MASS

INTERCHANGE

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Age and Driving

Older motorists on roadways are increasing in number. Nationally, the percentage of motorists over 55 is steadily growing to the point, that by the year 2010, one half of the US population will be 55 years of age or older.

In 1993, licensed motorists comprised 8.8% of the total population over 70. Advances in medicine, better life-styles, and other factors mean more of these older motorists will remain independent and continue to drive. Due to the large representation of motorists age 55 and over in automobile accidents, studies have been performed to identify errors among older motorists which lead to such accidents. The most common errors are:

*Failure to yield to right-of-way

*Failure to obey signs, signals, and markings

*Improper turns

All of these factors are compounded by high speed traffic and high density intersections. By understanding motorists, guidelines emerge for the traffic engineer to design the roadway elements to optimize use for older motorists. These same improvements also help the fatigued, preoccupied, or impaired motorist. The result is better and safer highways for all motorists.

Illustration reprinted with permission from graphic artist Jonathan Bouw.

Local Technical Assistance/Technology Transfer Center

How Well Do You See?

Older motorists don't see as well as they did when they were younger, especially at night...

Research on the older motorist has been increasing in recent years. Although there are a number of aspects of human performance related to driving which change with the passage of years, such as response time and information processing, more of these are extremely variable, i.e. age is a poor predictor of performance. Not so for visual perception. Although there are exceptions, for the most part, visual performance becomes progressively poorer with age, a process which accelerates somewhere in the late forties or early fifties.

Some of these changes are attributable to optical and physiological conditions in the aging eye, while others relate to changes in neural processing of the image formed on the retina. The abilities related to optical and physiological processes in the eye are:

*Ability to see detail ("visual acuity")
*Ability to see contrast
*Ability to see dim objects and objects in a cluttered background ("target detection")
*Ability to see object in glare
*Ability to see objects outside the line of sight ("peripheral vision")

These are the seeing abilities that decline with age, usually so slowly that the person doesn't realize for some years that they don't see as well as they used to. These ability declines affect the importance of traffic control device design and placement.

The *Manual on Uniform Traffic Control Devices (MUTCD)* that forms the basis for sign design and placement for all states and almost all local jurisdictions makes a fundamental assumption: that motorists can be expected to score at least 20/23 (slightly worse than 20/20). If you do a little trigonometry, the 1 inch letter height for 50 feet rule of thumb works out to 20/23. Studies have shown that 15 percent of the general driving population cannot read letters of that size at 50 feet, and 40 percent of motorists over 65 cannot see that well, even under the very best visual conditions.

There is also some evidence that the night vision system ages faster than the day vision system does. The bottom line is that only 30 percent of the light under daytime conditions that is recovered by the retina in a 20 year old gets to the retina of a 60 year old. Because of these changes, the brightness of an object (such as a curb) has to be increased by twice or more for a 70-year-old to see it at the same distance as a 30-year-old.

Test Chart for Visual Acuity

Though not as accurate as a doctor's exam, by propping this exam 10 feet away, you can get a feel for what we mean by visual acuity. Which line can you read? Try dimming the light in the room and notice what happens to visual actuity at the nighttime levels of light.

Line 5

xgeopb

Line 4

tpeowm

Line 3

qkhmle

Line 2

tburdx

Line 1

fgvlwp

Line 1 is 20/15, line 2 is 20/20, line 3 is 20/30, line 4 if 20/40, and line 5 is 20/60.

A 55-year-old person required more than eight times longer to recover from glare if their eyes are darkness adapted than a 16-year-old does.

Motorists may find themselves in very close quarters with opposing traffic when they least expect it, and visibility under condition of loss of darkness adaption must be considered.

Although the popular belief is that people "slow down" as they age, it depends a lot on what kind of task they are doing, why, and where. See page six for some general principles of positive guidance and methods of design.

Extracted from Positive Guidance and Older Motorists - Guidelines for Maintenance Supervisors, Texas A & M (Baystate TRA-61)

The **55 ALIVE Mature/Driving Program** helps older motorists to improve driving skills, prevent car crashes, and avoid traffic violations. This refresher course was developed by AARP (The American Association for Retired Persons) for motorists 50 years and older. It offers 8 hours of classroom instruction covering problems associated with impaired vision, hearing, reaction time that impacts older drivers, and the affects of alcohol and medications. If you would like more information or want to participate as a coordinator or instructor, contact:
AARP
55 ALIVE/Mature Driving Program
601 E Street, N.W.
Washington, DC 20049

