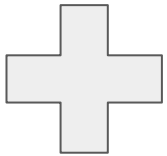
Proposed Concept

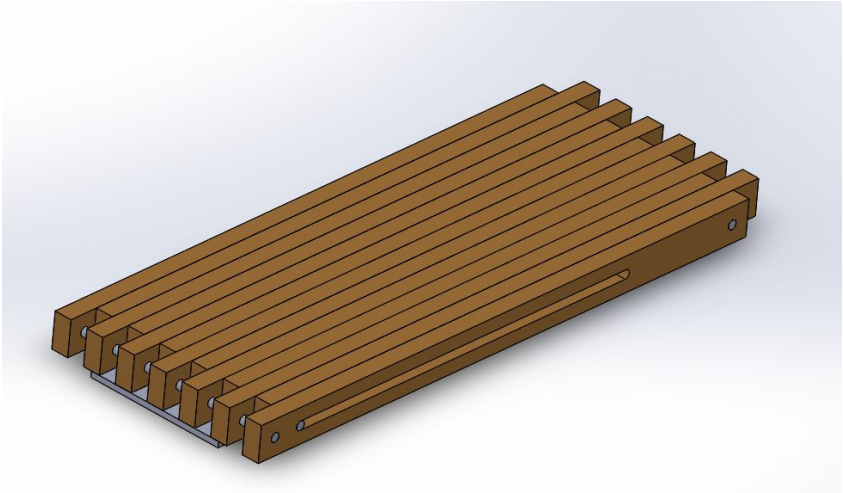
- Skateboard deck that can convert from a shortboard to a longboard
- Eliminates the need for purchasing both types of boards while providing the same performance for each board
- Used for transportation (no tricks)
- Deck can be used with standard off-the-shelf trucks and wheels

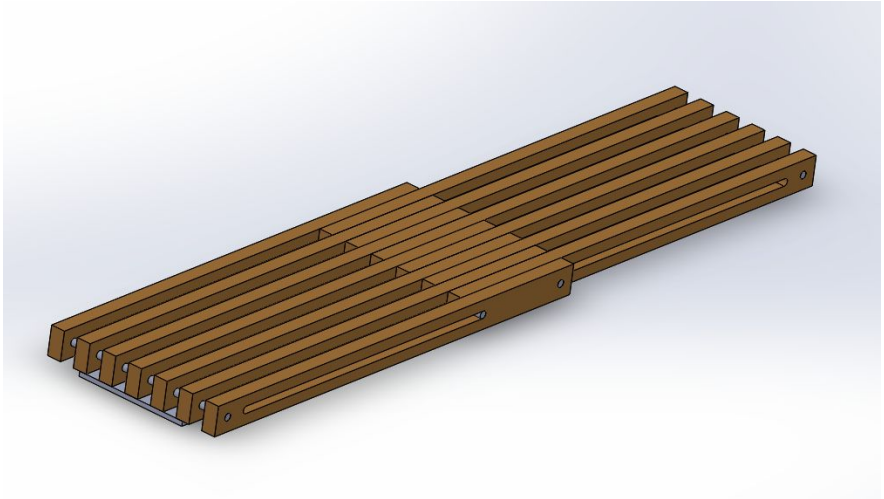


Design Considerations

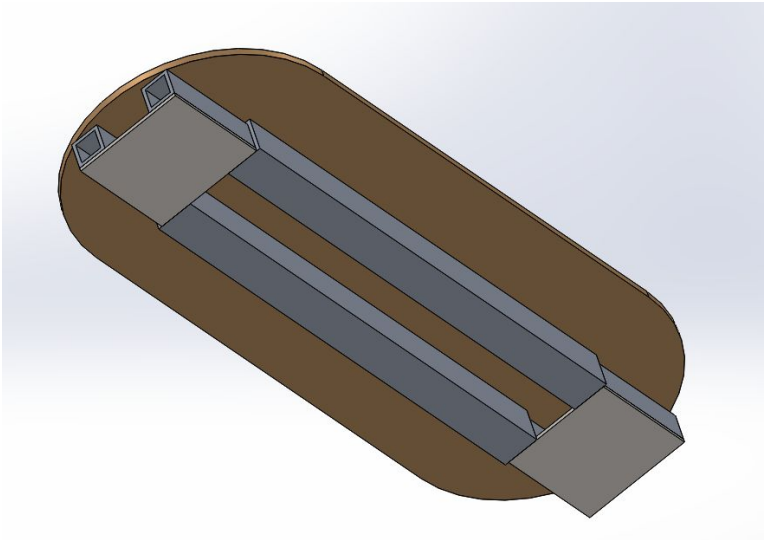
- Weight
- Board thickness
- Minimum and maximum length
- Ease of use
- Aesthetic
- Safety

