Baja SAE: Powertrain

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Abstract

Baja SAE is an international collegiate competition in which University of Utah will field a team for the **first time in a decade!**

The competition involves designing and manufacturing an offroad vehicle to compete in multiple events including:

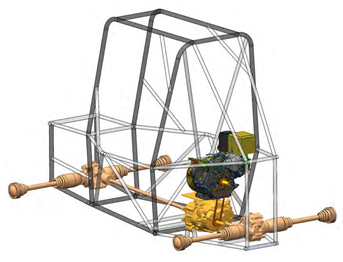
- Endurance Race
- Acceleration
- Rock Crawl
- Maneuverability
- Hill Climb

Our group has been tasked with designing, manufacturing, and installing the **powertrain** components of the vehicle.

What are Powertrain Components?

Transmission: Transfers and adjusts engine power to the drivetrain, allowing speed and torque control.
Driveshafts: Transmit rotational power from the transmission to front and rear differentials.

Differentials: Distribute torque between left and right wheels, allowing them to rotate at different speeds during turns.



CV (Continuous Velocity) Axles: Deliver power from the differential to the wheels while accommodating suspension movement and steering angles.

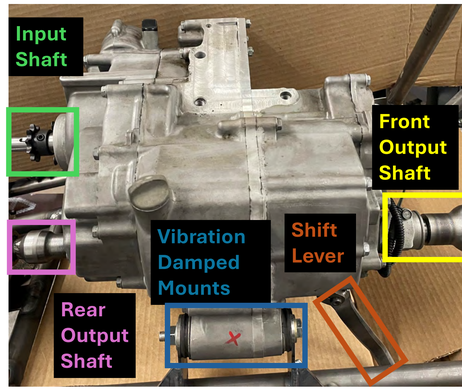
Transmission

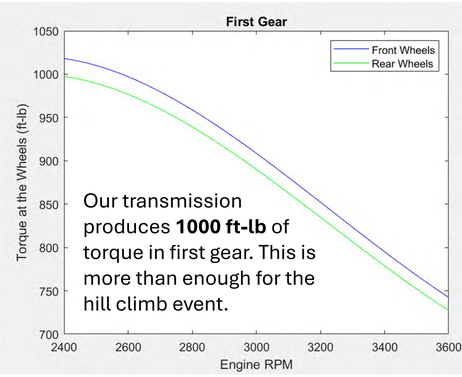
Requirements:

- Existing solution due to lack of funding and time
- **14 HP** capability
- **4WD** capability
- Reverse gear
- Vibration dampened mounting
- Space constraint from frame and other components
- Minimum Torque of **306 ft-lb** for hill climb event

Solutions/Results:

- We adapted a Honda Rancher transmission to fit our needs. **32 HP** capability . The sequential, 5-speed, manual transmission is **simple** and **inexpensive**
- Built in reverse gear eliminated need for transfer case
- **Dual output** shafts achieve 4WD
- Compact transmission package does not interfere with frame or other components.
- Rubber mounts dampen vibrations
- Simulated transmission 1st gear output torque proves hill climb capability





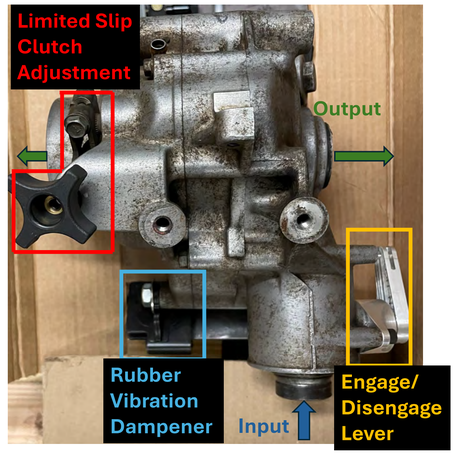
Differentials

Requirements:

- Existing solution due to lack of funding and time
- **14 HP** capability
- Lockable in the front and rear
- Independent disengagement for different events
- Space constraint from frame and other components
- Vibration dampened mounting

Solutions/Results:

- Obtained Kawasaki Brute Force differentials for front and rear which are inexpensive and accomplish all our goals
- Adjustable slip clutches within the differentials allow for limited slip and completely locked functionality
- Modified differential by adding an engage/disengage mechanism
- Rubber mounts dampen vibrations



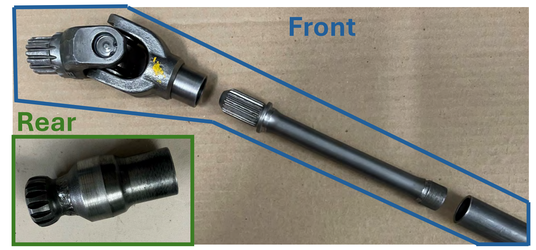
CV Axles / Drive Shafts

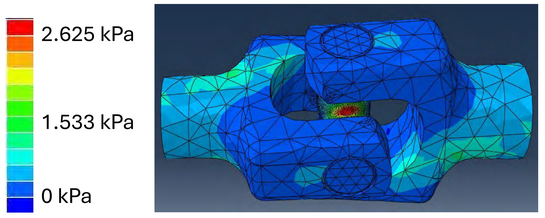
Requirements:

- Misaligned transmission output and differential input
- Must match articulation points of CV axles to suspension
- Spline features must fit our differentials

Solutions/Results:

- U joints on both ends of driveshaft which connects misaligned input and output.
- Cut and extended stock CV axles to align with suspension.
- Utilized OEM spline features by cutting and welding them to our shaft





Based on a worst-case scenario where the engine stalls at full speed. Applying a 1355 N*m torque on the driveshaft. The max stress of 2.625 kPa is far below the yield stress of 420000 kPa (420 MPa) for AISI 4340 Steel.