KILLER BEES 33

Notre Dame Prep High School
Auburn Hills, Michigan

FIRST

6x6 with articulating Center-wheel and CG Migration

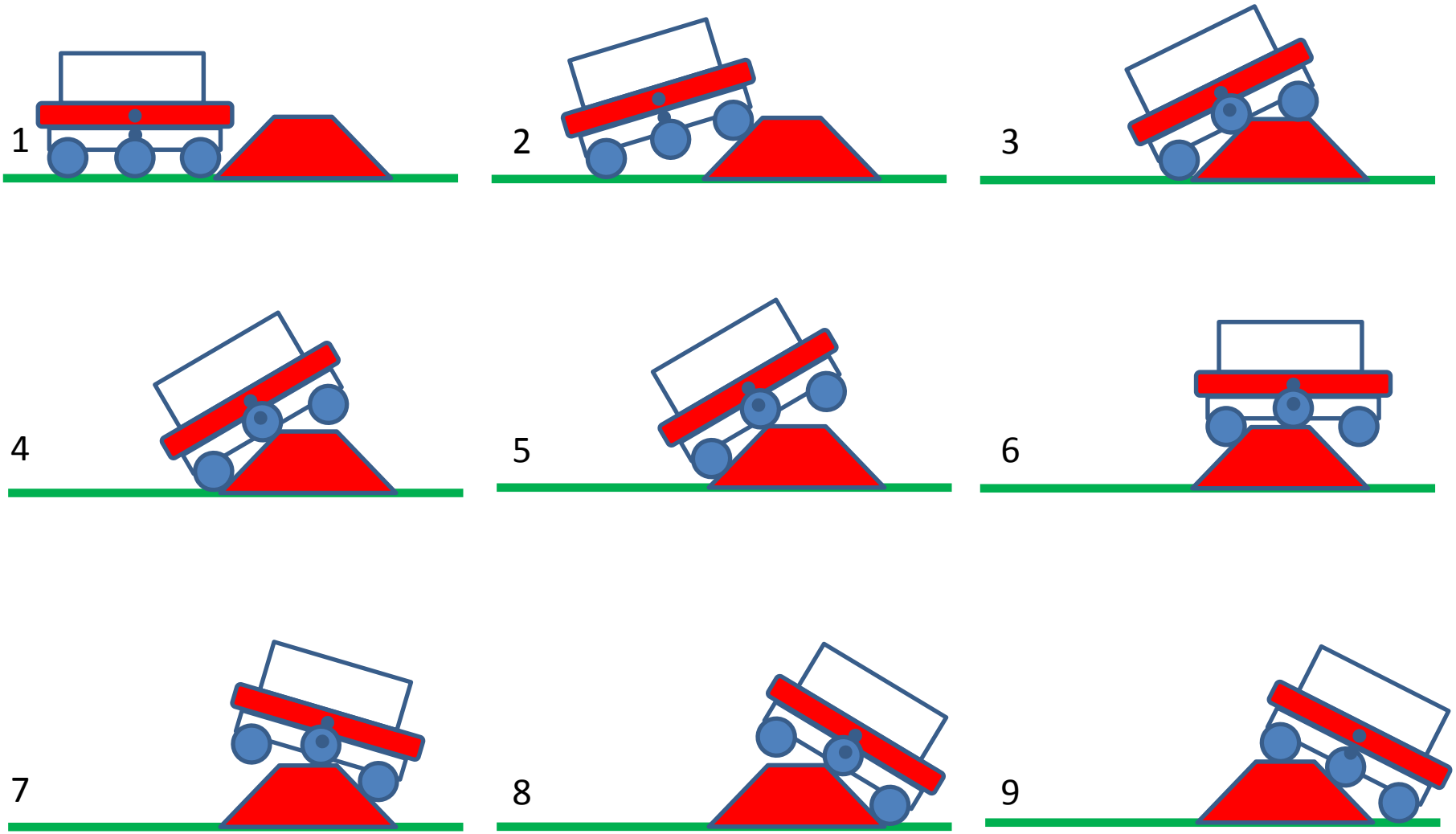
Options

- 4x4 long wheel base most stable design for going over bumps
- 6x6 drop center usually best compromise (traction vs. maneuverability vs. simplicity)
- 6x6 drop center will have Dramatic CG migration going over the bump (paper posted on Chief Delphi).
- Solution: 6x6 with articulating center wheel

