Southwest Region University Transportation Center

Positive Guidance and Older Motorists - Guidelines for Maintenance Supervisors

SWUTC/96/721917-2

Texas Transportation Institute
Texas A&M University System
College Station, Texas 77843-3135

Update
May 30, 1997

ERRATA SHEET FOR

Greene, F.A., et al: *Positive Guidance and Older Motorists - Guidelines for Maintenance Supervisors*

Please make the following corrections and additions to your copy:

1. Page 4-14 Between 1st and 2nd paragraph replace the words **"No Sign Zone"** as a paragraph heading by the word **Introduction**

2. Page 4-14 Between 4th and 5th paragraphs replace the word **Introduction** by the words **No Sign Zone**

3. Page 4-31 3rd paragraph add the words (Exhibit 4.23) after the first sentence

4. Page 5-3 4th paragraph, is taken directly from Hauer (Ref. 3), so replace (26) with Hauer (3).

5. Page 7-1 4th paragraph, first sentence should read:
The minimum size of characters on all signs should be increased by at least 30 per cent....

6. Please replace the reference page with the page provided in this update.

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16. Abstract

This is a field manual designed for maintenance supervisors and resident engineers responsible for repair and replacement of traffic control devices on highways and streets. Standards and practices have not always taken in account the realities of the performance to be expected from a growing minority in the United States, the older motorist. After describing some aspects of older motorist performance in basic terms, sections are presented on signing, signals, pavement markings and other traffic control provisions. Using the principles of *Positive Guidance* pioneered by Alexander and Lunenfeld of the Federal Highway Administration, suggestions are offered for improving the flow of information from the highway to the older motorist, which indirectly makes driving easier for everybody.

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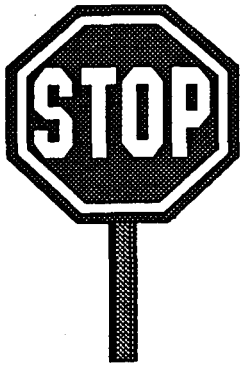
POSITIVE GUIDANCE AND OLDER MOTORISTS

GUIDELINES FOR MAINTENANCE SUPERVISORS



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December 1996

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The Texas A&M University System
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Foreword

This field book of guidelines presents a variety of suggestions for practical ways to improve the driving scene for the older motorists among us. It was compiled under funding from the Federal Highway Administration through the Southwest Region University Transportation Center at the Texas Transportation Institute in College Station, Texas. The suggestions and approaches presented in these guidelines represent the authors' best understanding of current practice and the research literature. In some cases where relevant research or standards were not available, the authors have not hesitated to use their best judgement on how to handle special situations that may arise on the highway or on a local street system. In keeping with the purpose of a field guide, references have not been given in most cases, but the main resources from which this material has been drawn have been listed in the rear of the report. Although every attempt has been made to adhere to the *Manual on Uniform Traffic Control Devices*, it is probably too much to assume that some errors have not been unintentionally made. At the very least, it is hoped that this collection of guidelines will stimulate extra consideration of those who someday, with a little luck, will be us--older motorists.

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Rodger J. Koppa
Katherine Rodriguez
Samantha Wright

Texas Transportation Institute
College Station, December 1996

DISCLAIMER

ACKNOWLEDGEMENT

The authors recognize that the support for this publication was provided by a grant from the U.S. Department of Transportation, University Transportation Centers Program to the Southwest Region University Transportation Center.

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Chapter 1 Introduction

About This Manual

The manual contains guidelines and specific examples for maintenance supervisors. The emphasis is on consideration of the older motorist on your roadways. The goal is to provide guidelines for your use and to produce a more effective roadway system by using what is known about needs of older motorists, along with a concept called POSITIVE GUIDANCE.

Please note the following:

- The manual addresses the concept of Positive Guidance.
- The chapters are organized by category of roadway elements and how they can be optimized for older motorist use.
- Examples are illustrative and are meant to convey general concepts.
- Geometry or sight distance may not let you follow all these guidelines
- In all cases, your local standards and the Manual on Uniform Traffic Control Devices (MUTCD) guidance must prevail in cases of conflicting principles.
- We have tried to follow the spirit of not always the letter of MUTCD, but your local standards may not be compatible with these suggestions.

