

New England University Transportation Center



NE University Transportation Center
77 Massachusetts Avenue, E40-279
Cambridge, MA 02139
Phone: 617-253-0753
Fax: 617-258-7570
web.mit.edu/utc

Principal Investigator: Per E. Gårder
Title: Professor
University: University of Maine
Email: Garder@Maine.edu
Phone: 1 207 581 2177

Co-Principal Investigator:
Title:
University:
Email:
Phone:

Final Report

Project Title:

All-Wheel Drive and Winter-Weather Safety

Project Number:

UMER23-1

Project End Date:

April 30, 2013

Submission Date:

March 8, 2013

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated under the sponsorship of the Department of Transportation, University Transportation Centers Program, in the interest of information exchange. The U.S. Government assumes no liability for the contents or the use thereof.

The New England University Transportation Center is a consortium of 8 universities funded by the U.S. Department of Transportation, University Transportation Centers Program. Members of the consortium are MIT, the University of Connecticut, University of Maine, University of Massachusetts, University of New Hampshire, University of Rhode Island, University of Vermont and Harvard University. MIT is the lead university.

Background and Objective

It is frequently stated that people living in northern states, the so called Snowbelt of the United States, benefit with respect to safety from driving all-wheel or four-wheel drive vehicles as opposed to front or rear-wheel drive only. This study tries to answer whether that is true or not.

Methodology

Vehicles involved in crashes, and observed on roadways, were classified with respect to if they were front-wheel drive only, rear-wheel drive only, four-wheel drive when activated else rear-wheel only, or all-wheel drive where the power transfers between the axles and wheels as 'needed.' Crashes in the state of Maine in 2011, for different roadway conditions, were analyzed. The crash data was provided by Maine Department of Transportation. A total of 31,274 crashes were reported to the police as occurring in 2011. The coded crash data does not directly indicate drivetrain type but gives VIN numbers of the involved vehicles. A sequentially random sample of all crashes from the beginning of the year, augmented with additional winter-related crashes, as well as all fatal crashes, had the involved parties' VIN numbers decoded and analyzed, in all 3,592 vehicles. The influence of driver age was looked at. Exposure was gathered to look at safety on a per-mile basis and safety was also analyzed using vehicle registrations as exposure. Finally, deer crashes were used as a measure of induced exposure.

Results and Conclusions

An analysis of all fatal crashes in the state of Maine in 2011 shows that all-wheel-drive (AWD) vehicles are not statistically overinvolved in winter-roadway crashes compared to front-wheel-drive or rear-wheel-drive vehicles even if AWD make up a slightly higher percentage of crash-involved vehicles in winter conditions than on dry roads.

An analysis of a sample of all crashes in Maine in 2011 gives similar results. On average, having AWD/4WD does not lead to significantly higher safety, or to significantly lower safety, on winter roads. It is also clear that pickup trucks in general, and especially 4WD pickup trucks, are overrepresented in winter-roadway condition crashes. However, the overrepresentation can be explained mostly by drivers choosing pickup trucks in snowy weather. Per mile driven, our conclusion is that 4WD pick-up trucks and SUVs, for its occupants, are no safer or less safe than two-wheel-drive vehicles, or at least within 20% of each other. In other words, people certainly do not cut their risk in half, or double their risk, by choosing one category of drivetrain instead of another. There is also no indication that the share of occupants who suffer serious injuries varies significantly with drivetrain type for winter-road conditions. A weakness of this study is that the estimates of exposure are limited. We can therefore not tell with great certainty what percentage of miles is driven in different types of vehicles in different types of weather. Overall, when comparing AWD and 4WD vehicles to two-wheel drive, we find that AWD/4WD has a slightly higher crash involvement than motivated by exposure on snow and ice. However, if looking at Subarus as a representation of cars with AWD, it seems clear that they are safer on snow and ice than two-wheel-drive cars in general. The results show that people 50 or younger have a statistically significant higher percentage of their crashes on winter-roadways than older people ($p = 0.0009$). Again, this is mostly an effect of exposure.

Documentation

A 25-page paper, All-Wheel Drive and Winter-Weather Safety, is available. Electronic copies of the paper can be obtained from Per Garder by contacting him by e-mail at Garder@Maine.edu