Over the Hump

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Executive Summary

A Pivot Robot with 4" wheels and 28" wheelbase is proposed for Breakaway. This drive-train was modeled going over the bump.

The 28" wheelbase is based on the desire to provide space for a full-width pusher-herder device in front. Without this pusher-herder, a 31" wheelbase is feasible.

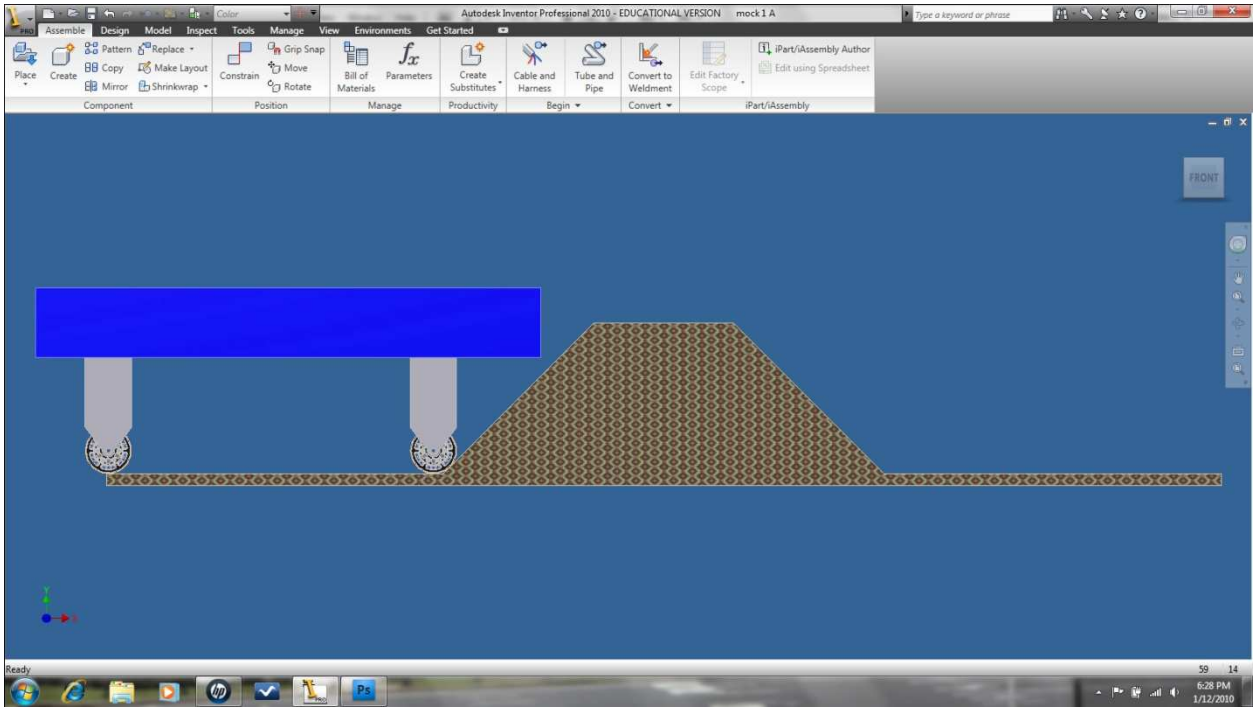
When traversing the BUMP, the maximum bump penetration into the inter-wheel space is 7.55" height. Recommend we provide 8" frame clearance for safety. The Max robot tilt angle is 27.7°.

With 8" frame clearance, a size 5 soccer ball will be able to penetrate the frame perimeter approximately 2" without force applied.

