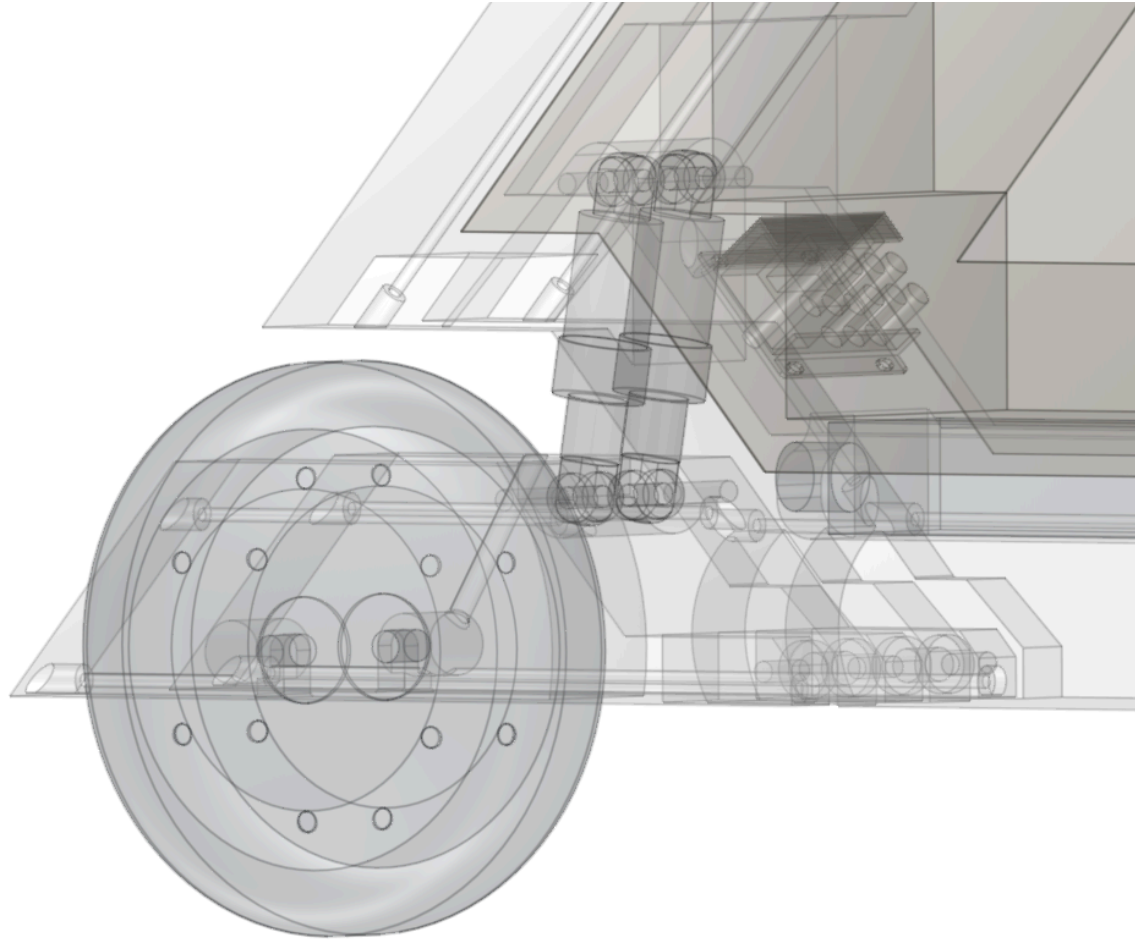


eMOPED: SAFETY SHEET



Vehicle Specs:

* OVERVIEW:

Motor: 350W

Battery: 36V, 7.8Ah

Top Speed: 19 MPH

Range: 18 Miles

Brakes: Drum (f), Electric (r)

Cumulative Weight Limit: 290 lbs

Weight:

Passenger Weight Limit:

Modes: Eco, Regular, Sport

Suspension: 30mm Fork (f), 15mm Dual Shock (r)

Material:

* FRAME:

KINGROON PETg Filament

Considered Filaments:

PLA

- Easy to print
- Low VOC and particle emissions
- 55-65 °C glass transition
- Low impact resistance

PLA-CF

- Steel nozzle required
- Medium VOC and particle emissions
- 62 °C glass transition
- Low impact resistance

PETg

- Easy to print
- Medium VOC and particle emissions
- 75-85 °C glass transition
- High impact resistance

PET-CF

- Steel nozzle required
- Medium VOC and particle emissions
- 75-79 °C glass transition
- Very high impact resistance

