













B: 23% reduction). The only severity level that went up in the remaining crashes was Possible Injury, which is the least severe of the injury categories, rising by 20%.

The current analysis was not able to examine how pedestrian and cyclist impacts might change with introduction of a LMV. In the dataset used to identify which crashes would be prevented with CCAT, almost all pedestrian and cyclist crashes are coded as being caused by the striking vehicle. Thus almost no pedestrian and cyclist crashes would occur with CCAT vehicles. In addition, because this study focused on identifying occupant protection priorities for the occupant of the LMV, the outcome of pedestrians and cyclists struck by LMVs would not be expected to affect the LMV occupant's outcome.

The simulations performed in this study assumed a best-case scenario that a CCAT would not be able to cause any crashes. In reality, different crash avoidance technologies are estimated to prevent 5 to 65% of particular types of crashes, and future research should examine the range of remaining crashes while considering more realistic estimates of effectiveness. In addition, some CCAT may help prevent the case vehicle from being the struck vehicle in a crash, which was not considered in the current analysis. However, by simulating an environment with 100% effectiveness at preventing particular types of crashes, we can identify that the highest priority for occupant protection in CCAT vehicles should be improving protection to occupants in near-side impacts. However, the injury risks for near-side impacts used in the simulation are likely a worst-case estimate, because the dataset used to generate the injury risk curves has a limited number of vehicles equipped with side impact airbags. Far-side crashes would be the next crash mode to prioritize with regard to occupant protection.

Injuries from frontal impacts would happen much less frequently than the current crash environment because of the substantially reduced exposure. Allowable injury risk in frontal impacts could increase and still have fewer injuries than the current frontal crash environment. However, another perspective is that if the current level of frontal crash protection could be maintained in an LMV, the reduced number of injuries in frontal impact would help offset the increase in injuries from side impact.

Although rear impacts would make up a greater proportion of the crash population than they do now, they do not make up a significant part of the AIS2+ injury problem. However, the most common injuries in rear impacts are usually considered AIS1 severity. Analysis at this injury level was not performed because the lowest severity injury data are not considered reliable in NASS-CDS [19]. While higher-level injuries from rear impact would not be a key consideration in LMV, there may still be frequent AIS1 level injuries.

## V. CONCLUSIONS

The simulations performed in this study demonstrate a technique for estimating occupant protection priorities as crash avoidance technologies are introduced into vehicles and vehicle mass is reduced. By examining the best-case crash avoidance scenario in which a vehicle could never cause a crash, the analysis highlights the possible changes in occupant protection priorities as the effectiveness of crash avoidance technologies increases over time. Side impacts will become the highest priority, followed by rear impacts, as the risk of injury from frontal and rollover crashes decreases. The study also developed a technique for estimating how crash severity distributions would change with the introduction of more low-mass vehicles into the fleet.

## VI. ACKNOWLEDGEMENT

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VIII. APPENDIX