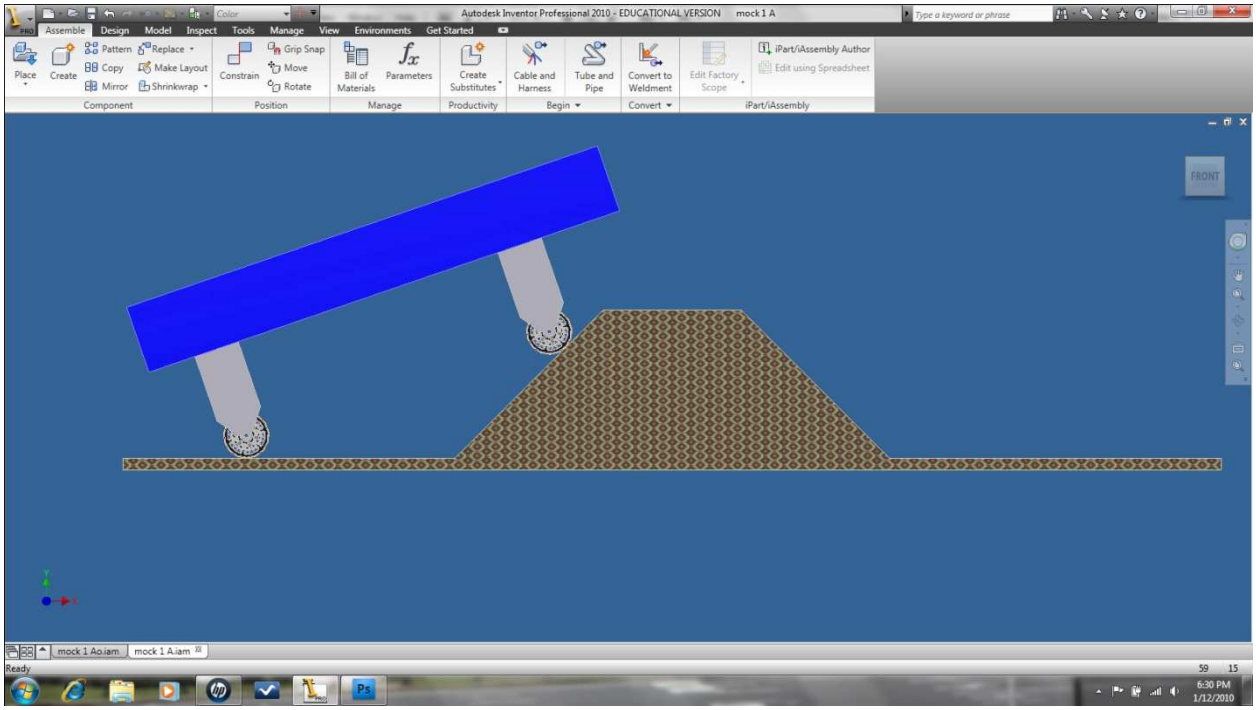
Bump sequence

A proxy robot and Breakaway BUMP were modeled in AutoDesk Inventor. The proxy robot comprises Bumper Perimeter (Dark Blue), Wheels and Wheel Pylons only. Dimensions are based on 37" frame length and allows for 3" frame penetration of the soccer ball in the front (for a full-width pusher/herder).