ABS

- Harder to print
- High VOC and particle emissions
- 105 °C glass transition
- Very high impact resistance

* HARDWARE:

Frame Fastening Rods

- A2 Stainless Steel
- M5
- 0.8mm threads
- x12

Frame Fastening Nuts

- Carbon Steel
- M5
- 8mmx4.7mm
- x24

Kinematics Axles

- Carbon Steel
- 8mmx150mm
- x3

Kinematics Bearings

- 608 ball bearings
- x4

Headset Bearings

- 6806-2RS ball bearings
- x2

* MISC:

Motor

- 36V 350W 8in Generic

Controller

- PN: YKSMD06ZZ01-A

Battery

-PN: ES-10S3P

Speedometer PCB

-Dashboard Display Circuit Board Generic

Throttle

-M365 Thumb Throttle

Charger

-42V 2A 8mm port

Solid FEA Analysis:

* Material Properties:

Material name: PETG_custom

Density (ρ) = 1200 kg/m³

Young's modulus (E) = 1.8e9 Pa

Poisson's ratio (ν) = 0.35

Thermal expansion (α) = 8e-5 1/K

Specific heat (Cp) = 1100 J/(kg·K)

Thermal conductivity (κ) = 0.17 W/(m·K)

κ_x = 0.17 W/(m·K), κ_y = 0.17 W/(m·K), κ_z = 0.17 W/(m·K)

Emissivity (ε) = 0.92

Transmissivity (τ) = 0

Heat of formation (Hf) = 0 J/kg

Speed of sound = 2250 m/s

Molar mass = 4e+4 kg/kmol

Electric conductivity = 0 S/m

Relative permittivity = 2.8

1200 N net applied force

Simulation was run with headtube as a fixed point, rotational connections through 3 suspension points, and forces applied to the rear axle and headset.

* Analysis Results:

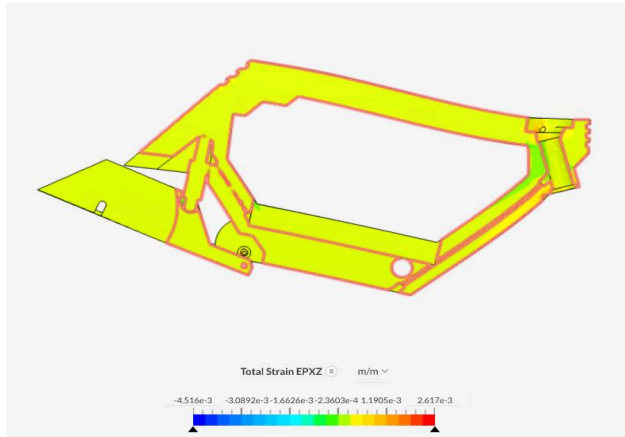


Fig 1

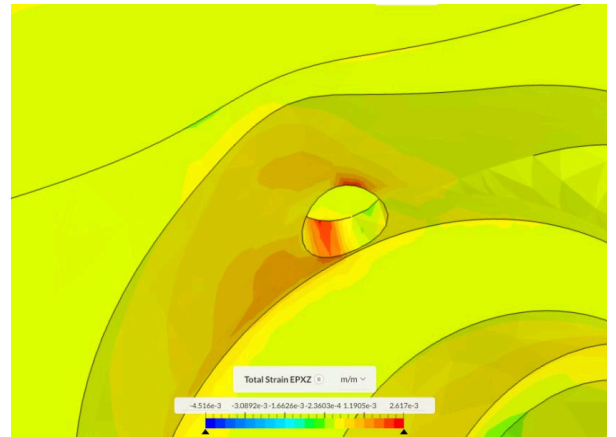


Fig 2

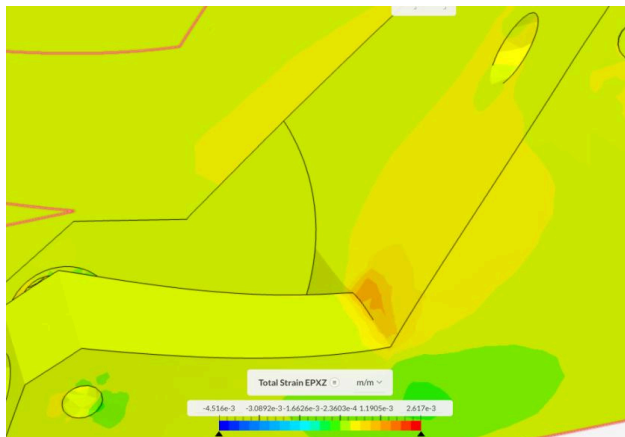


Fig 3

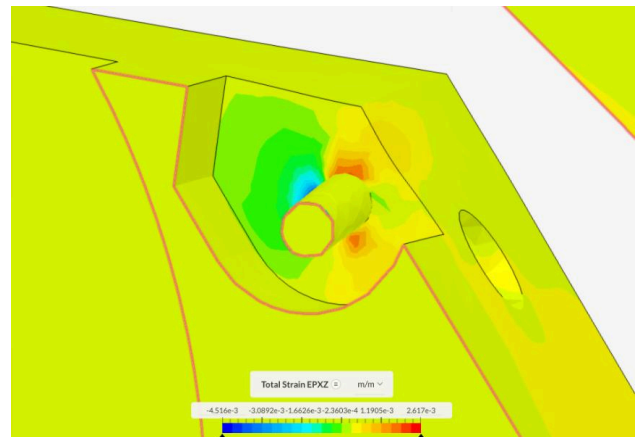


Fig 4

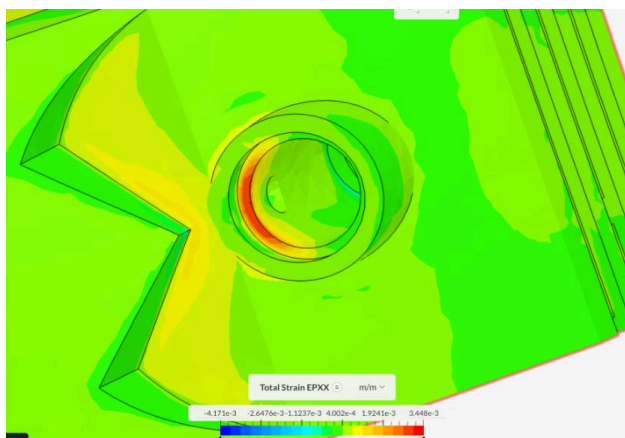


Fig 5

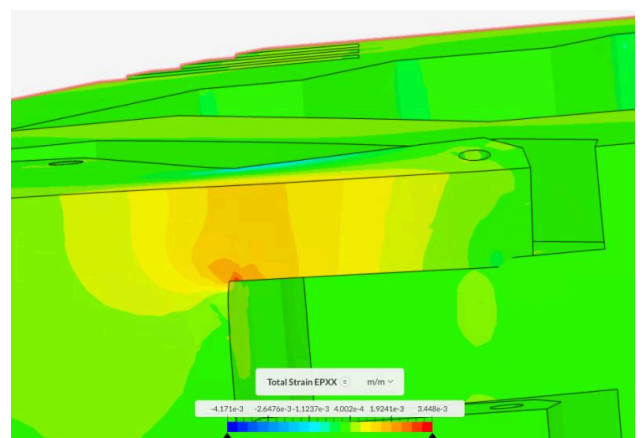


Fig 6

* Analysis Conclusion:

Overall, PETg is a flexible material. This means it will deform before it fails. While this is good for preventing catastrophic fractures, it is not ideal for something with lots of mechanical interaction that requires tolerances to be maintained.

Solid internal ballasts are placed in areas that have high Von Mises stress, and in areas that show massive deformation, even if that section has low Von Mises stress.

Fig 1:

Section cut frame under load. Ballasts to be integrated at top and bottom of headtube, in suspension pivot arms.

Fig 2:

Extremely high stress in port for throttle and brake cable to display PCB. External fillet to be integrated in display PCB well.

Fig 3:

High stress at top of suspension pivot arms. Ballasts to be integrated in each arm, extending into the larger volume.

Fig 4:

Extremely high stress in shock mounts. Ballasts to be integrated connecting inner walls to outer walls.

Fig 5:

Extremely high stress in headset bearings. Ballasts to be integrated connecting bearing cups to toptube and downtube.

Fig 6:

High stress at bottom of suspension pivot arms. Ballasts to be integrated in each arm, extending into the larger volume.

