

Basic Utility Vehicle: 2008 Design Upgrades

Lindsay Emerson

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Objective:

- Modify the design of the 2008 BUV to remedy problems that were a part of the vehicle's original form.
- Build and test the BUV to prepare it for possible field deployment to a 3rd world country.



2009 Contest Review:

- Endurance Run
- Acceleration Test
- Agility Test
- Obstacle Course
- Oral Reports
- Mogul Field
- Mud Pit
- Sheared Axle on the 1st day.
- Slipped Axle on the 2nd day.
- Throttle cable snapped on the 2nd day.
- Earned 3rd place in the Open Class Competition.

Skills Learned:

- Pro Engineer Software
- ANSYS 3D Analysis Package
- Machining and vehicle building skills

Special Thanks:

- Advisor - Dr. John Lumkes
- Shop Head – Scott Brand
- Shop Staff – Gary Williams
- Pro E Teacher - Jacob Oswalt
- Grad Students from the Hydraulics Lab
- 2009 Design Team
- 485 Professor - Dr. Joseph Irudayaraj

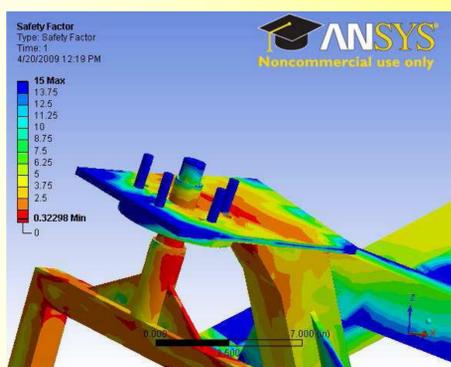
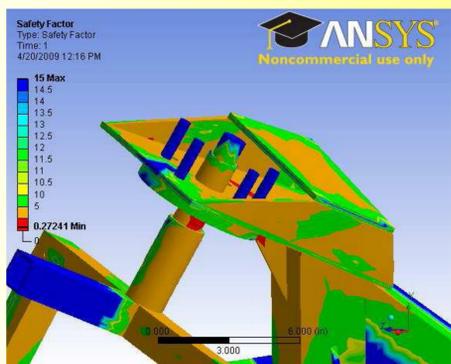
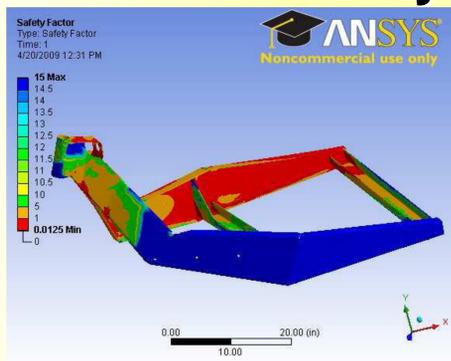
Front End Design Work

Original Design:



- Front plate
 - Flexed to stretch.
 - Deformed in multiple locations.
- Could not withstand a combination of vertical and lateral forces.
- The 1/4" plate was not strong enough.

Finite Element Analysis on Design Iterations:



- Prototype front frame in computer testing proved it could not withstand its designed purpose.
 - 1.5g vertical impact
- Single gusset with box was not long enough to provide support to the plate when tested at 1/4".
 - 3g 45° impact
- Pipe reinforcement was not long enough to provide proper support. This was also tested with a 3/8" plate.
 - 3g 45° impact

Final Solution:



- Increase plate thickness to 3/8".
- Add angled gussets from neck of the front frame to the plate.
- Remove 3 inches from the neck to increase clearance and reduce moment.

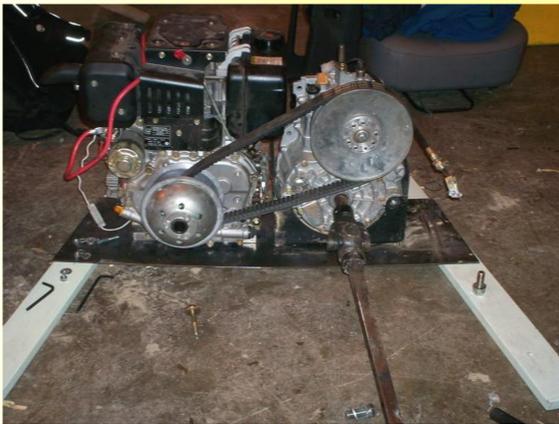
Transmission Mount Design

Original Design:



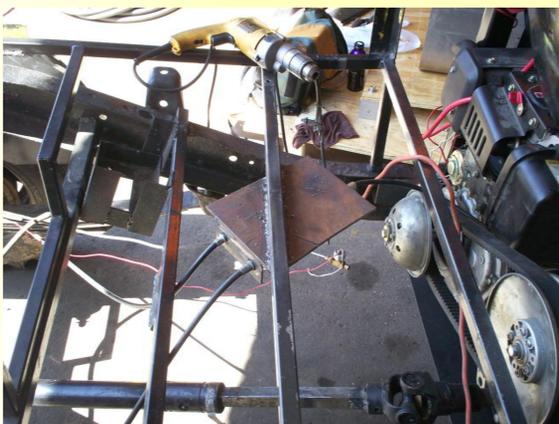
- Empty space shown used to hold the transmission.
- Transmission hung 4 inches below frame rails.
- Created clearance problems for the vehicle on uneven terrain.

Final Solution:



- Transmission was raised to level with the engine.
- Center pulley spacing was kept constant
- Deformation shown was corrected with a 1 inch square tube welded to the bottom of the plate.

Unforeseen Problems:



- Angle on the drive shaft became too steep. Thus the rear differential had to be rotated to reduce the angle.
- Brake pedal had to be removed and only one pedal for both rear brakes.
- Emergency brake lever and cable were moved around the transmission.
- Battery holder had to be moved to clear the lift in the drive shaft.
- Bed had to be cut and patched to make room for the battery and the parking brake cables.