## 1.4 Target Summary

The metrics involved in delaying the sink of the vehicle include the time to sink 5 meters, thermal conductivity, acoustic absorption in the range of 0-4000Hz, and the average density of the vehicle. These metrics were developed in hopes to keep the vehicle comparable in performance of insulation, while decreasing the density to decrease the rate at which the vehicle sinks. The acoustic absorption coefficient target was found by reviewing the publication from “Measurement of Absorption Coefficient, Surface Admittance, Radiated Intensity and Absorbed Intensity on the Panels of a Vehicle Cabin” which found the average value to be 0.55 for the roof and interior of an automobile. The thermal conductivity coefficient was found to be around k0.25, based on the American Society of Testing and Materials procedure ASTM C177. After the addition of our system to delay the sink of the vehicle, both the acoustic and thermal properties of the vehicle should be comparable to original values and can be tested by following the procedure outlined in the publications. The average density of the vehicle was targeted by using the curb weight and the dimensions of the Toyota Corolla found using the manufacturer's spec sheet. In addition to the curb weight, 3 passengers at 150 Ibs (68 kg) each were factored into the mass of the car. The average density of the vehicle and the passengers was calculated to be 124 kgm3 using the formula. The average density of the vehicle after our system has been integrated must be less than 124 kgm3to ensure that the rate of the sink decreased due to the car being less dense. Finally, a study done by Saginaw county sheriff's department in Michigan estimated that a 4 door vehicle will sink 5 meters in about 120 seconds with windows up. After the integration of the delay sink system, the car must sink slower than 5 meters in 120 seconds to ensure the passengers have more time to escape.

The metrics involved in sensing the sinking vehicle include the pressure, force and change in elevation. This is based on the need to know if there is a pressure acting on the bottom of the vehicle, whether the force acting on the springs has dropped, or whether the vehicle is below a critical elevation change. A typical vehicle weighs about 1800 lbs which is roughly equivalent to 8 kN. Each spring should experience about 2 kN of force when under normal loading. A drop to about 0.5 kN would indicate the vehicle is in a suspended state. The pressure transducer works within a range of about ± 15 psi which is about ± 103 kPa. A typical human being can exert about 10 kPa during a strong exhale. The sensor should not give a false positive for light changes in pressure. Accordingly, a pressure increase of about 10 psi (68 kPa) would be significant enough to warrant a reaction from the system while operating within the expected working range of the pressure transducer. The altitude of the vehicle should remain about constant for most driving conditions. A sinking vehicle would fall below this critical altitude and indicate distress. A distance of about 1 m should be used to warrant a reaction from the system.

Our targets for assisting in egress were determined based on what currently occurs when a vehicle is sinking. The time for egress taking less than 3 minutes was determined to be a target after learning that a vehicle without any modifications sinks in this given time. By setting our target to be less than this time, the passengers should be able to escape the vehicle before it is fully submerged. Our target for the window being fully opened in less than 4 seconds was determined as this was the amount of time it takes a traditional window to open. We also used the same target of 4 seconds for our door to fully open as this would allow for the quickest means of egress. The force needed to open a car door when fully submerged was calculated to be around 6.6 kN. After learning this, we set our target for the amount of force to be greater than this value to ensure that the car door would automatically open without any hesitation.