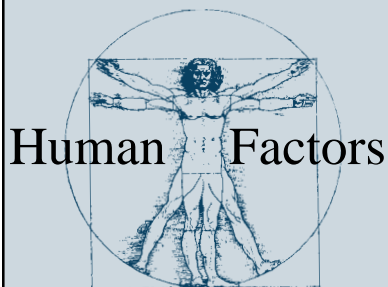


Summary Report



The Human Factors Research Program addresses human performance-related issues that affect highway system design. Current human factors research focuses on Highway Safety and Intelligent Transportation Systems (ITS).

FHWA is placing special emphasis on the trend of the United States to increase numbers of older drivers and implications of this trend on highway safety and ITS design. Human factors research products include highway system design guidelines and handbooks based upon empirical human performance data collected in the laboratory and in controlled, on-the-road tests.



U.S. Department of Transportation
Federal Highway Administration

Research and Development
Turner-Fairbank Highway
Research Center
6300 Georgetown Pike
McLean, Virginia 22101-2296

AN INVESTIGATION OF OLDER DRIVER FREEWAY NEEDS AND CAPABILITIES

This Technical Summary announces the completion of an FHWA study that is fully documented in a separate report (FHWA-RD-95-194) of the same title. (See report-ordering information on the last page of this Technical Summary.)

Introduction

Limited-access highways and the Interstate highway system have been largely responsible for greatly increasing the mobility and safety enjoyed by the American driving population. However, as the driving population ages, it is not known if the requirements for a driver using the freeway system are compatible with the capabilities of older drivers. The purpose of this study was to identify the problems experienced by older drivers on freeways and to recommend further research to make freeway driving more compatible with the needs and capabilities of older drivers.

Research Approach

Seven problem identification activities were performed:

- Task Analysis.
- Focus Group Discussions.
- Computerized Accident Analysis.
- Hard-Copy Accident Analysis.
- American Association of Retired Persons (AARP) Survey.
- Travel Diary Study.
- Research Recommendations.

Task Analysis

A task analysis was performed to identify the relationship between the freeway driving tasks and the age-diminished capabilities of older drivers. The task analysis addressed the basic driving task, maneuvering, abnormal conditions, emergencies, driver readiness, and vehicle readiness.

Focus Group Discussions

Eight focus groups were held in four cities: Washington, DC; San Diego, CA; Tampa, FL; and Phoenix, AZ. The 8 groups included 44 men and 44 women ranging in age from 65 to 88, with a median age of 70. There was no evidence to suggest that these older drivers avoided driving on freeways. The most-disliked aspects of driving on freeways included: the rudeness and dangerous actions of other drivers, large trucks, and high travel speeds. Participants were most concerned about congestion, inconsistent signing format and placement, inconsistent speed limits, too few police, short entrance ramps, construction zones, and inadequate rest areas.

Problems with signage included: unclear directions, inadequate advance notice, too much information (especially in California), difficulty seeing shoulder-mounted signs (well-lit overhead signs were preferred, especially with arrows specifying lane destinations), and inadequate advance notice for right-turn only and exit-only lanes.

Design issues included the need for larger, more gradual exit/entrance ramps and longer acceleration/merge lanes; increased use of concrete medians to promote safety and reduce glare; full cloverleaf interchanges; rumble strips and/or speed bumps to keep drivers alert; and a dislike of combination exit/entrance ramps.

Computerized Accident Analysis

Accident databases from five States (Illinois, Michigan, Minnesota, North Carolina, and Utah) over a 3- to 4-year period were included in the analysis. Comparisons were made between 4,155 crashes involving drivers over age 65 and 36,142 crashes involving drivers ages 31 to 45. The first series of analyses used all freeway accidents. The analyses found that: (1) no differences in involvement in multiple-vehicle, as opposed to single-vehicle, accidents; (2) older drivers were overinvolved in single-vehicle run-off-road accidents, possibly from the effects of fatigue; and (3) older drivers were slightly overinvolved in multiple-vehicle sideswipe, failure to yield/improper lane use, and merge/lane-change maneuver collisions.

A second series of analyses involved a paired-vehicle comparison of accidents involving one older and one younger driver. These analyses indicated that older drivers were more likely to be cited for failure to yield, improper lane use/passing, or speed violations, and older drivers were more likely to be merging or changing lanes just prior to the accident.