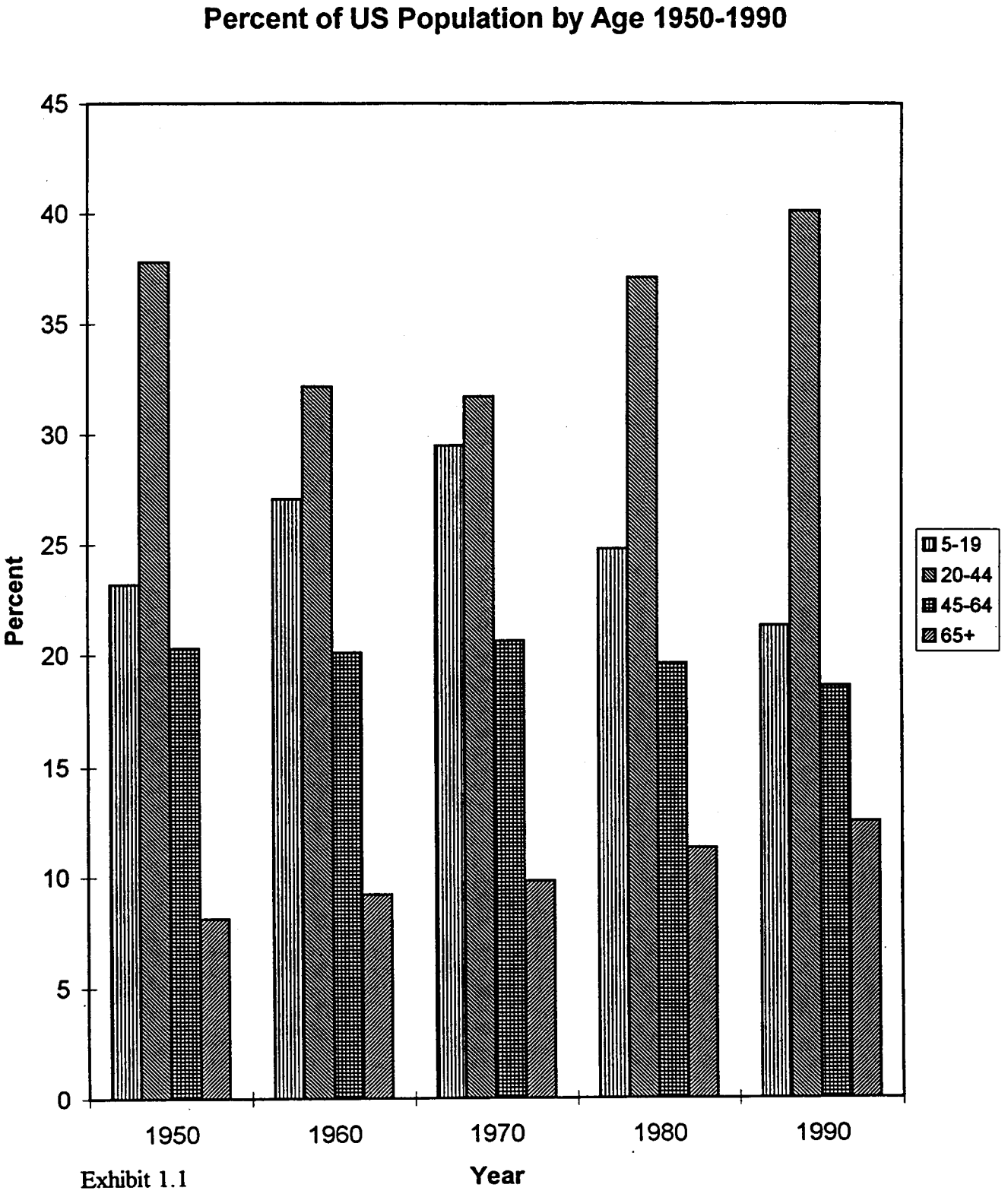
Percent of US Population by Age 1950-1990
45
40
35
30
25
20
15
10
5
0
Percent
1950
1960
1970
1980
1990
Year
5-19
20-44
45-64
65+

Exhibit 1.1

Older Motorist Statistics

Older motorists on roadways - they are increasing in number. Nationally the percentage of motorists over 55 are steadily increasing in number. By 2010, one half of the US population will be 55 years of age or older.

As seen in Exhibit 1.1, as compared to 40 years ago, the population age 65 and older has steadily increased. In 1993 licensed motorist over age 70 comprised 8.8% of the total population age 70 and over. Advances in medicine, better lifestyles and other factors mean more of these older motorists will remain independent and continue to drive. Due to the overrepresentation of motorists age 55 and over in automobiles accidents and fatalities, studies have been performed to identify errors among older motorists which lead to accidents. The most common errors are:

- Failure to yield to the 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.

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Chapter 2 Older Motorists

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

In general, this is true, as most older motorists will tell you. But it doesn't mean that any young motorist will always see better than any older motorist. But if you had to bet, the tendency is for vision to "worsen" as a person ages. What kind of vision, and what does it mean as far as driving and roadway information design is concerned?