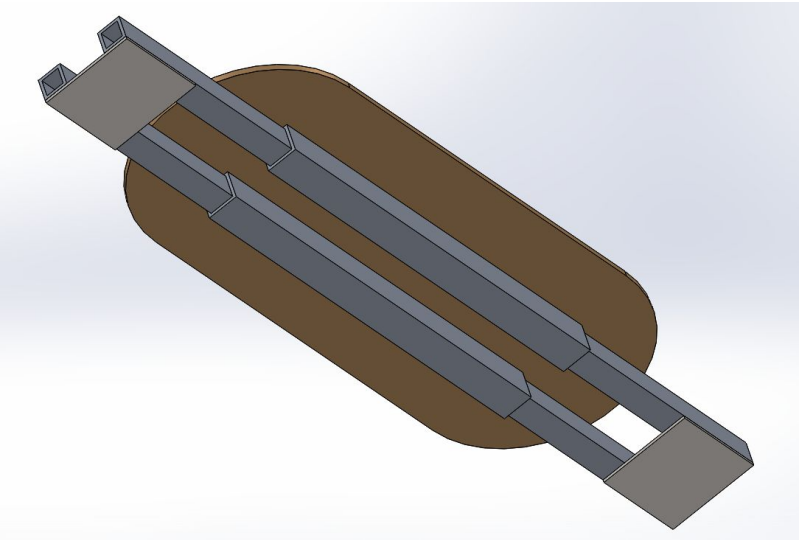
Design Concepts: Version 1



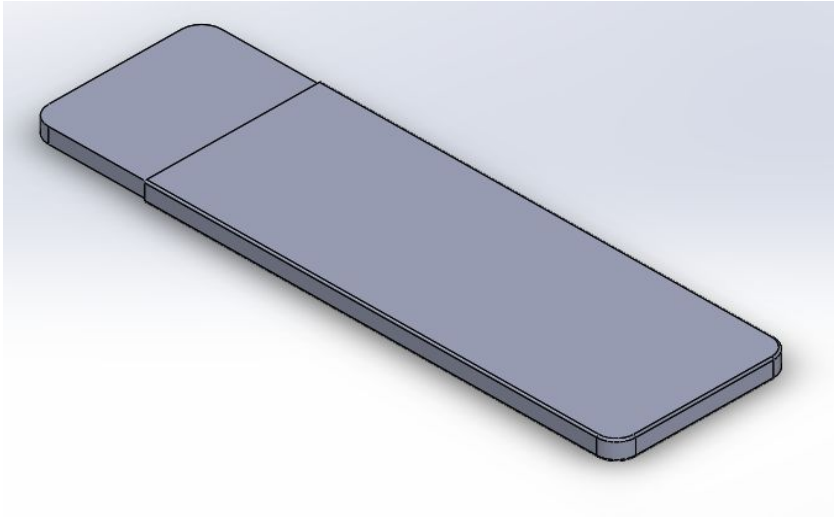


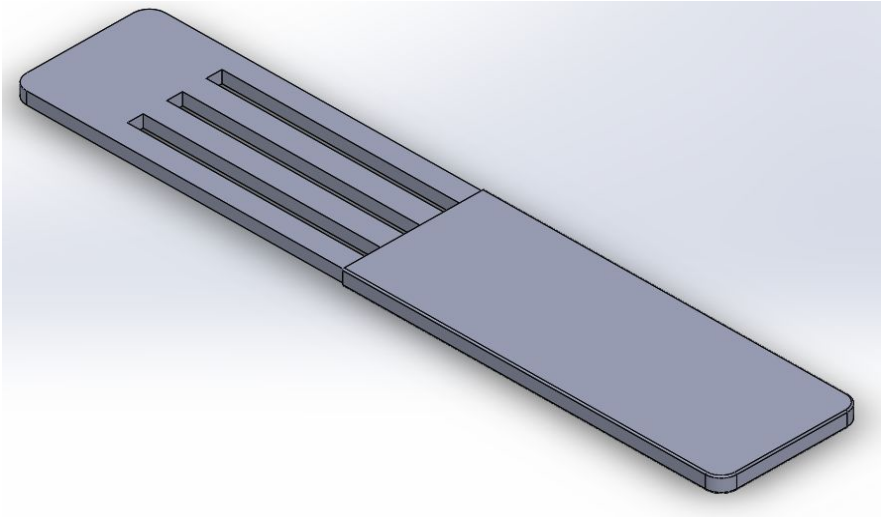