Hard-Copy Accident Analysis

The hard-copy accident analysis involved more than 900 accident reports from four States: Arizona, Florida, Illinois, and Maryland. Hard-copy accident reports were coded manually to identify causative and descriptive factors. Comparisons were made between accidents involving drivers 50 to 55 years of age and drivers over age 65. About one-quarter of the accidents involved single-vehicle accidents. The

analysis of the single-vehicle accidents revealed that older drivers were more involved in accidents on two-lane free-ways than on freeways with three or more lanes, and that almost one-quarter of the older drivers in single-vehicle accidents were found to be fatigued or asleep.

About three-quarters of the crashes involved two or more vehicles. In multiple-vehicle accidents, it was found that: (1) older drivers were struck by vehicles that were traveling faster; (2) unlike single-vehicle accidents, fatigue/falling asleep was not a factor in the multiple-vehicle accidents; and (3) there were no differences in lighting condition, road surface condition, vehicle type, vehicle speed, and involvement scenario.

The narrative and collision diagrams of the hard-copy accident reports were reviewed to quantify some of the more subjective aspects of the crash. It was found that older drivers were: (1) more likely to exhibit careless driving, be fatigued or asleep, or make improper turns; (2) less likely to be driving too fast for conditions; (3) more likely to be found “at fault”; (4) more likely to run off the road with no prior loss of control than the younger drivers in single-vehicle accidents; and (5) more likely to be hit by the other vehicle while changing lanes and while going slower than the younger drivers.

AARP Survey

Nearly 1,400 members of the American Association of Retired Persons (AARP) were surveyed. Members in 39 States completed an eight-page survey form in order to identify some of the specific problems or difficulties experienced by older drivers on freeways. Multiple responses were allowed. Respondents ranged in age from 50 to 97, with a mean age of 72.2. To identify age-related driver characteristics, the sample was divided into two groups: “younger” old drivers (age 72 or younger) and “older” old drivers (age 73 or older). There were 683 younger old drivers and 657 older old drivers. Chi-square comparisons were made between the two groups.

- About one-quarter of the drivers indicated that they avoided freeways,

with no differences between the younger and older drivers. The most common reasons for avoiding freeways included heavy traffic, high travel speeds, trucks, difficulties merging or changing lanes, and a preference for a more leisurely/scenic route.

- More than half of the survey respondents indicated that they drove less at night, during rush hour, and in snowy or foggy weather.
- Eleven percent of the respondents indicated that signs on the freeway were too small and 20 percent said signs were not bright enough.
- Three-quarters of the drivers indicated a preference for overhead signs as opposed to shoulder-mounted signs. They also preferred signs that indicated distances to several (as opposed to one) approaching exits.
- About half of the drivers indicated that sign messages (words and symbols) were either “sometimes” or “often” confusing.
- Lane-changing is difficult for older drivers. They indicated that they sometimes (60 percent) or frequently (17 percent) slowed down and followed a slower vehicle rather than pass it. They also never (17 percent) or almost never (23 percent) passed a slow-moving vehicle in the fast lane.
- Almost half of the drivers indicated that they either occasionally (45 percent) or often (3 percent) became fatigued while driving.
- Older drivers indicated that they sometimes (42 percent) or often (32 percent) used rest areas.
- Toll plazas created difficulties for some older drivers.

- Headlight glare from oncoming and following vehicles caused problems for half of the drivers.
- About a fifth of the drivers reported problems around construction zones.
- Drivers reported that they had problems staying in their lane because of worn or faded lane markings (56 percent), barriers or construction (25 percent), and large trucks (24 percent).
- Almost three-quarters of the drivers indicated that more lighting was needed at exit ramps (45 percent), rest stops (37 percent), construction areas (31 percent), and interchanges (26 percent).
- Drivers indicated that many highway features “help a lot,” including painted lane lines (90 percent), raised pavement markers (RPMs) (78 percent), guardrails (68 percent), post-mounted reflectors (68 percent), and rumble strips (50 percent).
- Some drivers had difficulties entering and exiting freeways: 25 percent said they actually stop before merging into traffic and 52 percent slow down before reaching the exit lane.

Travel Diary Study

A subset of the AARP Survey participants were recruited to record a 2-week account of their driving trips. The participants recorded date, time, odometer readings, origin/destination routes used, reasons for route selection, and problems encountered. The final sample involved 7,896 trips by 157 drivers who ranged in age from 65 to 89, with a mean age of 72.9. They represented 33 different States.