Changes in Motorist Performance with Age Depend on What Performance You are Talking About

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, information processing, and decision making, movement ranges and times most 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 eyes are:

- Ability to see detail - eye doctors call this "Visual Acuity";
- Ability to see contrast;
- Ability to see dim objects and objects in a cluttered background - "target detection";
- Ability to see objects in glare; and
- 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. Let's briefly discuss each of these abilities in the next few pages and what they mean for traffic control device design and placement.

Test Chart for Visual Acuity

Prop this page 10 feet from you to 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 acuity at the nighttime levels of light.

Line 5

x g e o p b

Line 4

x g e o p b

Line 3

x g e o p b

Line 2

x g e o p b

Line 1

x g e o p b

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

Visual Acuity: Ability to See Detail

This test chart is a commonly used test for the visual ability you probably know the most about. The familiar eye chart in the doctor's office or eye test machine at the motorists license station all measure *Visual Acuity.* Any person's visual acuity changes literally from moment to moment. The amount of light, the brightness contrast between the object being observed and its background, the size of the pupil of the eye, fatigue, drugs - all can affect visual acuity.

What Does 20/20 Really Mean?

Everybody knows that "20/20" means that you have "good" vision. Suppose you rate that in an eye exam. What it really means is that you can read letters of a certain standard size of 20 feet away. If a person has extremely good visual acuity, they might be rated 20/10. That means that they can see at 20 feet what you can see at 10 feet. On the other hand, a person with not-so-good vision might rate 20/40. What they can read at 20 feet you can read at 40 feet. A really "blind" person might score 20/200. they must be at 20 feet to read what you can read at 200 feet.

The standard letter, or object size, on an eye chart for the 20/20 rating is a letter that is 0.35 inch high. A letter twice as large or 0.70 inch is the size for the 20/40 line. If a person stands 20 feet away, and says that he cannot correctly read the 20/20 line, but that he can (and does) read the line of letters twice as large as the 20/20 letters, the doctor scores him as 20/40. Also keep in mind that you see most distinctly in a circle about twice to three times the diameter of the moon (1 - 1.5 degrees of visual arc). Outside that circle visual acuity drops off very rapidly. A 30 inch warning sign seen at 100 ft covers 1.5 degrees of arc - not very big. This is not an optical condition, it is related to how the retina (light sensitive coating at the back of the eye) is built. For the most part, this is not a problem because you keep your eyes moving constantly.

The law in most states for unrestricted licensing is 20/40. Some states accept 20/60 visual acuity - what does your state accept? This test is done under daylight conditions, with sometimes very lenient examiners. What happens to visual acuity at night, with dirty windshields, in the rain?

Contrast

"Contrast refers to the brightness difference between letters or symbols and their background. The defining formula is given at the left, plus some hints as to calculating it for design purposes. This formula produces "negative" contrast for signs and publications when the letters are dark against a light background, and "positive" contrast otherwise.

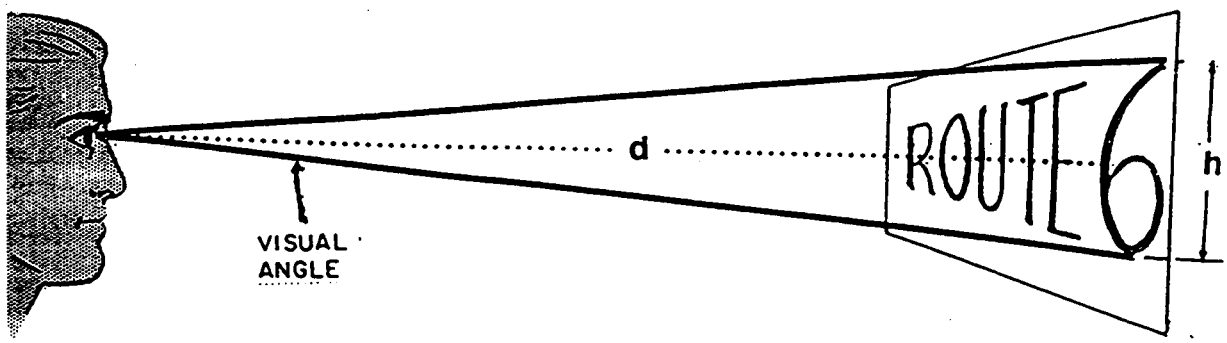


Exhibit 2.1

(For Angles less than 5 Degrees)

$VA_{degree} = \arctan(h/12d)$ or $VA_{radians} = h/12d$

Where: VA = Visual Angle; h = Height of character (inches); d = Viewing distance (feet)

MUTCD Rule is 1 inch: 50 ft or 1 inch: 600 inches

1/600 = 0.00167 Radians

If a character (h) subtends 0.00167 R at 20 ft,

h = (0.00167)(20)(12)

h = 0.4 inch, compared to standard character height of 0.35 inch (20/20) on visual acuity chart.