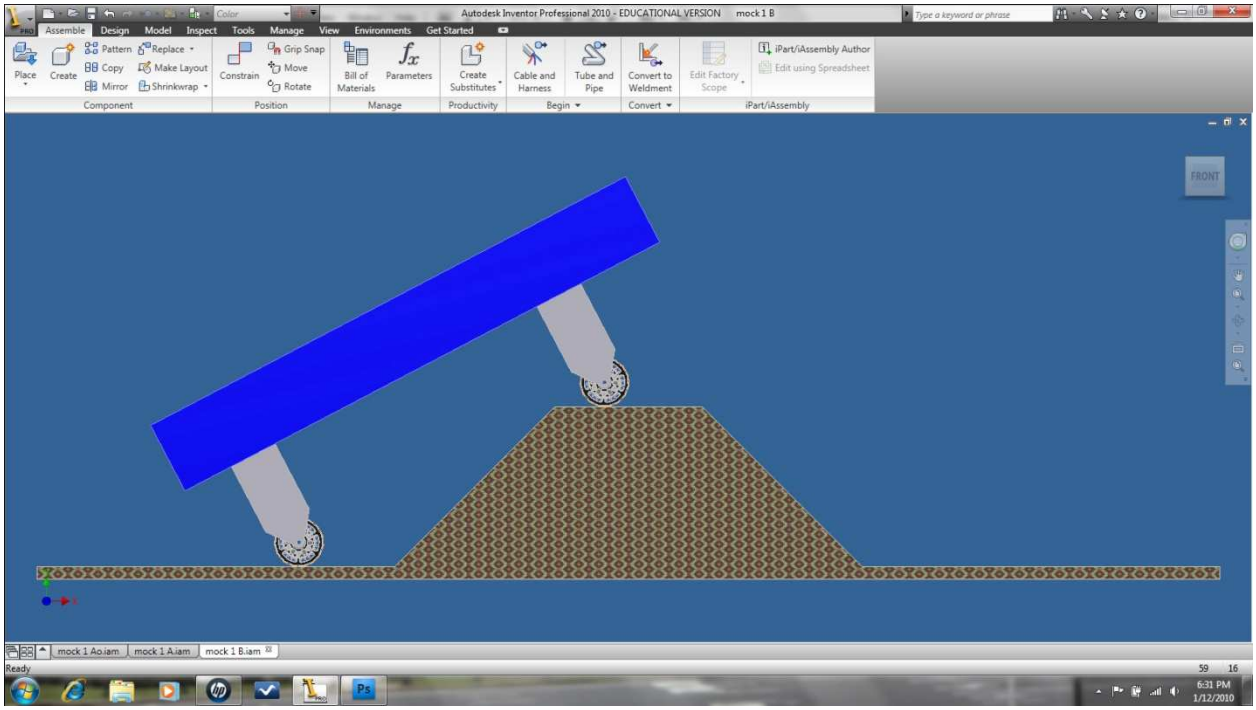
A. First Contact



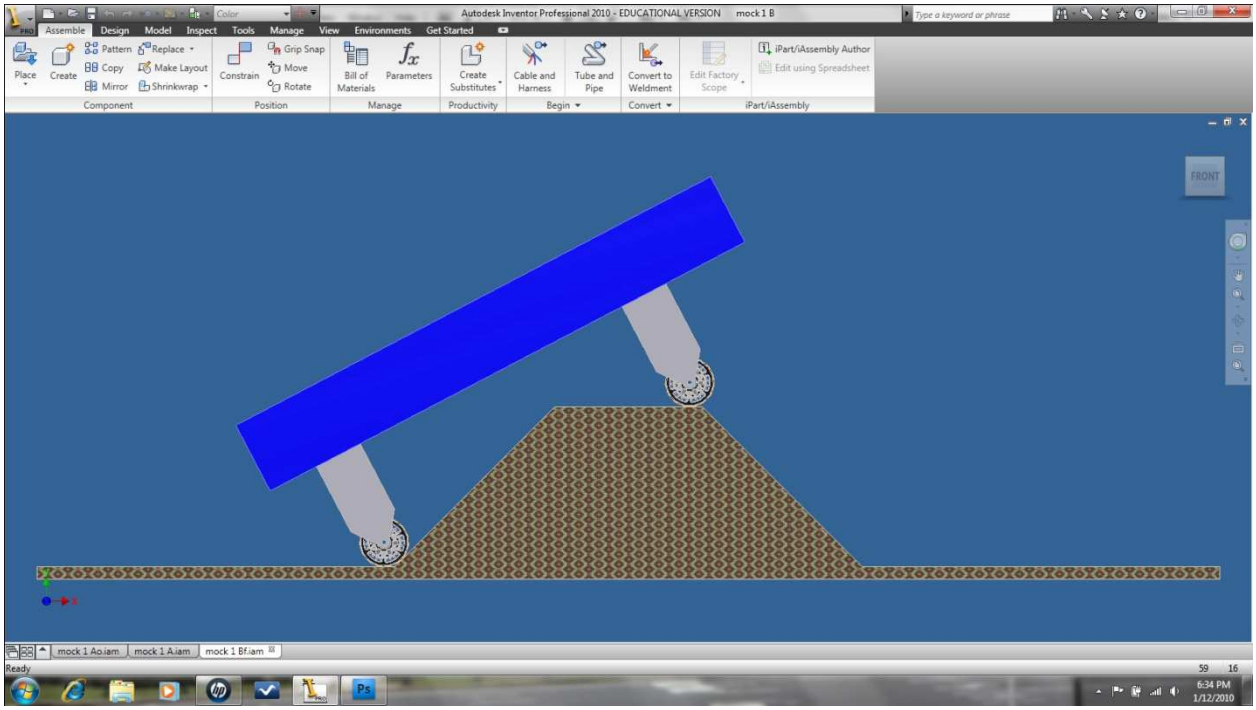
B. Climbing Front Face - robot tilt angle increasing. Rear traction unimpeded.