As expected, most (80 percent) of the trips involved no freeway and 8 percent were all or mostly freeway. The analysis focused on the 20 percent of the trips that involved at least one-quarter or more freeway travel.

Comparisons between the time of day of travel and the time of day of accident involvement revealed that the distribution of freeway accidents was very similar to the distribution of freeway trips. Apparently, older drivers successfully scheduled their trips to avoid periods of heavy congestion and higher accident risk.

The older drivers indicated that they typically selected their route because it was shorter/faster or because they were more familiar with the chosen route. They were more likely to choose their route to avoid local streets and traffic congestion than to avoid freeways.

The most frequently encountered problems on freeway trips were: congestion (16 percent), construction (6 percent), and bad weather (3 percent).

Research Recommendations

The ultimate purpose of this project was to identify the problems experienced by older drivers on freeways and to identify additional research needed to address these problems. These problems were categorized by problem areas, and a variety of potential study topics were identified. Table 1 (on the following page) summarizes the research recommendations. The first column, Research Area, describes the general topic of the suggested research. The second column, Problem(s), describes the problem(s) that older drivers have on freeways that is addressed in the suggested research. The last column, Needed Research, describes the research that is needed to address the specific problem(s). It should be noted that the research recommendations are those of the authors and, as such, are not necessarily endorsed by the Federal Highway Administration.

For More Information:

Contact Elizabeth Alicandri, Manager, Human Factors Laboratory, HSR-30, Turner-Fairbank Highway Research Center, Federal Highway Administration, (703) 285-2415.

Research Area	Problem(s)	Needed Research
Navigation/ Wayfinding	Difficulties navigating. Overinvolvement in accidents in unfamiliar areas.	Further define problem. Develop and test alternative traffic control device designs.
Freeway Ramp Merging	Merging onto mainline from ramps.	Identify ramp geometrics and mainline characteristics that contribute to the problem. Develop and test alternative designs.
Freeway Transition Areas	Exit ramps, bifurcations, and lane drops.	Identify geometric features and traffic control devices to minimize problems in transition areas.
Illumination Requirements	Nighttime driving. Reduced driving at night.	Identify critical factors associated with highway lighting, i.e., placement, amount of lighting.
Speed/Lane Selection	Inappropriate lane selection. Inappropriate speed selection.	Identify relevant design parameters: horizontal/vertical curvature; lane, roadway, and shoulder width; median type and proximity; guardrail type and proximity.
Construction Areas	A major concern and a reason for avoiding freeways.	Identify characteristics of construction areas that are troublesome to older drivers. Develop and test treatments to improve older driver performance in construction zones.
Fatigue/ Medication	Fatigue is a major factor in single-vehicle accidents. Many respondents indicated they were often fatigued while driving.	Identify roadway characteristics (geometrics, delineation, lighting) associated with fatigue and fatigue-related crashes.
Lane-Changing/ Passing Behavior	Lane-change-related crashes. Problems reported with passing/lane-changing.	Conduct detailed behavioral analyses of lane-changing and passing behavior. Determine adequacy of exit signing and advanced exit signing relative to time needed to complete passing maneuver or change lanes to exit.
Roadway Delineation	Heavy reliance on delineation, RPMs, and post-mounted delineators. Run-off-roadway and lane-changing accidents may be related to poor delineation.	Determine optimal delineation width and reflectance of RPM and post-mounted delineator spacing, etc. Wet/nighttime performance is especially critical.
Roadway Signing	Strong preference for overhead signing and for listing multiple exits on advance warning systems.	Determine readability and legibility advantages and disadvantages of overhead vs. shoulder-mounted signing. Determine optimal message content (length and format) of advance exit signing.
Rest Areas	Older drivers use exiting rest areas and would like more of them. Fatigue-related accidents might be reduced if more rest areas were provided.	Determine optimal rest area spacing and characteristics (services, lighting, security, etc.).
Toll Plaza Design	Merging with other vehicles to get in line and merging with other vehicles leaving the plaza.	Determine factors that affect merging behavior when approaching and leaving toll booths (delineation, signing, illumination, etc.) Optimize the most salient factors for older drivers.
Congestion-Related Accidents	24 percent of the older driver multiple-vehicle accidents involve striking stopped or slowing vehicles.	Determine effects of both active and passive advance warning signs for "congestion ahead" situations. Determine optimal type, placement, and wording.

Table 1. Recommended Research