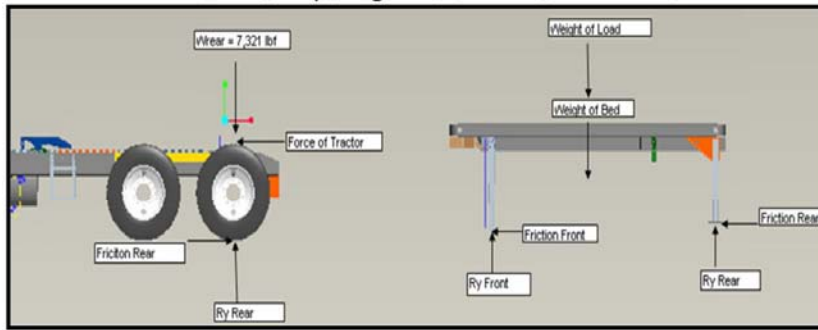
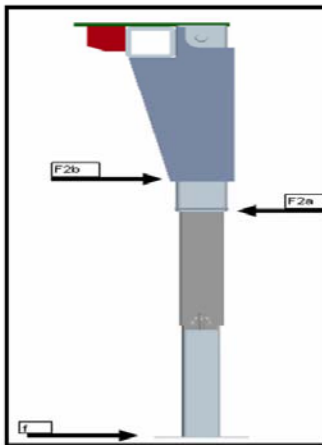


### Free Body Diagram: Overall Mechanism



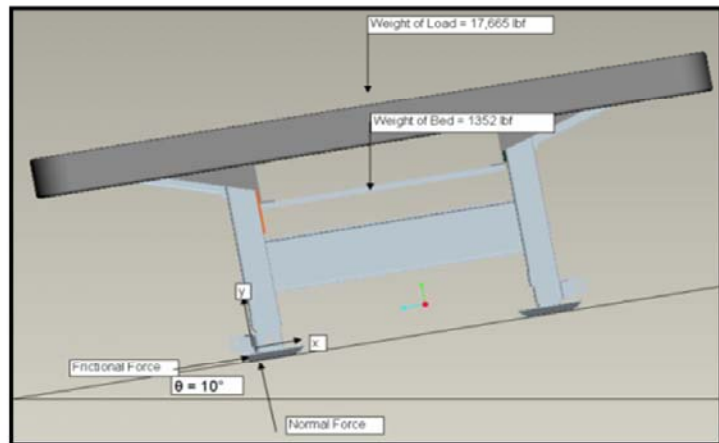
- The forces were determined by simplifying the design to analyze of forces that the semi-tractor and the detachable bed experienced.
- The worst case loading scenario was the magnitude of the forces that were applied to the system.
- The worst case loading scenario assumed that the system would be able to handle the regular day to day loads.

### Free Body Diagram: Front Outrigger



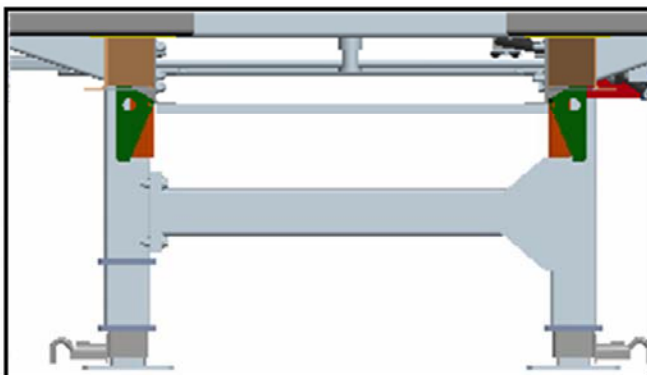
- The forces acting on the front out rigger was broken into 3 different reaction forces:
- $f$  was the force applied at the bottom of the jack, which was calculated to be 5,800 lbf.
- $F2a$  was the reaction force that was applied in the positive X-axis, which was 9,316 lbf.
- $F2b$  was the reaction force that was applied in the negative X-axis, which was 7,753 lbf.

### Free Body Diagram: Rear End



- The forces in this free body diagram (FBD) represented the worst case loading scenario that was expected.
- The worst case loading that the detachable bed was expected to experience was when it would be loaded with 19,000 lbf of vertical force, and when the bed was on a hill with an angle of  $10^\circ$  to the horizontal.
- The 19,000 lbf load was composed of 17,665 lbf, which was 5 seed corn pallets and 1,352 lbf, which was the weight of the bed.
- The lateral friction force was the force that was of most concern. If this force was too high then it could snap the legs off of the detachable bed causing a massive failure.

### Connection Type: Weld Connections



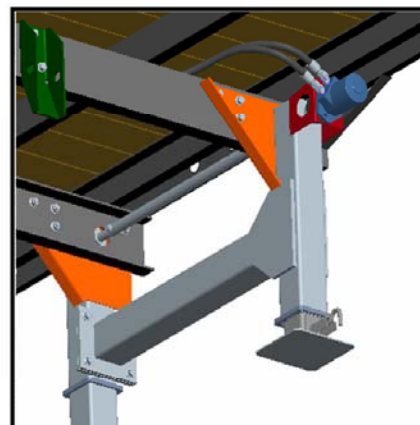
- The formula to calculate the stress in the welds is shown below:  

$$\sigma_w = \frac{(M)}{(Z_w W)}$$

$$\sigma_w = \text{Stress (psi)}, M = \text{Moment (lb-in)},$$

$$Z_w = \text{Section Modulus (in}^2\text{)}, W = \text{Weld Throat (in)}$$
- The maximum stress that the weld to hold is 5,000 psi for static loads and 14,000 psi for dynamic loading conditions.

### Connection Type: Bolt Connections



- The clamp loads (CL) were determined by the FBD's of the system to hold the assembly together.
- The bolted connections are held by SAE Grade 5,  $\frac{1}{2}$ "-13.
- The CL for each bolt is 9,050 lbf.
- The dry tightening torque for each bolt is 75 ft-lbf.