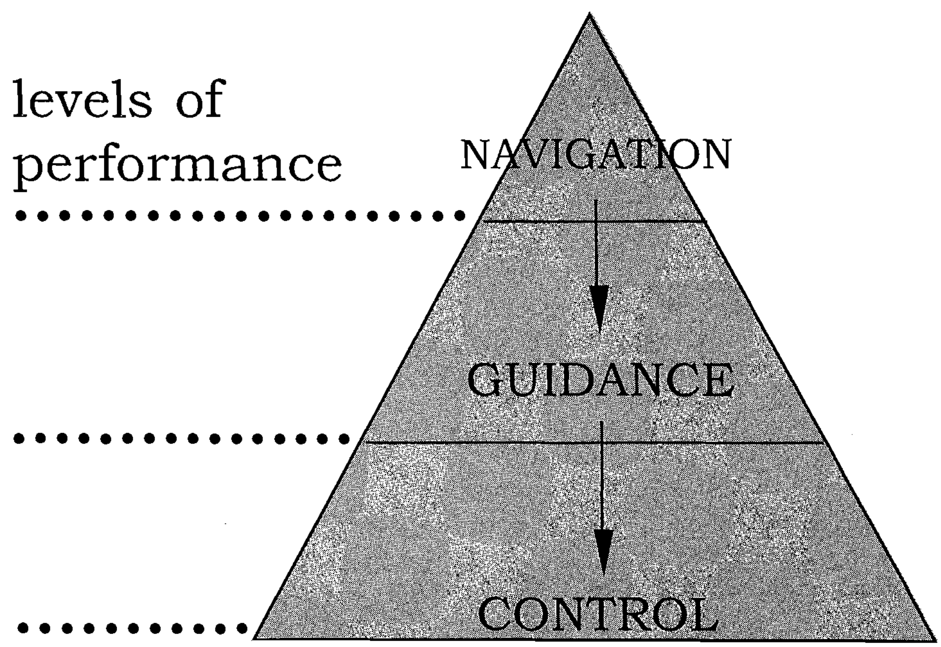
DRIVING TASK MODEL

There are three aspects behind the idea of "Positive Guidance," which build upon one another. First formulated by Alexander and Lunefeld of the Federal Highway Administration, the ideas of Positive Guidance have taken hold in traffic engineering.

1. Navigation Level of Performance
This top level of driving is most like that of a captain of a ship or a supervisor at a construction site. Before the trip begins, the motorist may plan his route using maps, directions, or past experience with the area to be traveled. While on his way, the motorist uses information from guide signs, as well as landmarks, and checks to confirm the pre-trip plan. Information that he may receive while driving can also change the pre-trip plan. Examples of this information would be detours or construction areas. The motorist must integrate the pre-plan information with the real-time changes from work zone detours to successfully *navigate* to a final destination.

2. Guidance Level of Performance
This next level down involves the tasks of keeping the vehicle in the intended lane and maintaining speed in the context of the roadway and other traffic. Judgement, estimation, and prediction are all important elements of *Guidance* performance in the constantly changing environment of the vehicle moving along its path. *Guidance* level decisions are implemented as speed and path change in response to alignment, grade, hazards, traffic and the environment. It is at this level that much information from traffic control devices, signals, markings, and delineation from the roadway is processed, making this information **critical** to the motorist.

3. Control Level of Performance
The most basic level is the control of performance. This level has all the components of driving concerned with operating the controls and reading the displays. Information for the *Control* level of performance comes from the roadway, the vehicle displays, and the "feel" of the vehicle. For most people, the *Control* level of performance quickly becomes almost automatic. For some older motorists, skills mastered during years of driving may slip a little, and require more attention.



Future Car Equals Future Design

Don Fisher's new car originally cost about $12,000, but is now worth over half a million... and it doesn't even have an engine! This dark green, 1995 Saturn is used as part of Project MIDAS (Mass Interactive Driving Acoustic Simulator), which runs driving scenarios with various subjects to test everything from reaction time to accident probabilities.

Formerly a Mathematical Psychologist (one who studies performance behavior), Dr. Donald Fisher and a team of 15 graduate students at UMass/Amherst, analyze volunteers' reactions to various driving situations. These volunteer drivers sit in the Saturn and watch computer-generated scenes displayed onto a screen directly in front of the car. Through a perimeter of circuit boards around the engine compartment, the driver's steering, acceleration, and braking send signals to the main computer. These signals are translated into a continuously changing scene which moves according to the driver's actions.

I had momentary flashbacks...

The graphics are so realistic that a sharp turn can bring on an instinctive lean for compensation. In Seattle, where one of the other two simulators are housed, crash scenarios were abandoned since subjects left the site feeling the slight shock and fear of driving that often follows a real accident. In fact, it feels so real that after a mere 10 minutes of simulated driving, I had momentary flashbacks during the following weekend when doing similar driving motions in my Nissan.

The only problem with the simulations is that the inner ear is not being jogged as it would in a real driving situation, and thus confuses the equilibrium, causing nausea in some test subjects (such as myself - Ugh!). However, the benefits of these tests far outweigh the minor discomforts of a few test subjects.