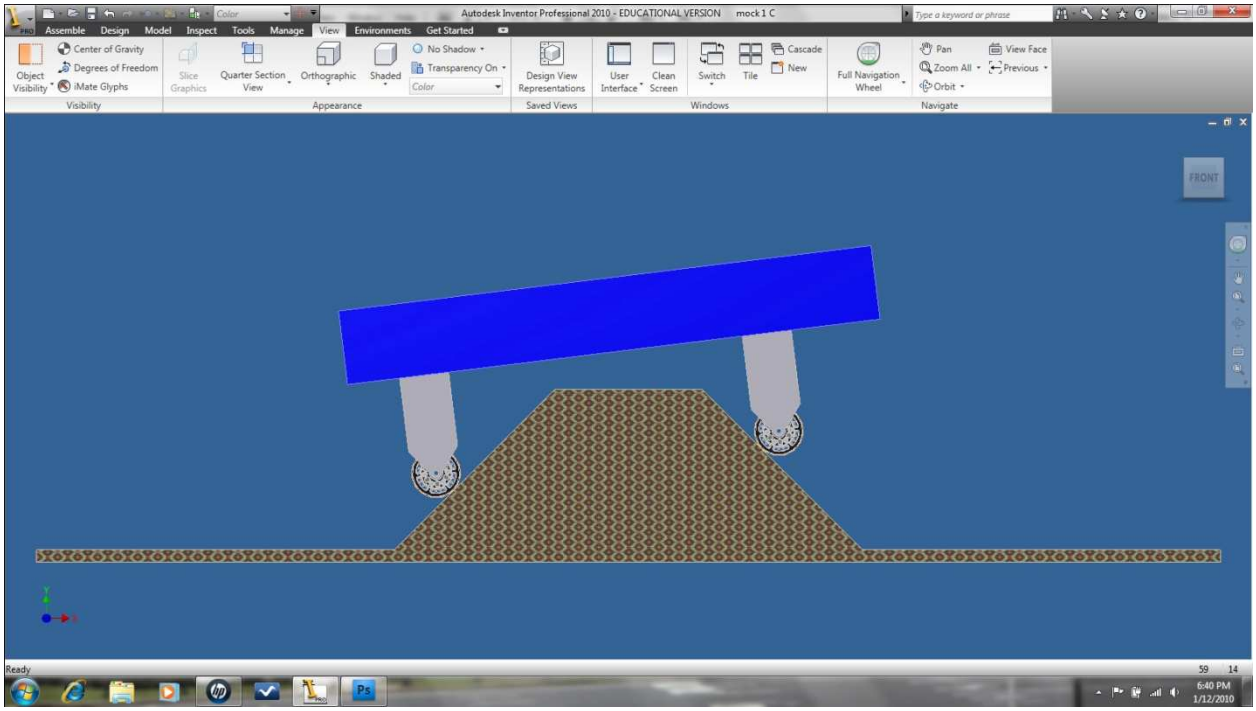
C. Front Wheel on Top - robot is at maximum tilt angle. Rear traction unimpeded.



