

EFFECTIVENESS OF CERTIFIED- ADVANCED AIR BAGS IN REAL WORLD CRASHES

Nathan Greenwell, NHTSA

Redesign of Frontal Air Bags

FMVSS No. 208 Occupant Crash Protection

- First generation
- Sled test option
- Certified advanced 208-compliant

Fatality rates were gathered for model years 2002-2009 during calendar years 2004-2011

2,573 front-seat fatalities in frontal crashes of vehicles with certified-advanced air bags

117 make-models were selected:

85 make-models transitioned from sled-certified with advanced features

32 make models transitioned from sled-certified without advanced features

Advanced features ranged from multi-stage inflators, buckle switches, seat weight sensors, seat belt usage sensors, to seat track sensors

Frontal Fatality Risk Relative to

Control Group of Non-occupant fatalities

Not affected by other occupant protection technologies (side air bags, pretensioners)

Per vehicle registration years

For each model year, data is restricted to calendar years greater than the model year

Control Group of Non-frontal Fatalities

Intuitively seems reasonable since frontal air bags are primarily designed for action in frontal crashes

Comparison may yield a biased result due to change in side air bags and not solely upon the transition to certified-advanced air bags

Overall Frontal Fatalities Relative to Non-Occupant Fatalities

	Frontal Fatalities	Non-Occupant Fatalities	Frontal/ Non-Occupant Risk Ratio
Sled-certified with or without advanced features	3,004	1,348	2.2285
Certified-advanced air bags	2,573	1,186	2.1695

- 2.65% Reduction of Frontal Fatalities (relative to non-occupant) for CAC
 - Not statistically significant ($\chi^2 = 0.3122$, P-Value = 0.5763)

Overall Frontal Fatalities Relative to Vehicle Registration Years

	Frontal Fatalities	Vehicle Years	Frontal Fatalities per Million Years
Sled-certified with or without advanced features	3,004	68,977,602	43.55
Certified-advanced air bags	2,424	57,959,450	41.82

- 3.97% Reduction of Frontal Fatalities per million registration years for CAC
 - Not statistically significant ($\chi^2 = 2.1992$, P-Value = 0.1381)

Drivers' Overall Frontal Fatalities Relative to Non-Occupant Fatalities

	Frontal Fatalities	Non-Occupant Fatalities	Frontal/ Non-Occupant Risk Ratio
Sled-certified with or without advanced features	2,457	1,348	1.8227
Certified-advanced air bags	2,083	1,186	1.7563

- 3.64% Reduction of Frontal Fatalities (relative to non-occupant) for CAC
 - Not statistically significant ($\chi^2 = 0.5567$, P-Value = 0.4556)

Drivers' Overall Frontal Fatalities Relative to Vehicle Registration Years

	Frontal Fatalities	Vehicle Years	Frontal Fatalities per Million Years
Sled-certified with or without advanced features	2,457	68,977,602	35.62
Certified-advanced air bags	1,964	57,959,450	33.89

- 4.87% Reduction of Frontal Fatalities per million registration years for CAC
 - Not statistically significant ($\chi^2 = 2.7205$, P-Value = 0.0991)

Child Right-Front Passengers' Overall Frontal Fatalities

Age 0 – 12 years riding in the right front seat

	Frontal Fatalities	Vehicle Years	Frontal Fatalities per Billion Years
Sled-certified with or without advanced features	15	68,977,602	217.55
Certified-advanced air bags	12	57,959,450	206.94

- 4.79% Reduction of Frontal Fatalities per billion registration years for CAC
 - Not statistically significant ($\chi^2 = 0.0166$, P-Value = 0.8973)

Both rates are much lower than the 992.0 fatalities per billion years in CY 1998-2004 with barrier-certified pre-1998 air bags.

Discussion

Certified-advanced and sled certified air bags reduced the risk of air bag deployment in comparison to barrier-certified pre-1998 air bags for front seat occupants.

In every one of the various analyses, certified-advanced air bags slightly reduced the risk of frontal fatality compared to sled certified air bags, but that difference was not statistically significant.

Certified-advanced air bags fully preserve the benefits of previous generations of air bags for average-size and larger adults, while they have mitigated the risk for child passengers or small adults