One beneficial finding relates to elderly drivers. The National Institute of Aging in Bethesda, MD, asked MIDAS to investigate why older drivers are involved in more accidents while making left turns than younger drivers. Dr. Fisher found that there was a large disparity between printed directional signs and a lack of signs altogether when used in conjunction with left-turn arrows. Surprisingly, they found that a sign of "protected left on green yield" in conjunction with a green arrow led to a 25% false alarm rate. This rate was lowered when the sign was either "yield" with a green globe, or "protected left" with a green arrow. This type of variable message sign could be as simple as the type used for "walk/don't walk" signals. However, the rate of error went to nearly zero when there were no signs at all! Many more tests need to be conducted before the MIDAS team can present this as the best alternative to the state of Massachusetts.

These tests and experiments assist with the design of new roads and the renovation of established motorways. In addition to studies of the elderly driver, MIDAS is also conducting research on everything from teen-driver, CD ROM prep courses to cellular phone design.

For more information about this study or others being conducted by Dr. Donald Fisher at the University of Massachusetts/Amherst, check the **WEB** under http://www-unix.ecs.umass.edu/

by Danielle Carriveau, a Masters candidate in the School of Education, UMass/Amherst

calendar

Sept. 10, 1998	Massachusetts Highway Assn. Annual Equipment Show at Fort Devens Contact: Jerry Daigle 508-634-8669	Ayer, MA
Oct. 20-21, 1998	BAYSTATE Culvert Inspection Workshop	Northampton, MA
Oct. 22-23, 1998	BAYSTATE Culvert Inspection Workshop *REMINDER ONLY - REGISTRATION IS FULL*	Westborough, MA
Oct. 27, 1998	BAYSTATE Share the Road with Bicycles	Andover, MA
Oct. 28, 1998	BAYSTATE Share the Road with Bicycles	Hyannis, MA
Nov. 17, 1998	BAYSTATE Share the Road with Bicycles	Northampton, MA
Nov. 18, 1998	BAYSTATE Share the Road with Bicycles	Worcester, MA
Nov. 4, 1998	BAYSTATE Snow and Ice - What's New	Northampton, MA
Nov. 11, 1998	BAYSTATE Snow and Ice - What's New	Worcester, MA
Nov. 12, 1998	BAYSTATE Snow and Ice - What's New	Taunton, MA

Congratulations!

to the Work Zone Safety Contest Winners

Thanks to all who participated in our recent contest...hope you had fun answering those 17 questions! As noted in our last newsletter, the winners of the Instrusion Alarms will be asked to give us feedback on their benefits and this will be reported in a future issue. And now...the envelope PLEASE!

GRAND PRIZE: Intrusion Alarm and Two Safety Vests

Richard Anctil
Town of Yarmouth

Paul S. Bokoski
Town of Bellingham

SECOND PRIZE: Seven 28" 2-collar cones and One Safety Vest

Edward D. Parent, Jr.
Town of Hull

John J. Marsh
Easton Waterworks

THIRD PRIZE: Five 28" 2-collar cones

Anita Hegarty
Town of Boylston

FOURTH PRIZE: Two Safety Vests

Richard Malatesta
Town of Rochester

Don Gillette
Town of North Brookfield

Unlike the subject of gerontology studies done just a few years ago featuring people who came of driving age in the 1920's or even before, the old of tomorrow started driving in the 1940's and after. They are more affluent, better educated, in better health, and have driven under modern conditions since their teens. The future older motorist may well exhibit much less decline in many of these performance areas in which central processes are dominant.

We must be careful not to overdesign for the elderly of yesterday.

General Principles of Positive Guidance

Many of these principles sound like common sense, and indeed they are, but you have probably encountered lots of situations in your work in which common sense has, in retrospect, been violated. Sometimes it makes sense to spell out common sense!

1. **Design for...Motorists!** Motorists are the "users" of the roadway, not traffic engineers or the transportation industry. They don't understand the relation of technical concepts to design, operations, or motorist information. Some motorists are very well educated, some are not even literate, at least not in the English language. They are intent on simply getting from point A to point B, and the technical aspects of the facility should be "transparent" to them, while still providing them what they NEED to know.

2. **Accommodate Target Groups** There are certain types of motorists who may need special design consideration, more in some locales than in others. Older motorists are a special concern but there are other special groups, such as truck motorists in hilly country or the tourist in rush hour.

3. **Take into Account Motorist Task Demands and Motorist Abilities** Roadway information should consider how heavy the motorists' attention demand may be, and how well a motorist can meet those demands. Motorist information needs are certainly marked differently on a crowded freeway at rush hour than through a small town. Anticipation of information needs is critical.

4. **Satisfy ALL Information Needs** Speed and path information should always be available. Routes, services, and hazards should be displayed when appropriate, all in a form suitable for the motorists and the current driving situation. Fulfilling this principle can be a very tall order. Often in an attempt to provide ALL the information overload, frustration, confusion, and even an accident may result. The key is the RIGHT information at the RIGHT time.