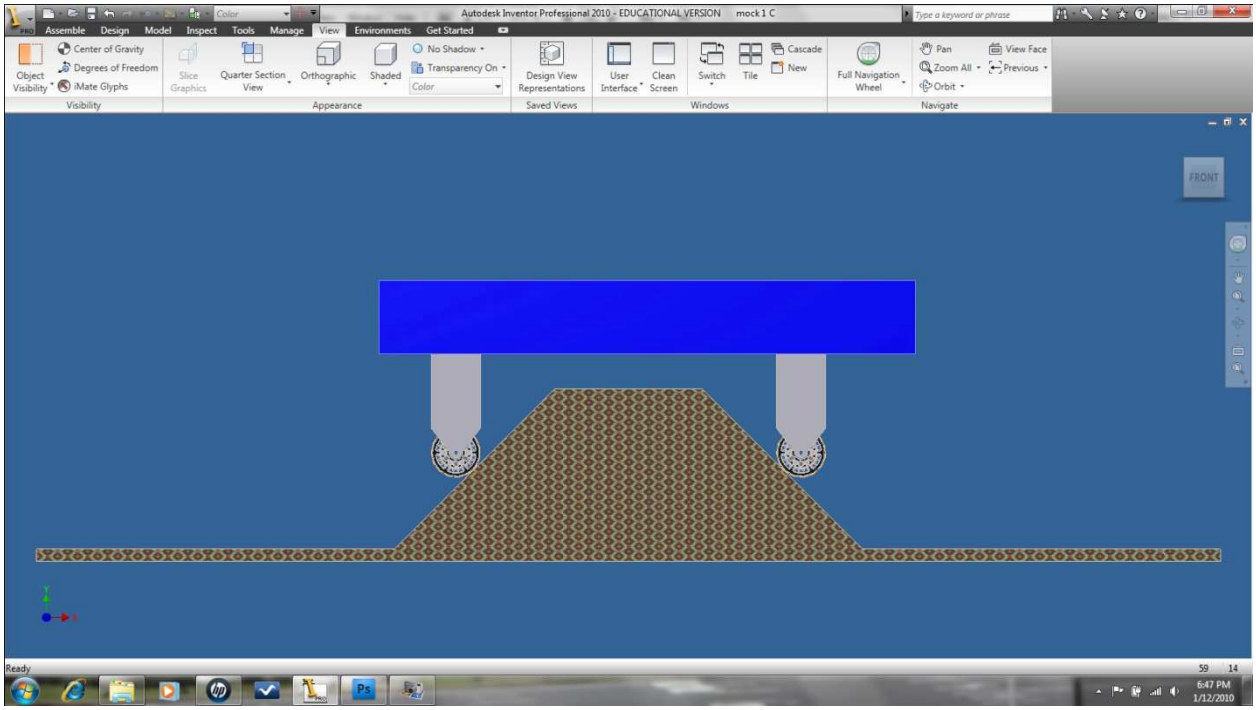
D. Rear wheel contact - toughest part of the climb from a traction standpoint



