Report #: 082608-1
Date: 26.08.2008

Dynamic Analysis investigation of container falling from trolley in relation to; speed, radius, secured/unsecured to trolley.

1. General:

It was required to test the dynamic behavior of a container that was carried upon a trolley during inland travel in 2 ways:

- The trolley is laid upon the trolley and is not attached to it.
- The trolley lies upon the trolley and attached to it with a secured hook.

For those needs dynamic modules of the trolley and the container were build and rendered in ADAMS under different ride circumstances (Velocities and Turning Radiuses). The simulation results were the speed of the overturns for the different turning radiuses. The goal of this report is to summarize the work that has been performed in it includes the description of the module, the details of the different weights and analyzes that were performed, results and the conclusions.

2. Description of the modules.

2.1 Module #1 – Unsecured container:

A schematic view of the module is displayed in images #1-2. The module is compiled of a stiff surface that represents the trolley, and from a hard box that represents the container. The weight of the container including the cargo is 24.5 Tons. In the edges of the stiff floor there are fences that constitutes an integral part of the trolley. Between the trolley and the box, and the fence to the box exists contact forces that represents the interface between the container and the trolley.

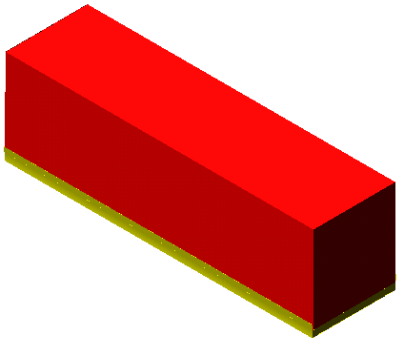

Image #1 - Module 1 – Unsecured Container

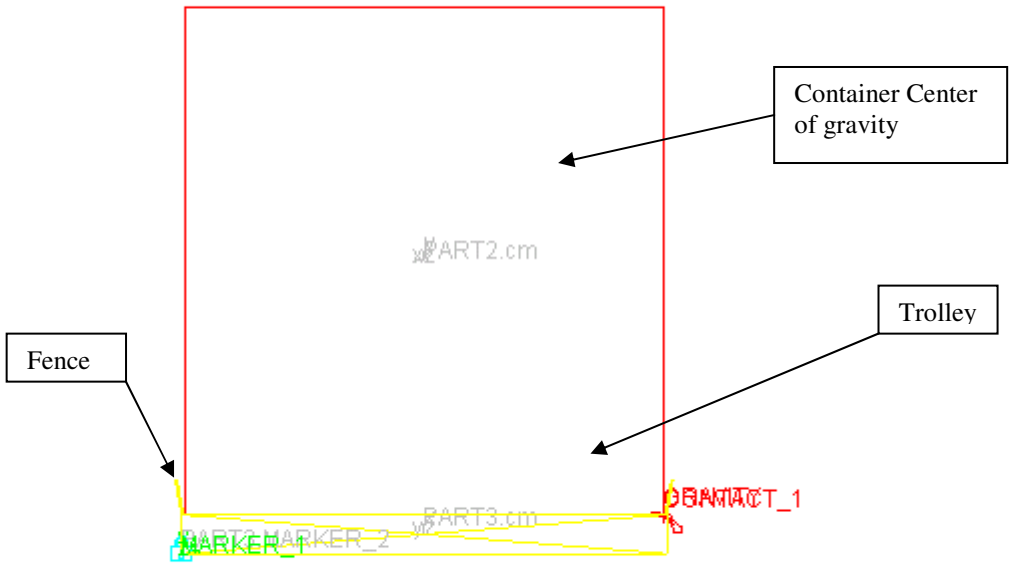

Image #2 - Module 1 – Unsecured Container

2.1 Module #2 – Secured Trolley:

A schematic view of the module is displaying in image #3. In this module the trolley is fully represented and the road is represented by a stiff floor. The trolley weight is 8 Tons. The container is attached to the trolley stiffly. Between the trolley and the floor exists contact forces that represents the interface between the trolley wheels to the road.

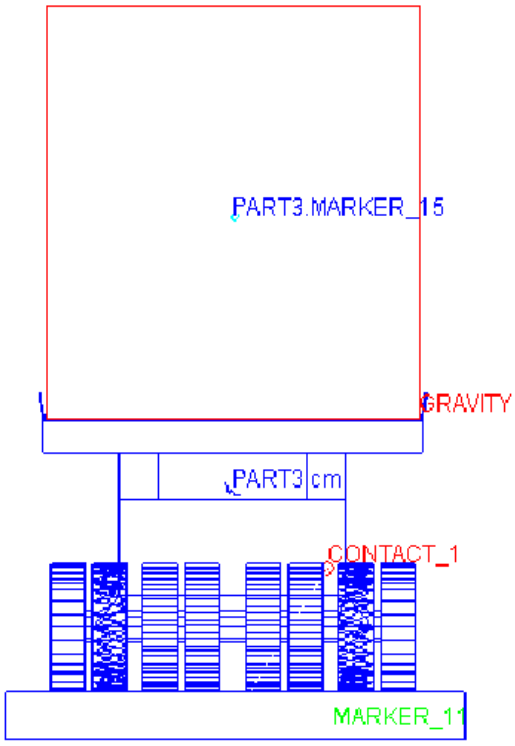

Image #3 - Module 2 – Secured Container

3. Results:

For every module there is a graph that shows the side force that is active on the container which make it overturn, as a function of the velocity of the drive, for different turning radiuses. In every graph there is a dotted line that marks the required side force to overturn the container. We can see that for a secured container a lower force is required to make it overturn. This fact is derived from the location of the weight center which is higher in compare to an unsecured container. Simulations Results is displayed in photos #4-5.