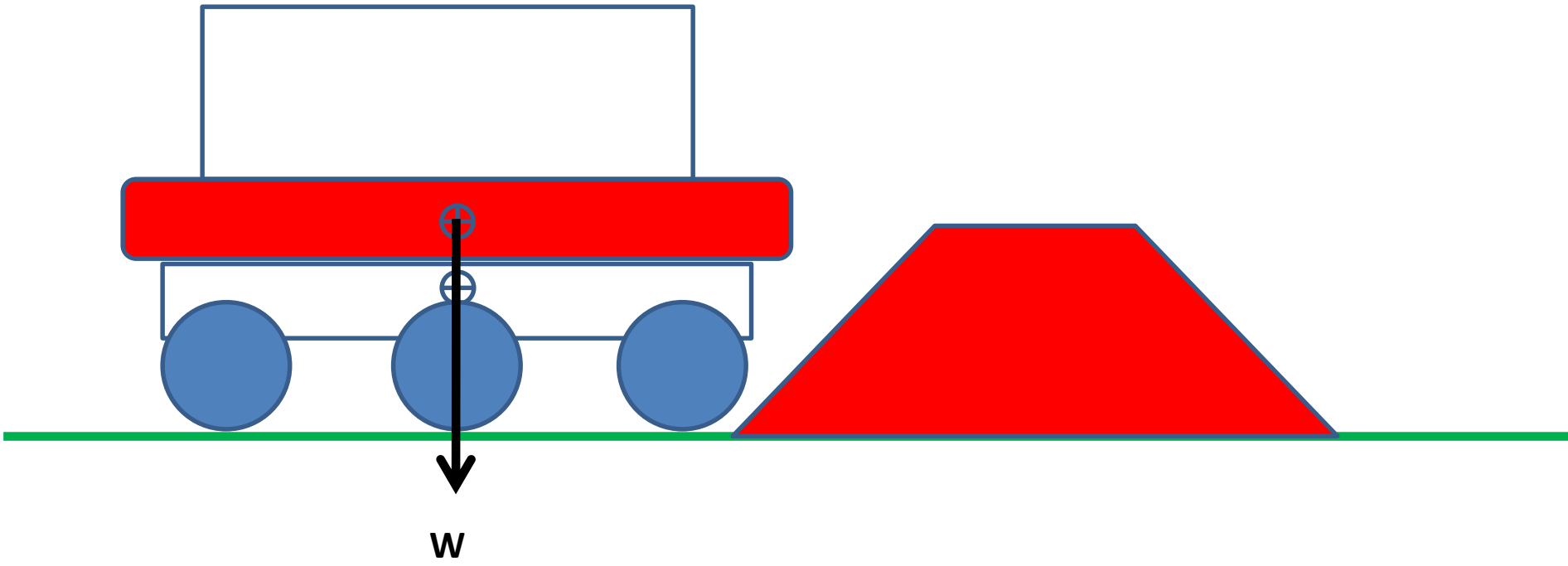
6x6 with Centered CG

- Assume 6x6 with centered (for-aft & side to side) CG
- Using 8” wheels, assume a CG height at 9&13”
- Pictures show a sprung middle wheel with 4” of vertical travel
- Spring Rate will be discussed during slides.