Design Concepts: Version 2



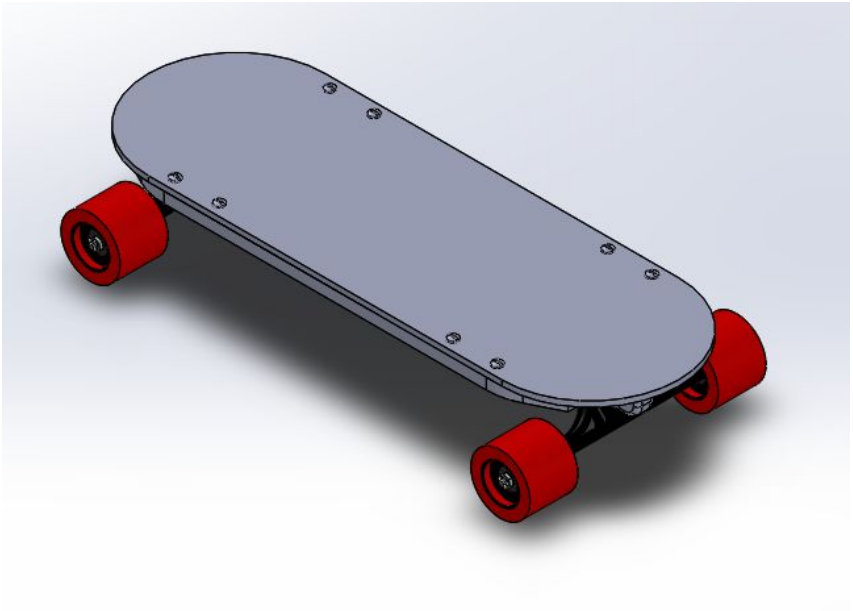


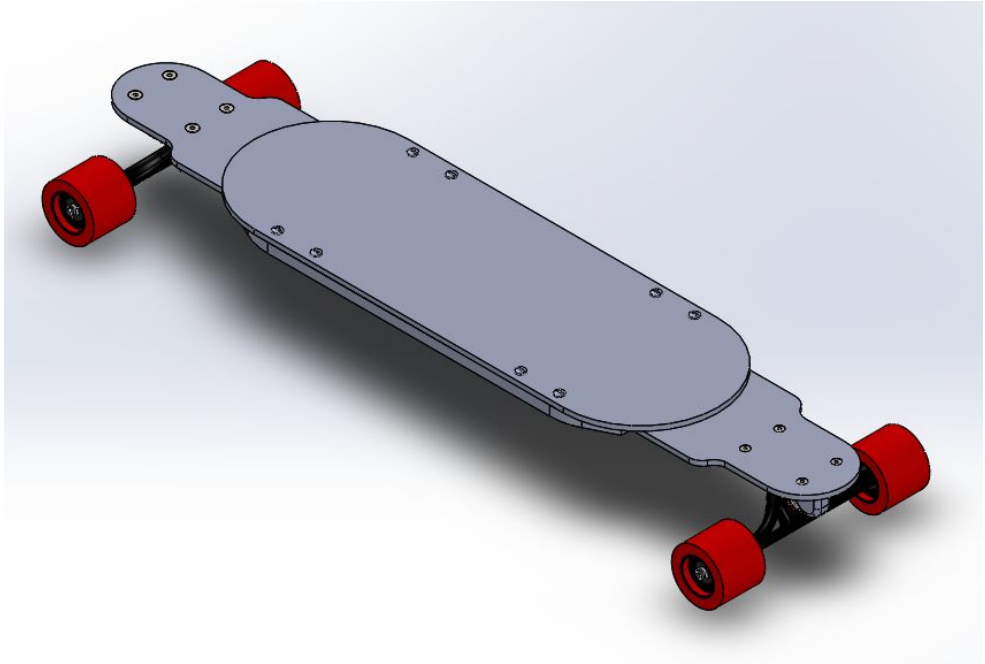
Design Concepts: Version 3



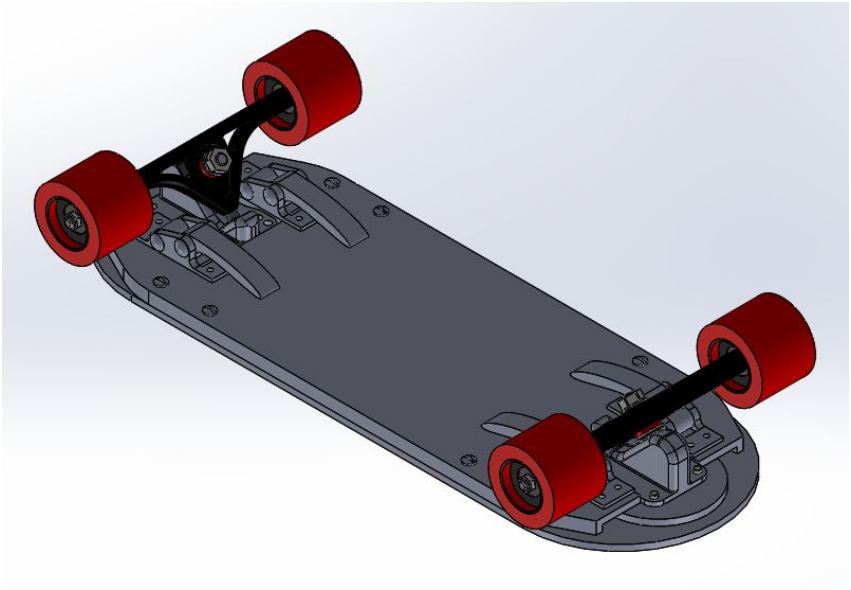