In a case of a secured container, the container and trolley overturns as a single unit, and the overturn vector moment is measured from the road to the shared weight center of the trolley and the container. In the case of an unsecured container, overturn vector moment is measured from the floor of the container to the weight center of the container – which is shorter.

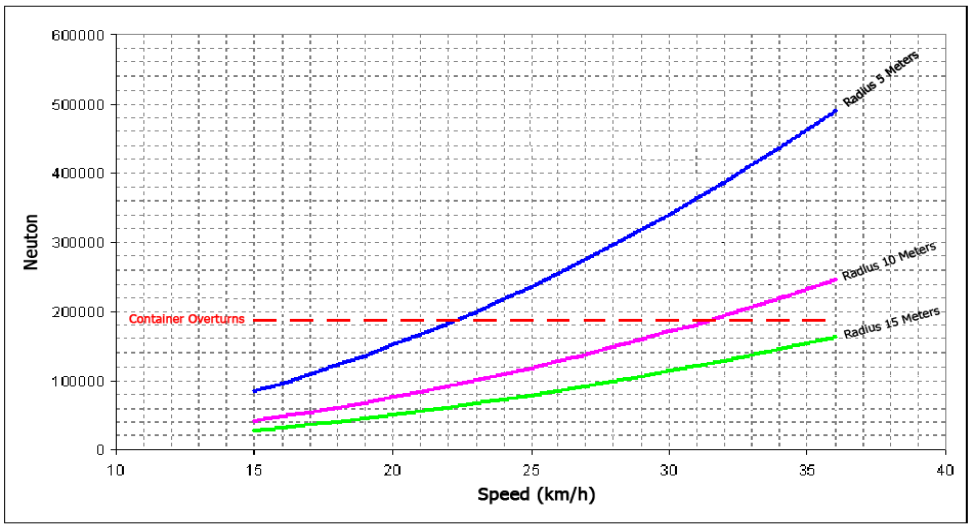

Image #4 – Module 1 – Unsecured Container

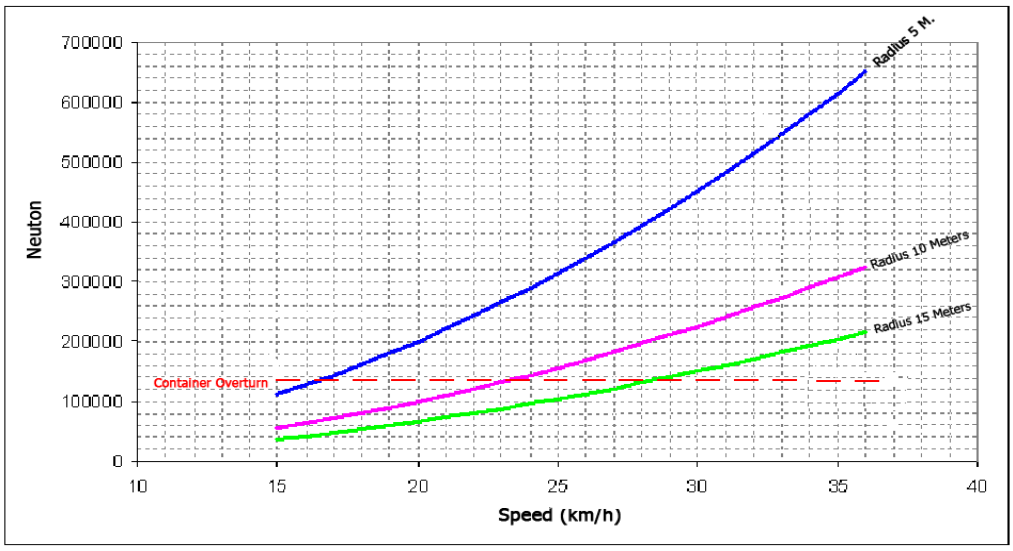

Image #5 - Module 2 – Secured Container

Images #6-7 shows graphically the state of the container before the overturn for both cases.

Image #6 – Module 1 - Unsecured Container

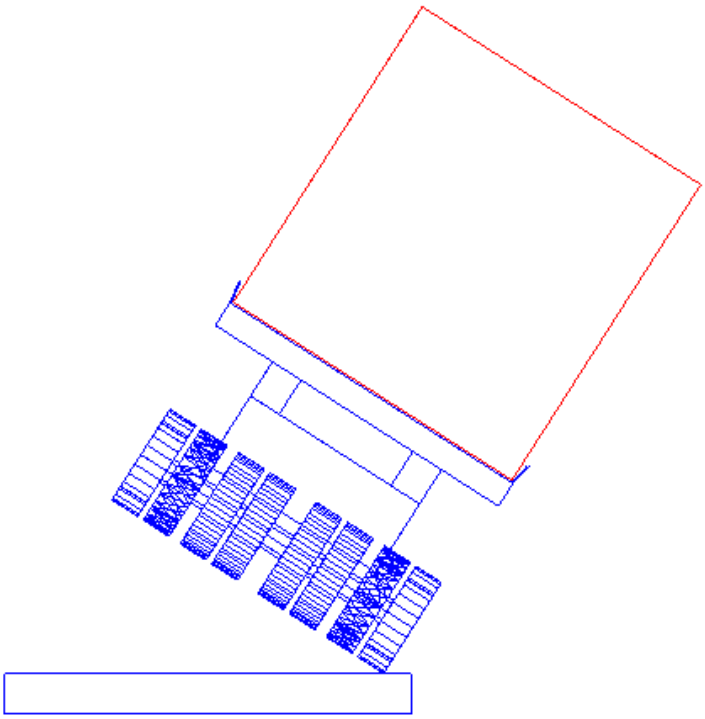

Image #7 – Module 2 – Secured Container