Migration of Articulating Center Wheel 6x6

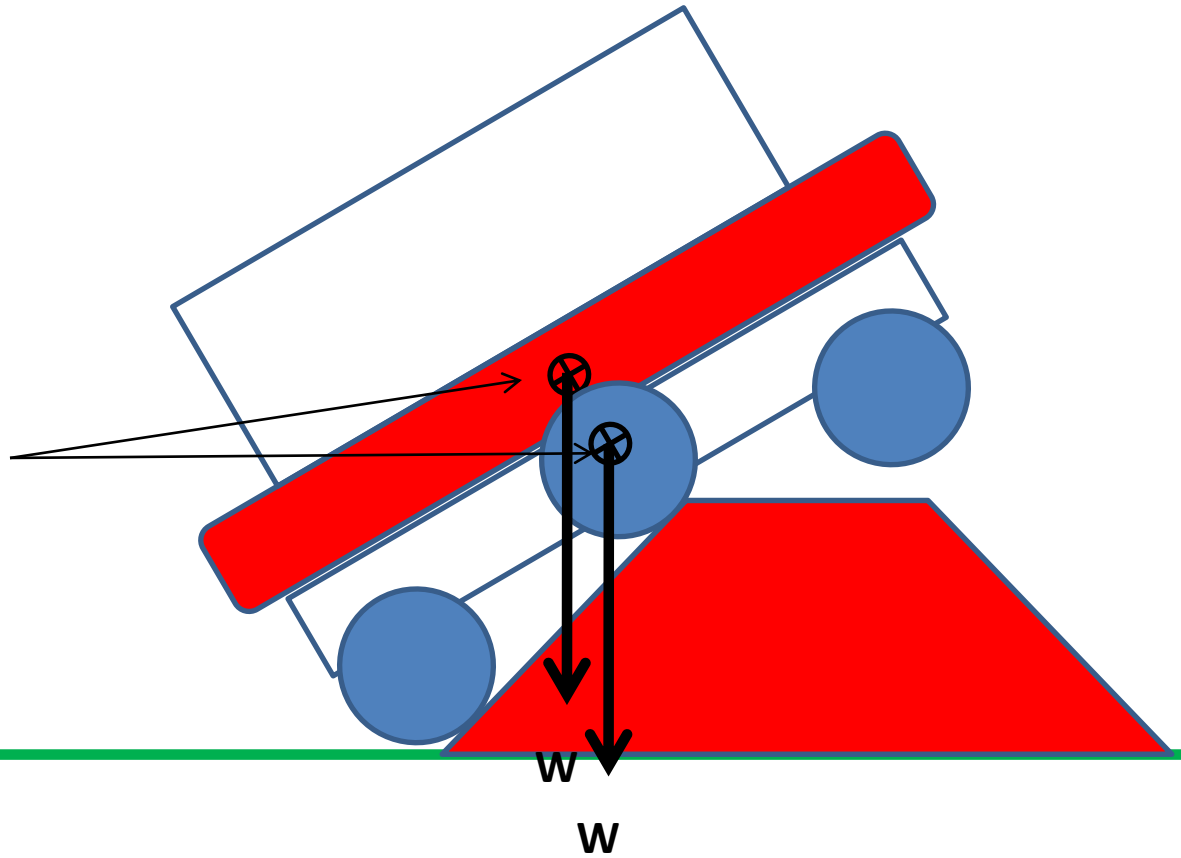


6x6 4” lift Centered CG



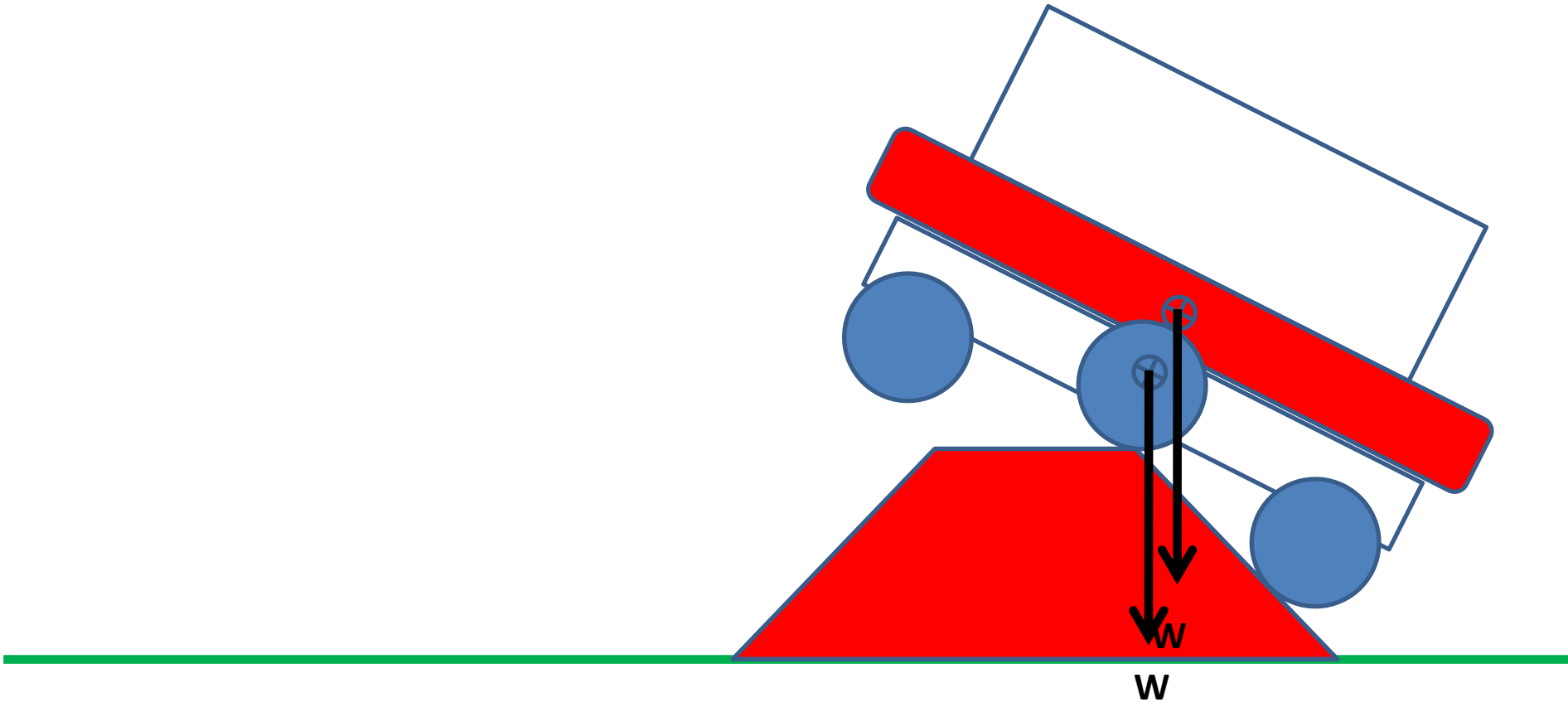
6x6 4” lift Centered CG

Two different CG locations and the appropriate Gravity Vectors



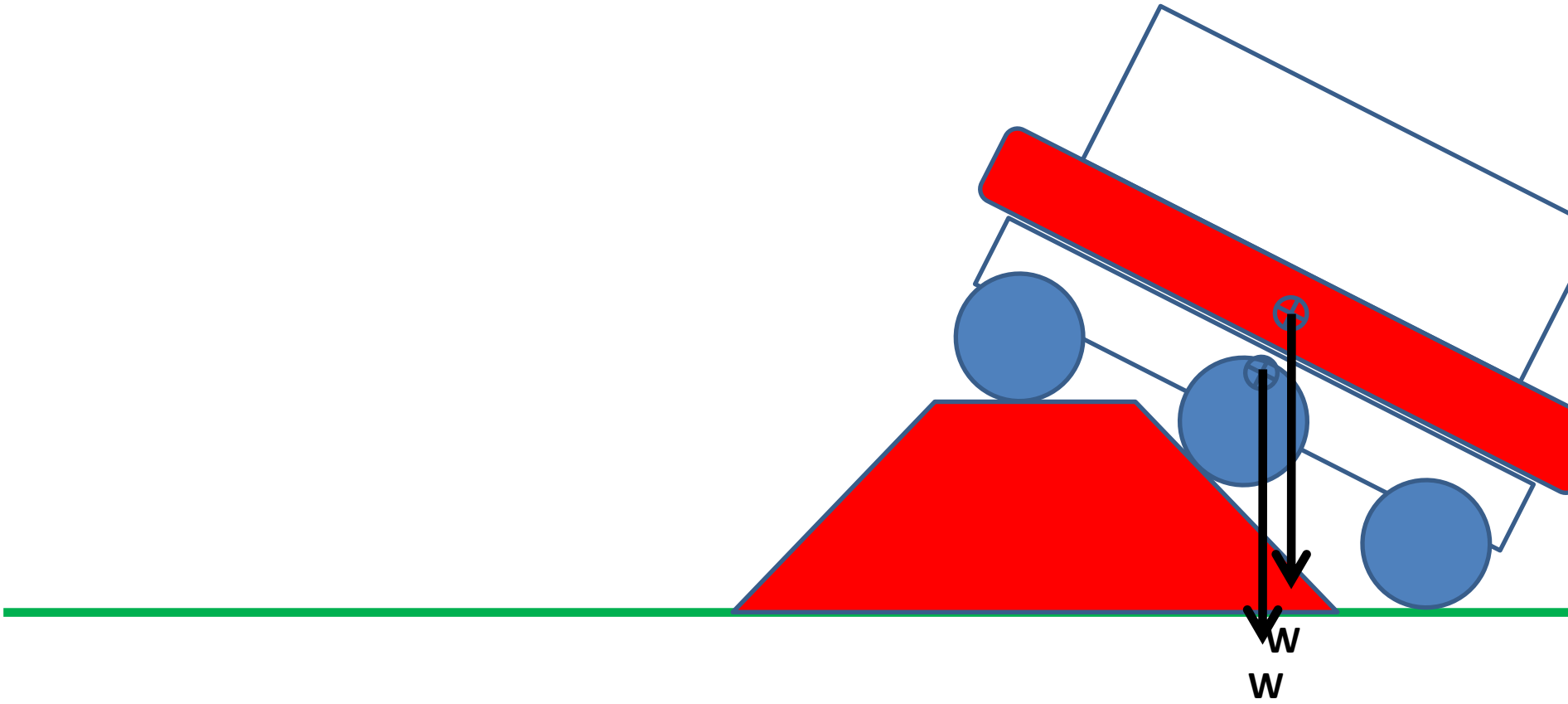
Articulation engaged. Chassis is climbing. This is the worst inclination and will the resultants show between 60% and 50% spring rate would still work. Adding in rear axle torque (for an 8” wheel), this will go down significantly (assuming 50% weight on rear wheel, torque could be as high as 140lbs*0.5*4”rad=280in*lbs. At this angle, 700 in*lbs would balance the bot thus there can be no more than 42 lbs of spring load on the middle wheels.