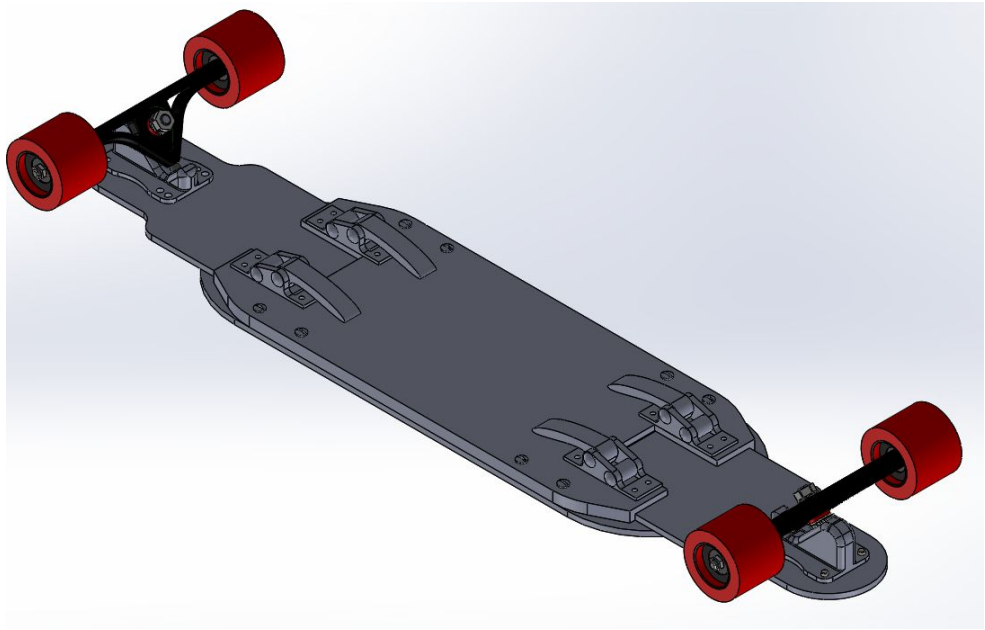
Final Design (isometric, top)





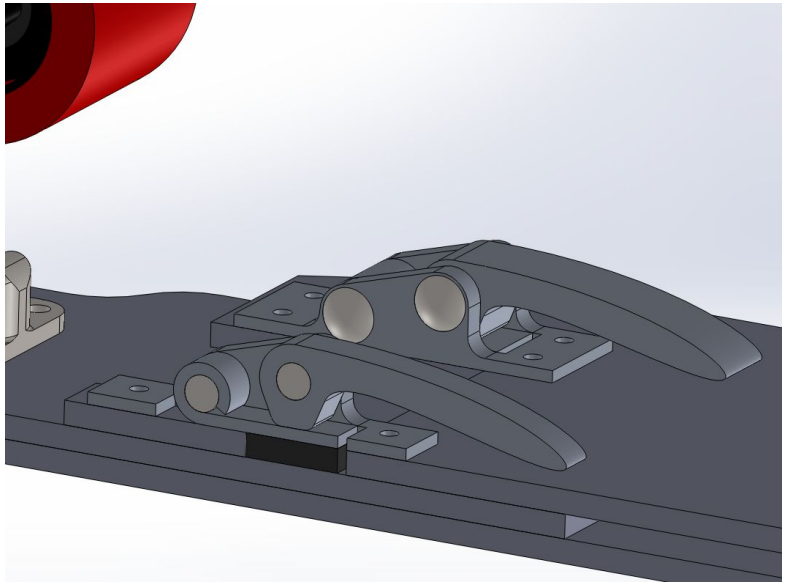
Final Design (isometric, bottom)



