

Enhance Safety of Long Distance Buses by Preventing Rupture of Fuel Tank During Impact



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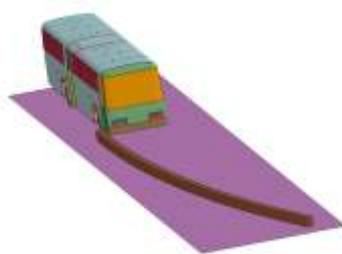
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Abstract:

As per the Ministry of Surface Transport, in India 45% of the bus accident fatalities are caused by fire hazards. This has been quite evident in the spree of fires that broke out on board long distance buses in the latter half of 2013. In all these cases fire broke out because of fuel leaking from fuel tank, ruptured by its impact with guard rail and caught fire. Risk of fuel tank rupture, and resulting fire, is increased by the fact that modern day long distance buses can achieve speeds as high as 100 km/h. An impact at that speed with guard rail can cause severe damage to the fuel tank, unless structural protection is provided.

In the present work a protective structure for fuel tank has been designed to prevent its tank rupture when bus hits a guard rail. A long distance bus was chosen for which the fuel tank was modelled and attached to the finite element model of a bus. In the simulation bus travelling at 90 km/h was made to collide against a guard rail along a curved portion of the road. Curvature of the guard rail was designed as per the specified norms of highway design. Simulation results revealed that certain areas of the fuel tank were more prone to rupturing. Plastic strain was used as failure criteria for fuel tank material. A safety cage was provided to protect the fuel tank. It was observed that just a safety cage was not enough to prevent rupture of fuel tank as it is displaced excessively from its position because of the flexibility of its support.

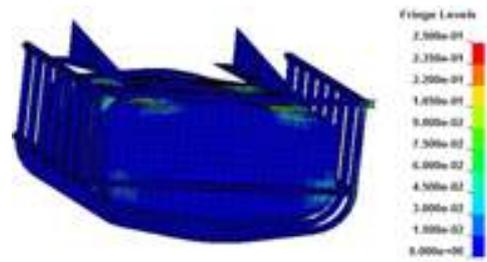
An additional mount was provided to harness the fuel tank and to prevent its movement during impact. This proved effective and thus the fuel tank survived rupture. Combined effect of the safety cage and fuel tank mount prevented rupture and fire for a long distance bus travelling at 90 km/h. The cage then was modified to reduce its weight. Simulations proved that this new modified cage was also effective in preventing the rupture of fuel tank.



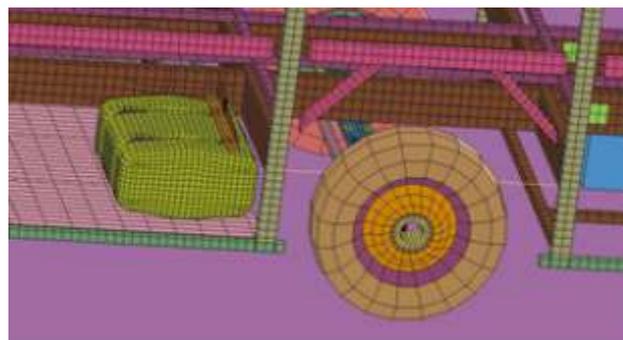
Model of bus and barrier



Model of fuel tank



Stresses in fuel tank and cage



Position of fuel tank in bus