Research Note

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Analysis of the Crash Experience of Vehicles Equipped with Antilock Braking Systems (ABS)

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NHTSA's National Center for Statistics and Analysis has recently completed an initial analysis of the crash experience of passenger cars (PCs) and light trucks and vans (LTVs) equipped with antilock braking systems (ABS). Separate analyses were conducted for PCs and LTVs. Data from NHTSA's Fatal Accident Reporting System (FARS) were used to analyze the crash experience of ABS-equipped and non-ABS-equipped vehicles in both analyses. In the PC analysis, state crash files for Florida, Maryland, Missouri, and Pennsylvania were also used. In the LTV analysis, data from Florida, Maryland, Michigan, and Missouri were used in addition to the FARS data.

In each analysis, four types of crashes were identified as "ABS-relevant," that is, crashes for which it was assumed that ABS would be beneficial in avoiding the crash and/or ameliorating the outcome of the crash. The four "ABS-relevant" crash types identified were: (1) rollovers, (2) side impacts with parked vehicles or fixed objects, (3) frontal impacts with parked vehicles or fixed objects, and (4) frontal impacts with another motor vehicle in transport. Crash types (1) and (2) typically involve driver loss of control. For these crash types, ABS is expected to increase the directional stability of the vehicle, allowing the driver to maintain greater control and remain on the roadway. Crash types (3) and (4) typically involve driver loss of control or the presumption that the driver did not apply the brakes or was not able to stop in time. Both analyses examined the experiences for ABS and non-ABS-equipped vehicles in the four ABS-relevant crash types, compared to a control group of crashes that were assumed to be unaffected by the presence of ABS.

Both analyses also examined the crash experiences of the vehicles on "favorable" vs. "unfavorable" road conditions. Conditions for road surfaces that were paved, free of debris, and dry were considered "favorable." Road surfaces that were wet, snowy, icy, unpaved or composed of gravel were considered "unfavorable."

The following findings were noted for PCs:

- A significant reduction in non-fatal frontal impacts with another motor vehicle in transport crashes was associated with the presence of ABS;
- Significant increases in non-fatal frontal impacts with parked vehicles or fixed objects and in non-fatal side impacts with parked vehicles or fixed objects were associated with the presence of ABS; and
- Significant increases in fatal rollover crashes and in fatal side impacts with parked vehicles or fixed objects were also associated with the presence of ABS.

For LTVs, two types of ABS were analyzed separately: rear-wheel antilock (RWAL) and all-wheel antilock (AWAL) systems. RWAL is much more prevalent in the on-road LTV fleet, while AWAL-equipped LTVs became available in recent years. RWAL systems control only rear wheel braking, thereby increasing directional stability. AWAL systems operate on all four wheels, and therefore, are expected to increase directional stability and provide benefits in stopping distance on low friction surfaces experienced during rain and snow, for example.

The following findings were noted for LTVs:

- Significant reductions in non-fatal rollover crashes and side impacts with fixed objects/parked vehicles were associated with the presence of RWAL;
- A significant reduction in non-fatal rollover crashes was associated with the presence of AWAL;
- The reductions in non-fatal crashes did not extend to fatal crashes, in which no significant reductions associated with the RWAL or AWAL were found;
- Significant increases in non-fatal and fatal frontal crashes with another vehicle in transport were found, associated with the presence of RWAL; and
- The relatively small sample size available for AWAL systems made it more difficult to detect significant differences in crashes.

Both analyses are based upon data that comprise the initial years of crash experiences for the first groups of vehicles equipped with ABS. While the findings indicate some reductions, increases were also noted. Thus, NHTSA estimates that there has been little or no net crash reduction with ABS, to date. Further analysis is warranted, especially for passenger cars. NHTSA has implemented a plan of analysis and vehicle testing to obtain a clearer understanding of the performance of ABS, particularly in crashes that typically result in rollovers and collisions with fixed objects. Meanwhile, NHTSA urges drivers to gain an in-depth understanding of the operation of their ABS-equipped vehicles.

An Analysis of the Crash Experience of Passenger Cars Equipped with Antilock Braking Systems, by Hertz, Hilton, and Johnson (DOT HS-808 279, May 1995) provides detailed findings for the PC analysis. The LTV findings are contained in *An Analysis of the Crash Experience of Light Trucks and Vans Equipped with Antilock Braking Systems*, also by Hertz, Hilton, and Johnson (DOT HS-808 278, May 1995). For a copy of either report, contact the National Center for Statistics and Analysis, NHTSA, NRD-31, 400 Seventh Street, S. W., Washington, DC 20590, (202) 366-1470 or the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161, (703) 487-4650 or fax (703) 321-8547.