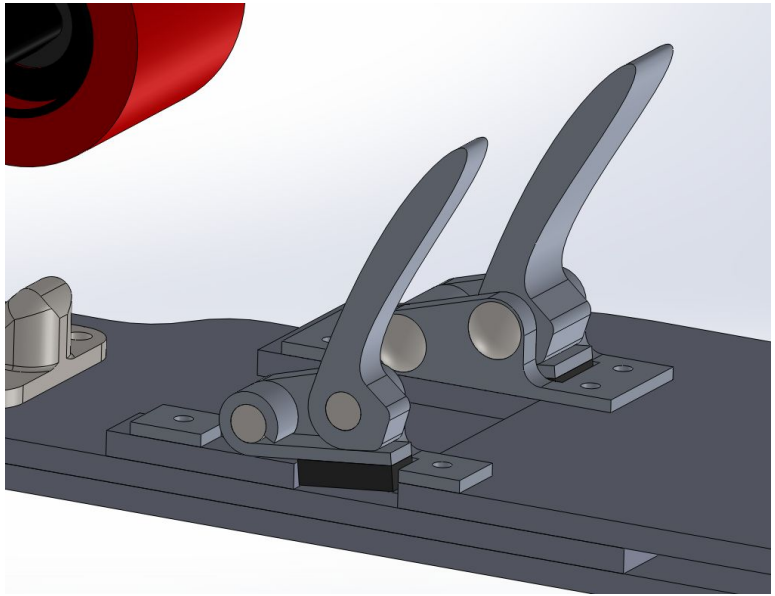


Final Design: Cam Clamps

- Critical component for holding extensions in place



Closed Clamp



Open Clamp

Critical Design Points

- Fixture points
  - Stress on extension at fixture
- Extension base
  - Moving parts; short ⟷ longboard
  - Load transfer between user and reaction force

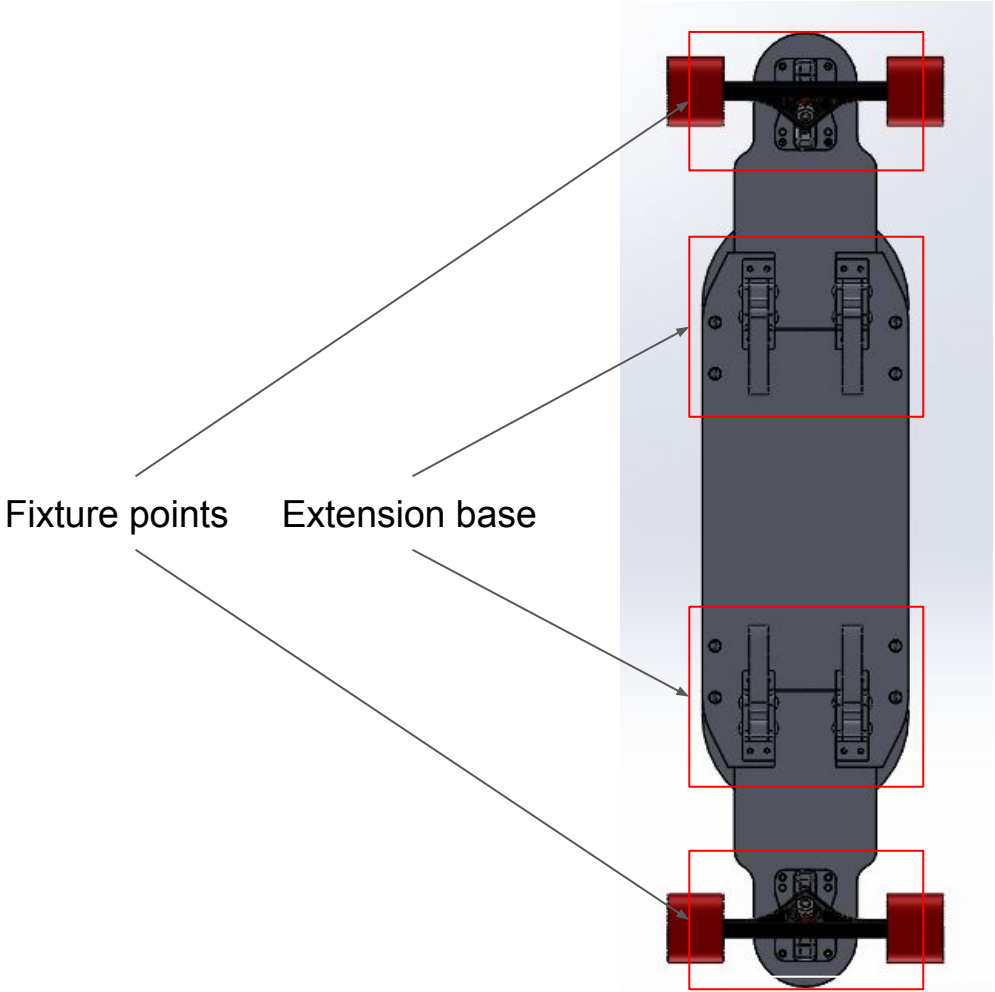


Figure: Bottom face of longboard assembly

Simulation Approach

- Emphasis on evaluating longboard configuration
- Assumed user weight of average American male (~200lb)
- Material initially based on existing skateboards
    - Light-weight metal as alternative