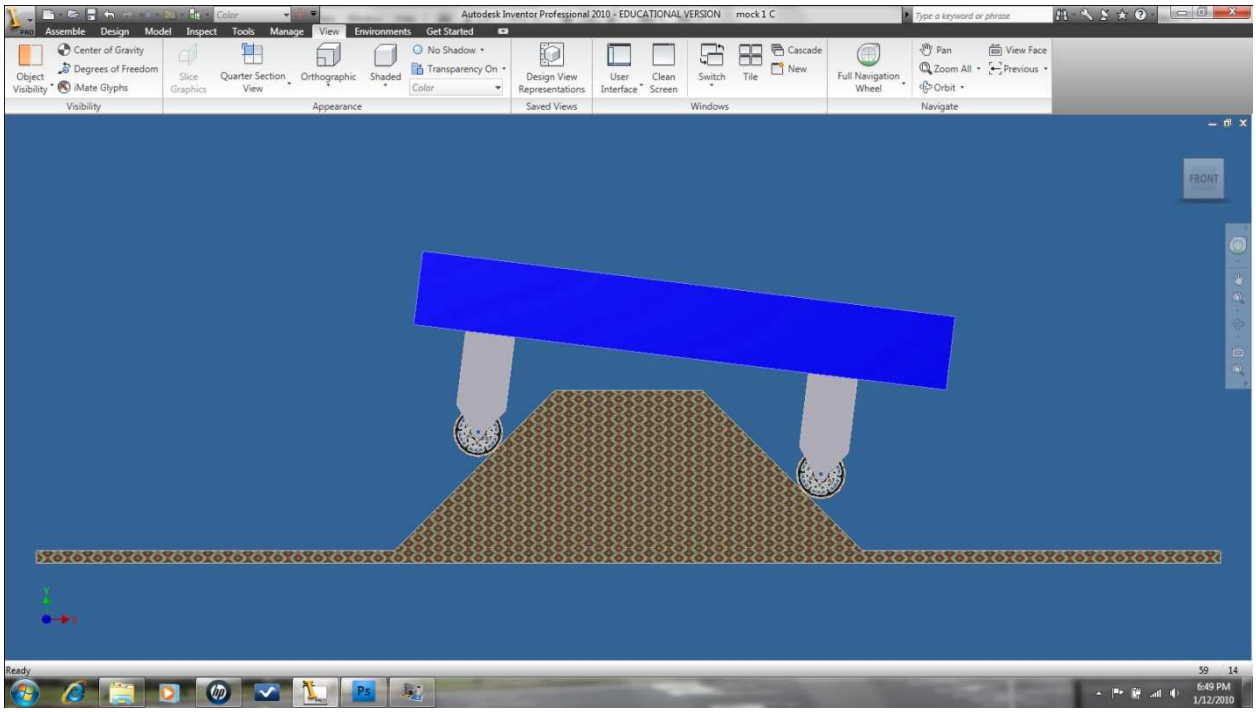
E. Furthest Penetration - 7.55"



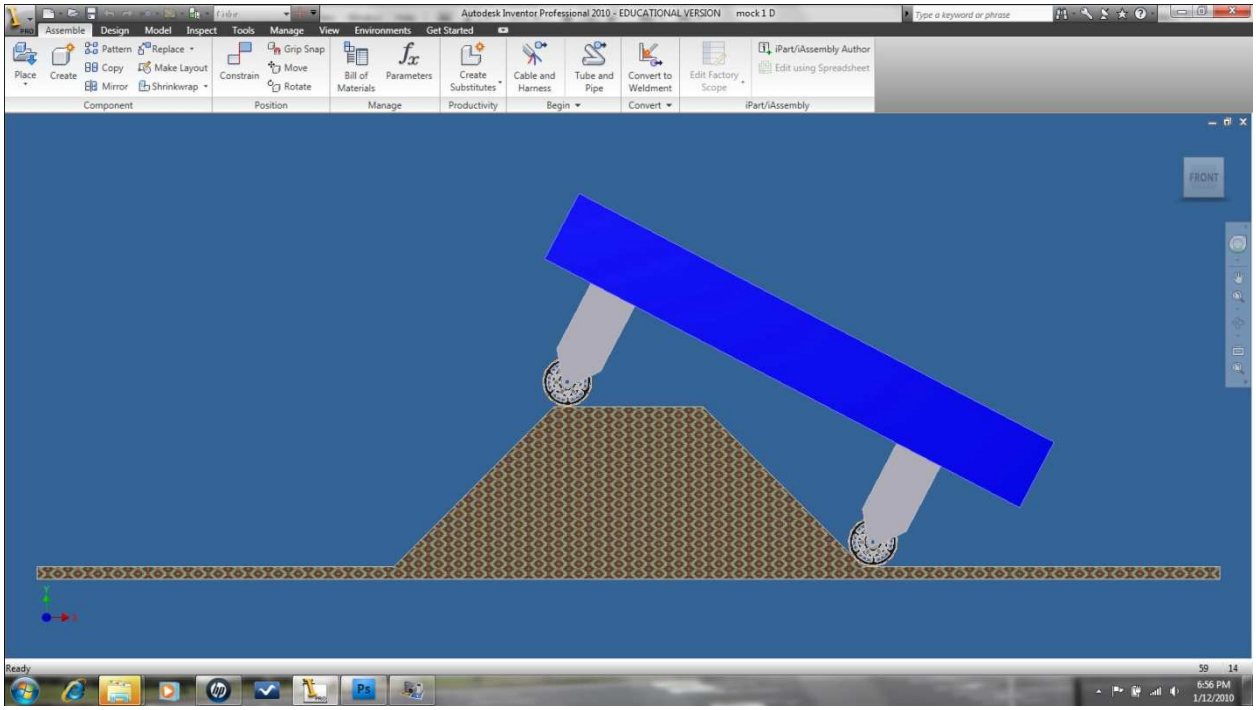
F. Straddling the BUMP - Penetration = 7.17"