6x6 4” lift Centered CG



Here the robot is beginning its descent down the front slope.

6x6 4” lift Centered CG



Front Wheel has touched down and the robot will drive off relatively stable.

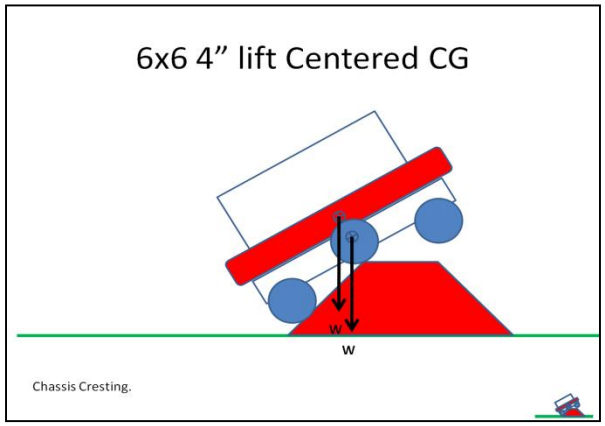
Conclusions

- Articulating 6x6 will likely have a rear biased CG. Move heavy components (motors, battery, pump…) as far forward as possible to strive for a balanced chassis.
- Pictures show a sprung middle wheel with 4” of vertical travel
- Spring Rate in the down direction must be minimized as it does not help going over the bump.
- By lifting the middle wheel, even a 13” CG should be relatively stable.

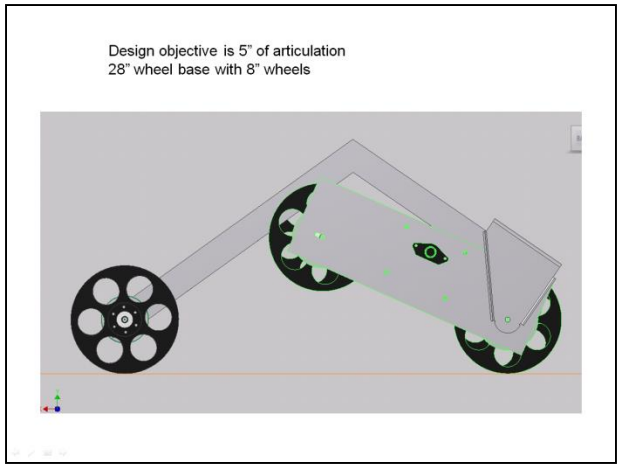
Chassis Design Process

Lego Model

Powerpoint Concept & Analysis



CAD Model & Verification



Final Chassis on Bump