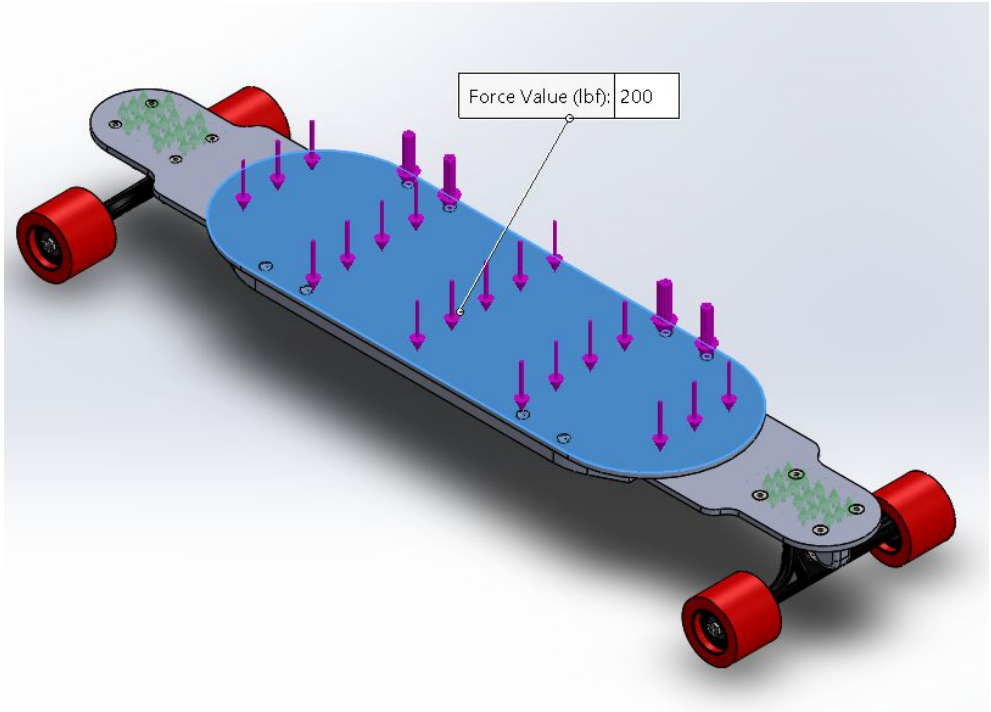


Figure: Conditions reflecting design approach

Key Measures & Simulation Conditions

- Measure product viability by:
  - Yield stress in direction of gravity
  - Deflection
  - Impact strength
- Fixture points
  - Truck base plates - extensions
  - Clamp - extensions
- Contact sets
  - Deck - housing
  - Housing - extensions