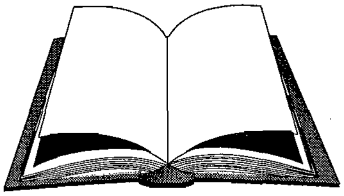
5. **Maintain Compatibility between Roadway and Information** The information in the context of the roadway where it is installed should be reviewed either by mock-up or computer simulation to make sure they are consistent with each other. This is another principle that is often hard to meet. Sometimes, for example, direction-guide sign arrows can be confusing and not reflect actual geometrics at an intersection. No wonder we are all confused as motorists!!

6. **Avoid Surprises and Expectancy Violations** When motorists are suddenly confronted with unexpected features, hazards, or choice points without prior information many things can and DO happen. A well-designed information system should be predictable, even boring, to free the motorist from too much information load at critical times.

7. **Eliminate Information Error Sources** Common examples of information error sources are missing information; traffic control devices that are inoperative, defective or defaced; and devices hidden by plants, snow, or construction debris. Other error sources include the placement of devices or markings too close to the hazard or choice point and obsolete or nonstandard devices.

8. **Provide a Steady Flow of Needed Information** As the motorist proceeds, he should get just what he needs to know, neither more and certainly not less. The information must be "spaced out" to permit him to process it at a pace compatible with the other tasks in the Positive Guidance Pyramid (page 3).

9. **Where Information Needs to Compete, Use Priorities** Priority is determined by what performance level is being given information, and by degree of hazard if the information is not provided. Control is always highest priority, guidance next, and navigation the lowest of all. Like some of the other rules, it can be difficult to satisfy this principle for all motorists.



publications and videos

PUBLICATIONS

☒ Sixth International Purdue University Conference on Concrete Pavement Design, Vol. 1, 2, and 3	COC-53 A, B, C
☒ Accessibility for Elderly and Handicapped Pedestrians - A Manual for Cities	PED-01
☒ Traffic Calming	TRA-45
☒ Improving Operational Safety on Local Roads and Streets	SAF-10
☒ Guide to Safety Features for Local Roads and Streets	SAF-25
☒ Positive Guidance and Older Motorists - Guidlines for Maintenance Supervisors	TRA-61

VIDEOS

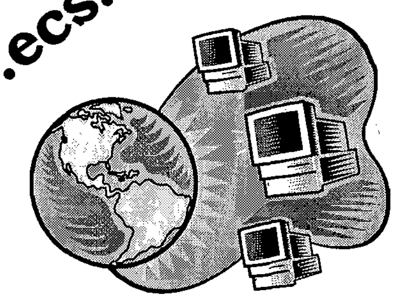
☒ Safety Features for Local Roads and Streets, Part 1	ST-102
☒ Safety Features for Local Roads and Streets, Part 2	ST-103
☒ Roadway Design: Balancing Safety, Environment, and Cost	ST-172

Please FAX your requests by code number to Baystate Roads at 413-545-6471 or call 413-545-2604.

1998 DEADLINE FOR UNDERGROUND STORAGE TANKS

EPA will not extend the December 1998 deadline for upgrading, replacing, or closing underground storage tanks. Under regulations that the EPA issued in 1988, owners and operators of underground storage tanks (UST's) storing petroleum and hazardous substances have until December 22, 1998 to change UST's that do not meet federal requirements for protection against spills, overfills, and corrosion. These requirements are a key element in state and EPA efforts to prevent groundwater contamination. EPA and states will continue to work with UST owners and operators to encourage compliance in advance of the 1998 deadline. For more information, call the EPA's UST helpline at **1-800-424-9346.**

Visit the **Baystate Roads** website at **baystate.ecs.umass.edu**



Congrats!

to our newest BAYSTATE ROADS SCHOLAR...

Susan Brackett

Assistant Town Engineer for the Town of Northborough

in this issue

The Baystate Roads Program, which publishes *Mass Interchange* each quarter, is a Technology Transfer (T2) Center created under the Federal Highway Administration's (FHWA) Local Technical Assistance Program (LTAP). FHWA is joined by the Massachusetts Highway Department, the Department of Civil and Environmental Engineering at the University of Massachusetts/Amherst, and local public works departments in an effort to share and apply the best in transportation technologies.

In addition to publishing *Mass Interchange*, the Baystate Roads Program facilitates information exchange by conducting workshops, providing reports and publications and videotapes on request, and offering one-to-one technical assistance on specific roadway issues. Because the program relies on input from many sources, inquiries, articles, and ideas are encouraged.

Local Technical Assistance/Technology Transfer Center

To contact the Baystate Roads Program call (413) 545-2604 or FAX 413-545-6471.

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