Crashworthiness of Low Speed Vehicles

Emma Cusano, Sherwin Francis, Michael Pinto & Dr. Oren Masory
College of Engineering of Florida Atlantic University

Introduction

- The purpose of this research project is to determine the crash worthiness of Low Speed Vehicles and analyze effect on the occupants during impact. As LSVs are not required to have crash protection, there is very little frontal impact protection and even less side impact protection. In the event of an impact, even at low speeds, data has shown that occupant sustained debilitating head and neck injuries in addition to other bodily harm. The purpose of this project is to determine both the full extent of damage to the LSV and severity of injury to the occupant. Additionally, based on the results, design modifications can be proposed for safer LSVs.

Method

Crash Test Dummy

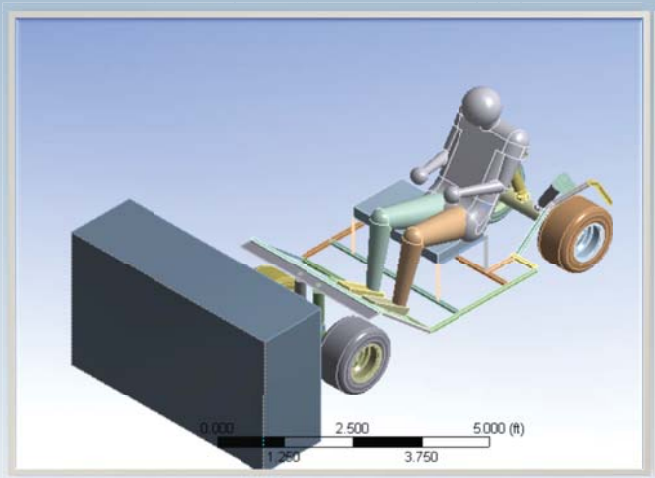
- Fully assembled Adult Male Dummy at approximately 180 lbs.
- Direct Sensor Integration into Dummy

Testing Parameters

- Testing parameters consist of the winch system, engine, and quick release mechanism
- Winch system – consists of Frame, Spool, Sprocket and Towing cable
- Engine- determined a necessary 5 hp, purchased a 6.5 Predator horizontal shaft OHV gas engine
- Quick Release – Releases tow cable at predetermined point to enable LSV to roll freely into crash wall

Data Acquisition

- The Data Acquisition System is comprised of 5 durable boxes, each containing an Arduino Uno, Data logging SD card and 6 axis accelerometer/gyroscope. All sensor boxes are then synced via a master Arduino DUE. The collected data is then post processed for clear and plotable results



Results & Discussion

- Overall, the results of this project were quite surprising. The initial expectation for this project was that even in the case of a low speed impact, significant damage would be sustained by the vehicle and occupants alike. The estimated hand calculations showed that a low amount of g-forces would be experienced by the driver. After testing, it was shown that although the occupant could have sustained some damage, the carts remained completely unscathed.

References

- [1] "Test Crash Statistics Report 2010." Web. 23 Apr. 2015. <http://www.flhsmv.gov/hsmvdocs/CS2010.pdf>.
- [2] "Federal Motor Vehicle Safety Standards." Web. 23 Apr. 2015 <http://www.nhtsa.gov/cars/rules/rulings/lsv/lsv.html#lsv5>.
- [3] "Golf Cart & LSVs." *Golf Carts & LSVs (Low Speed Vehicles)*. Web. 23 Apr. 2015 <http://www.golfcartsafety.com/golf-carts-vs-lsv>.
- [4] https://learn.sparkfun.com/tutorials/i2c
- [5]https://www.arduino.cc/en/Main/ArduinoBoardDue
- [6]http://www.invensense.com/products/motion-tracking/6-axis/mpu-6050/
- [7]http://electronics.stackexchange.com/questions/39714/how-to-read-a-gyro-accelerometer