

Improving Occupant Safety in Small Overlap Crash Test



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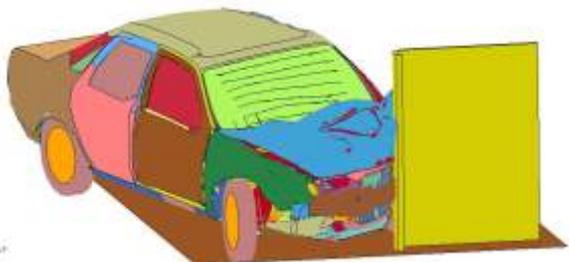
Keywords: Small Overlap Test, HIC, Multi Body Dynamics (MBD)

Abstract:

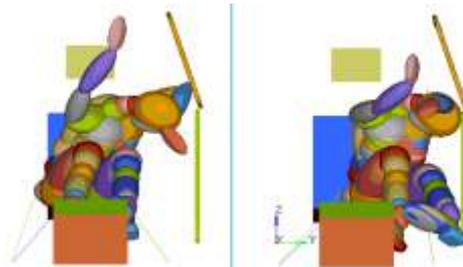
Among accidents involving frontal crash, incidence of crashes where only about 25% of the front end bears the crash load is quite high. In this scenario, point of action of crash load is far from the centreline of the vehicle. This causes considerable amount of post-crash yaw motion of the automobile. Resulting kinematics of the driver causes the head of the driver to miss the airbag and impact the structure, resulting in injury levels higher than experienced in full frontal or off-set frontal crashes. To address this, small overlap test is being introduced as a mandatory test for safety assessment of cars.

Very few cars of current design are able to meet small overlap crash test requirements. To achieve this, it is needed to modify the front end structure to redistribute crash force over a wider area, thus reducing yawing tendency of cars. In this project, based on the structural deformation and resulting mechanics of the car structure, some design changes to the front end are proposed to reduce head injury levels to occupants.

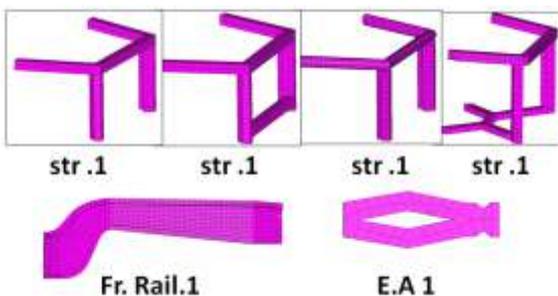
In the project, a combination of non-linear dynamic and multi-body dynamic simulations were used to reproduce structure and occupant response to a small overlap crash. Small overlap impact of Ford Taurus was simulated and from its history, acceleration of vector at driver seat location was obtained. These three pulses of acceleration in longitudinal, lateral and vertical directions, were used in a multibody dynamic simulation of a sled test to assess the dummy kinematics and head injury levels. Additions and modifications to the front end structure to bring down head injury levels were suggested and assessed. Effect of these changes were also assessed for full frontal crash and were found to be adequate.



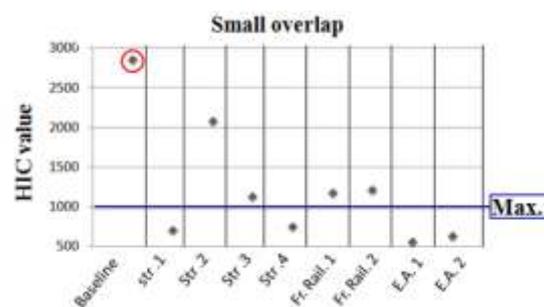
Small overlap crash simulation



**Occupant response in frontal (left) and
small overlap (right) test**



**Suggested structural modification for improved
performance in small overlap test**



**HIC values in small overlap crash for different
suggested structural modifications**