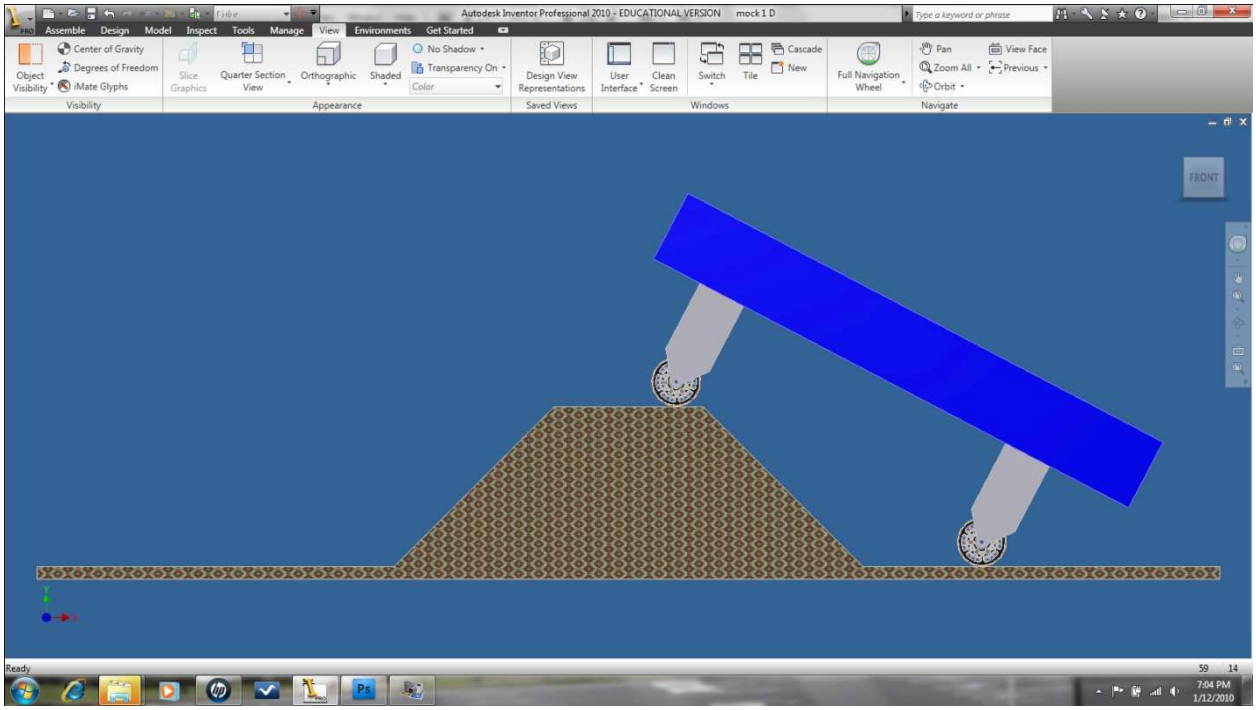
G. Furthest Penetration - 7.55"