Infill / Print Orientation:

* Infill:

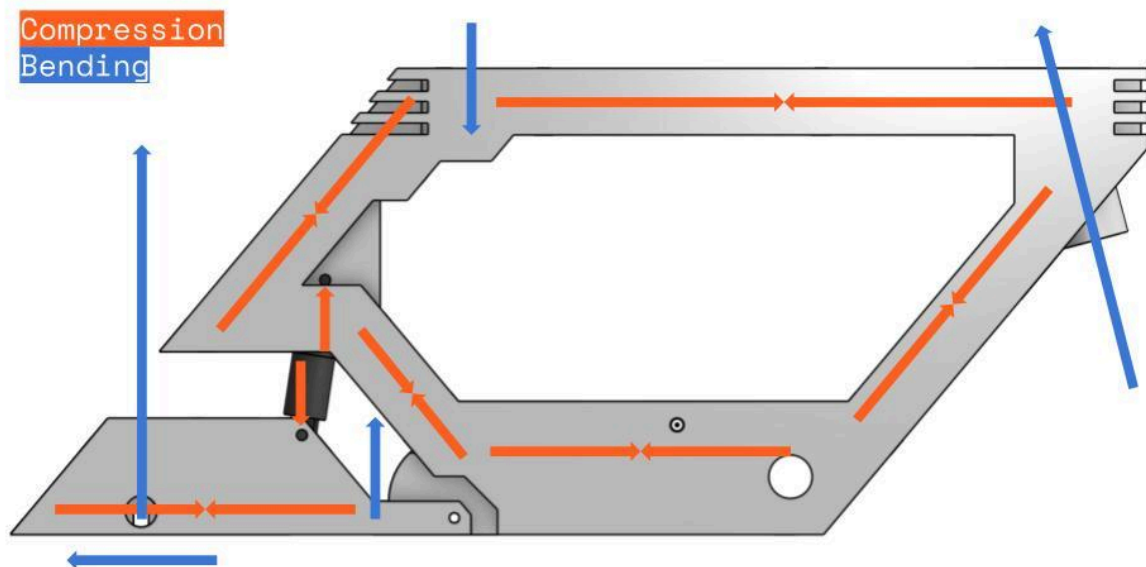
Cubic @ 40%

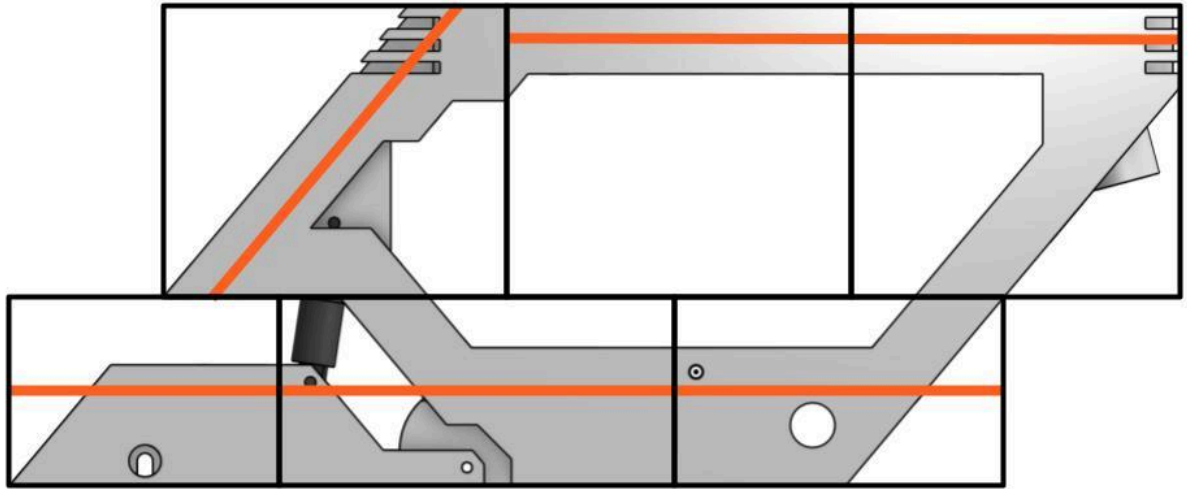
Cubic is used as it is very strong in each direction, but is much faster to print than gyroid. Internal solid ballasts placed at high-stress areas. Fillets are used to more effectively transfer force.

* Print Orientation:

Overall strength is completely dependent on infill and print orientation. Tension load should be parallel to layer lines for maximum strength. Bending load should be normal to layer lines for maximum strength.

By drawing forces on the frame, optimal orientation can be devised:





Conclusion:

* Possible Failure Points:

Frame Fracture

- Ineffective print settings
- Moisture in filament
- Excess forces

Frame Melt

- Electrical issue
- Over use

Kinematic Failure

- Improper bearing tolerance
- Excess suspension cycling (offroading)
- Stanchion seal failure
- Shock mount pin deformation

* Disclaimer:

This vehicle was not reviewed by any PE or any transportation organization. Operating this vehicle may result in injury or death.

How To Ride:

1:Click Helmet

2:Push Button

3:Twist Throttle