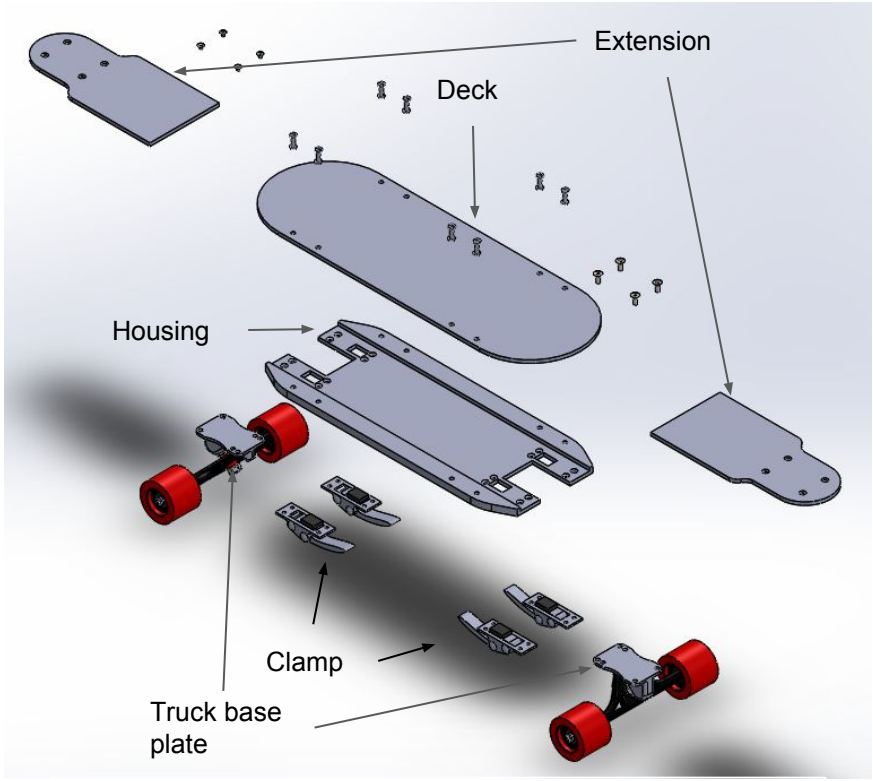
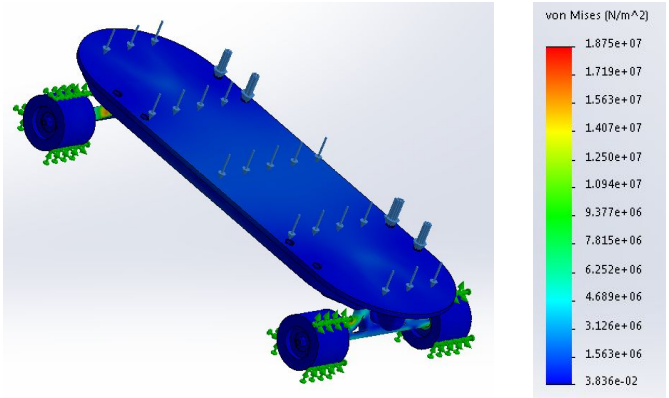
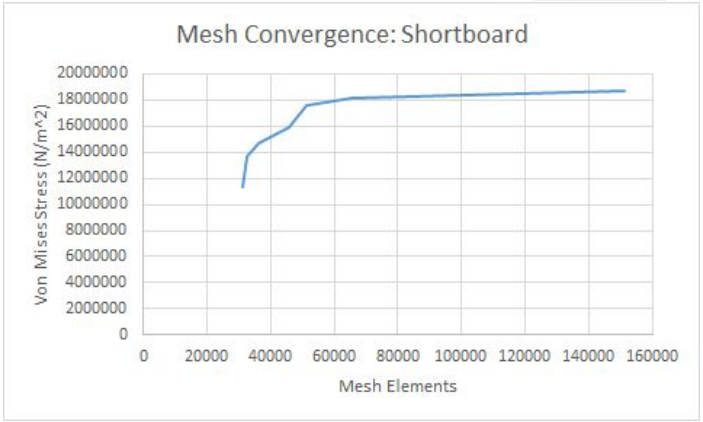


Figure: Exploded view of final assembly

First Simulation Results: Static Study Shortboard





Material used: Aluminum Alloy 6061

Force Applied: 200lbf normal to board surface

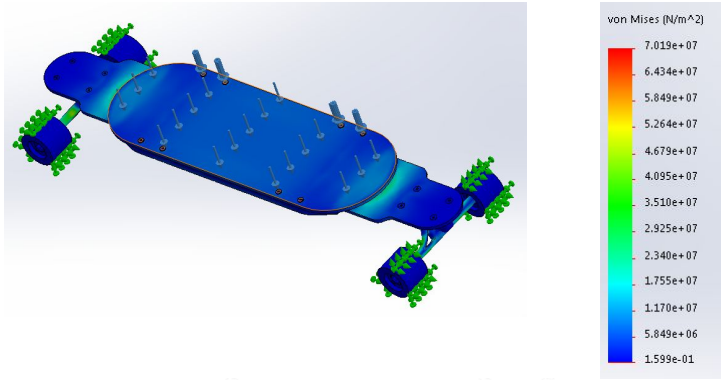
Fixtures: Wheels

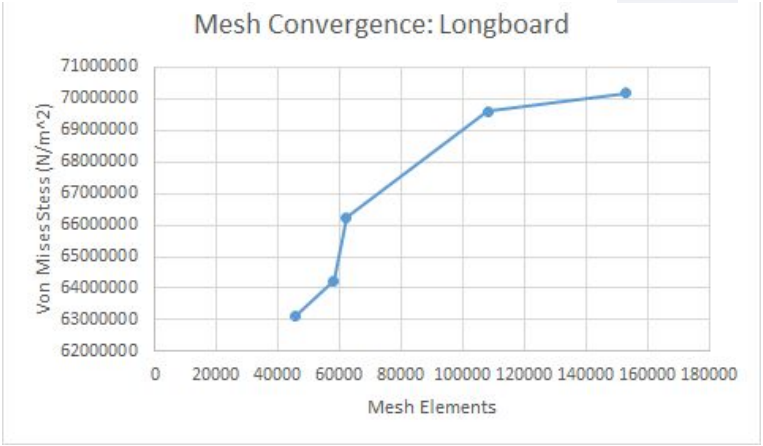
Mesh Type: Curvature based Mesh

Results:

- Factor of Safety - 10.0
- Max Deflection - 0.073 mm

Second Simulation Results: Static Study Longboard





Material used: Aluminum Alloy 6061

Force Applied: 200lbf normal to board surface

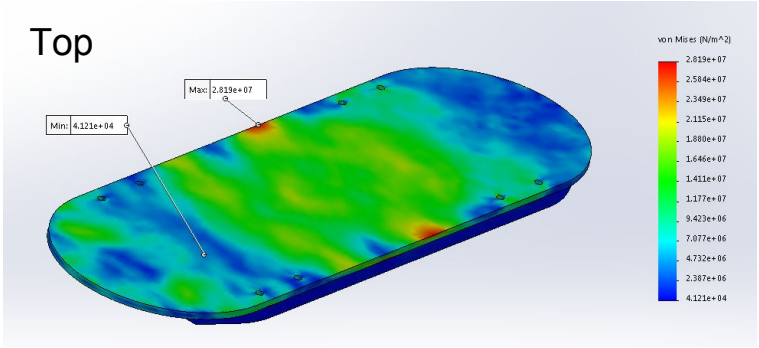
Fixtures: Wheels

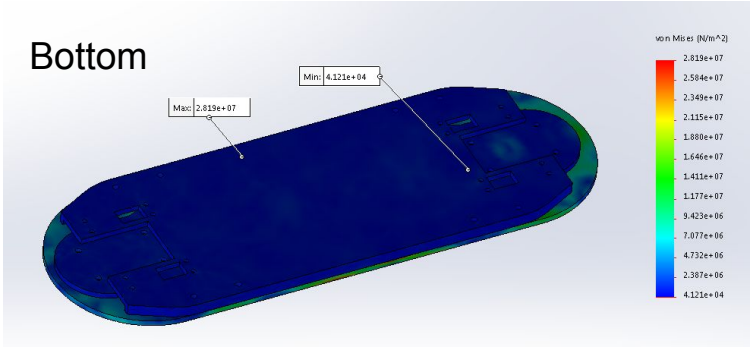
Mesh Type: Curvature based Mesh

Results:

- Factor of Safety: 0.86
- Max Deflection: 1.5 mm

Third Simulation: Drop Test Shortboard





Drop Test: 15mph on edge of board

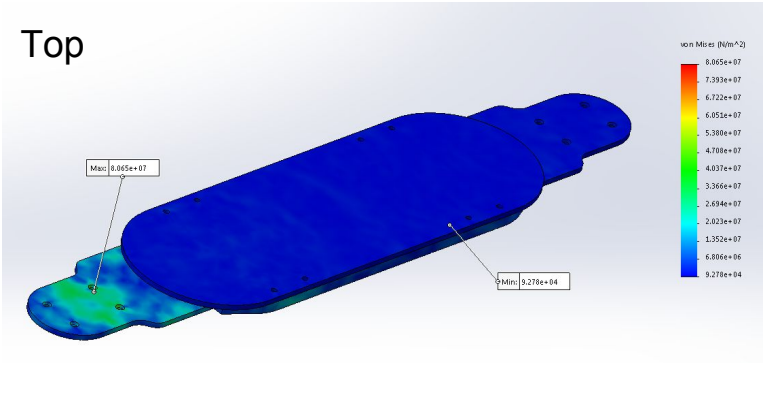
Max Stress: 2.819e+07

Material Yield Strength: 5.516e+07 N/m^2

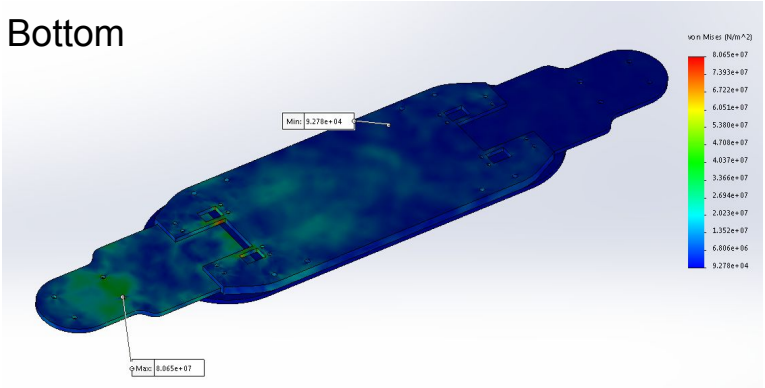
Mesh Type: Standard

Fourth Simulation Results: Drop Test Longboard

Top



Bottom



Drop Test: 15mph on edge of board

Max Stress: 8.065e+07 N/m^2

Material Yield Strength: 5.516e+07 N/m^2

Mesh Type: Standard

Conclusion/Improvements

- Design challenge primary in longboard configuration
- Design considerations
  - Geometry of model
  - Component thickness
  - Material selection
- Additional simulations
  - Torsional strength
  - Drop test
  - Mesh convergence
  - holding force of the clamp
- Explore composite materials to reduce weight & increase strength

Thank you