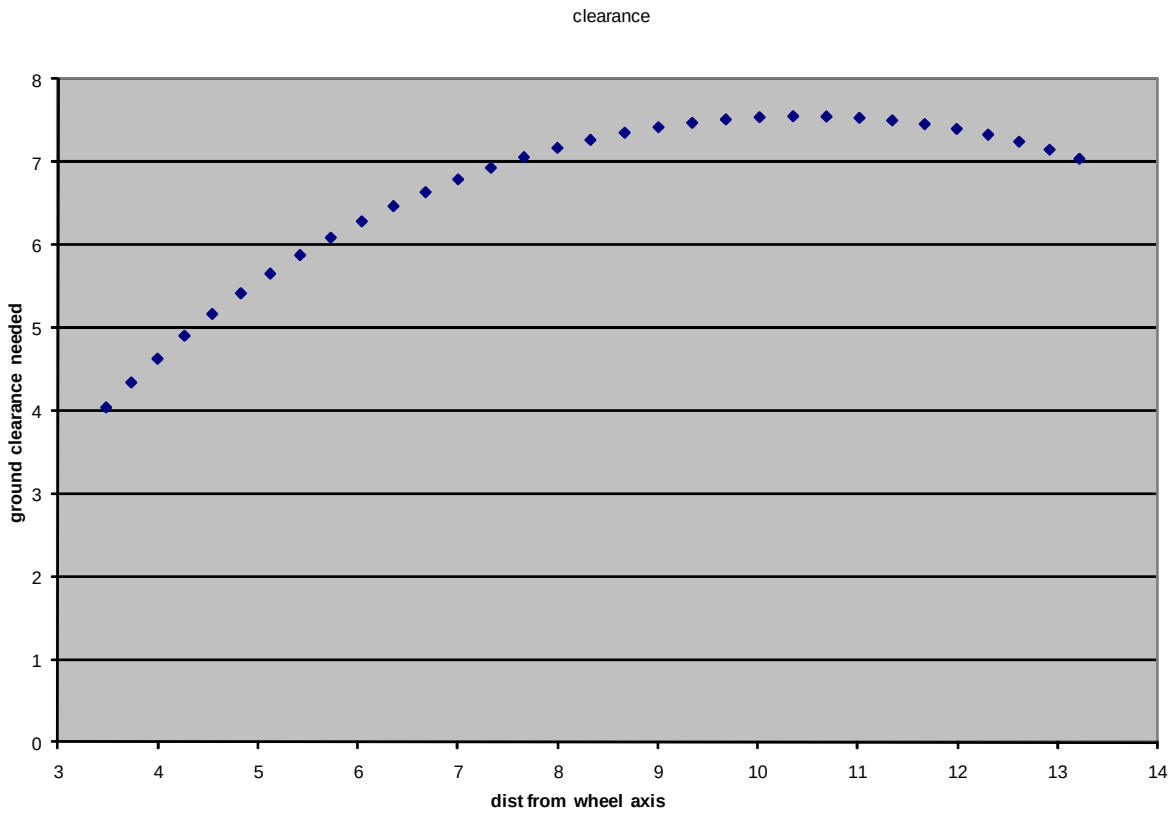
H. Re-contact Floor - Maximum robot tilt & highest probability of flipping.



I. Descent - Tilt angle and tipping probability remains high until rear wheel is off the BUMP top. Front traction unimpeded.



Clearance needed versus Distance from Wheel Axis



Center of Mass

The robot's Center-of-Mass must be within the triangle below or the robot will tip while going over the BUMP. Of course, the lower and "centerer" the Center-of-Mass is, the more stability the robot will have while traversing BUMPS.