Letting VD = viewing distance for 20/20 observer (240 is the result of multiplying 12 in by 20 ft), then by simple proportion

$\frac{0.35}{0.40} = \frac{240}{VD}$ VD = 274.3 in or 23 ft. So the visual acuity is 20/23.

Contrast (%) = $(L_c - L_b)/L_b \times 100$

Where: L_c = Luminance (brightness) of character

L_b = Luminance (brightness) of background

"Luminance" is measured in ft-lamberts or in candela/meter^2

Note: If you know the reflectance (in percent) of the characters and the sign background, you can substitute those values for the L_c and L_b in the equation above to find the contrast. Black type has a reflectance of 10 %, and white paint has a reflectance of 90%. Substituting in the equation above, the contrast would be

Contrast =((10-90)/90)x100 = -88.9%

The MUTCD and Visual Acuity

The manual of Uniform Traffic Control Devices (MUTCD) that forms the basis for sign design and placement for all states and almost all local jurisdictions make 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. How we came up with this number is explained in the diagram to the left. 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 seeing conditions.

Causes of Loss of Visual Acuity

Fifteen of 25 percent of the population 65 and older register visual acuity's of worse than 20/50 corrected, owing to degeneration of the eye with age. Cataracts (dense spots in the lens or cornea of the eye) are common in older motorists, and can also degrade visual acuity if they are in the direct line of sight. Most of the losses in visual acuity with age are caused by thickening and darkening of the lens, light scatter in the eyeball, changes in the retina, and changes in the brain.

Exhibit 2.2 compares the visibility's of letters based on visual acuity's ranging form 20/10 to 20/60. The major message here, however, is that letters, symbols, and other details on signs need to be larger than the minimum standards of MUTCD. Recent research indicates sign character (text or symbol) needs to be 30% larger to accommodate the older motorist. It could be said the bigger the better, however, that runs up against other conditions of sign structure, cost, and possible clutter.

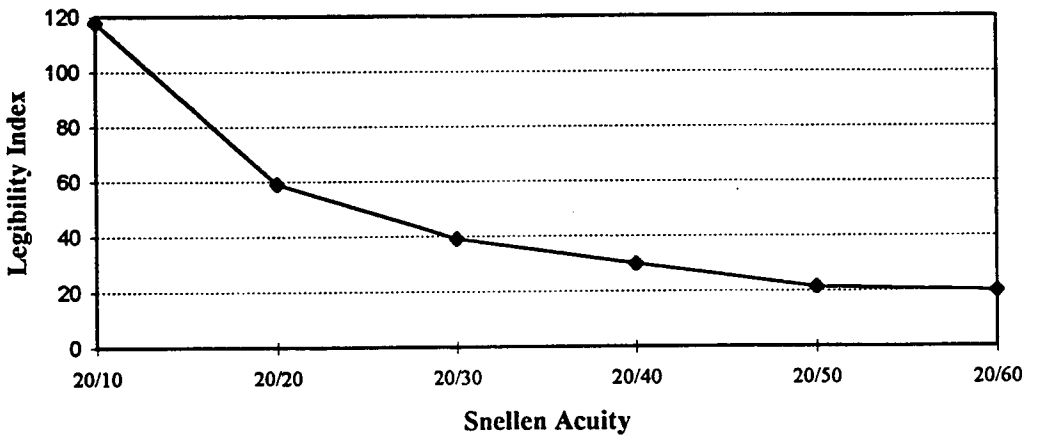


Exhibit 2.2

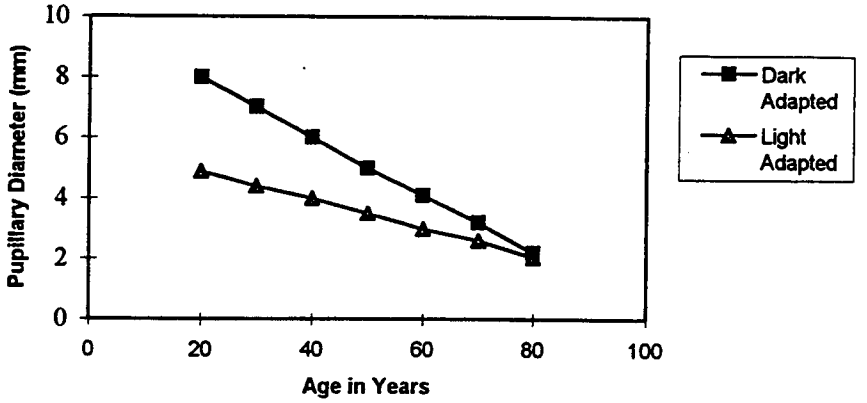


Exhibit 2.3 Diameter of pupil as related to age for both the dark and light adapted eye. Note the pupil gets smaller as age increases, allowing less light in.

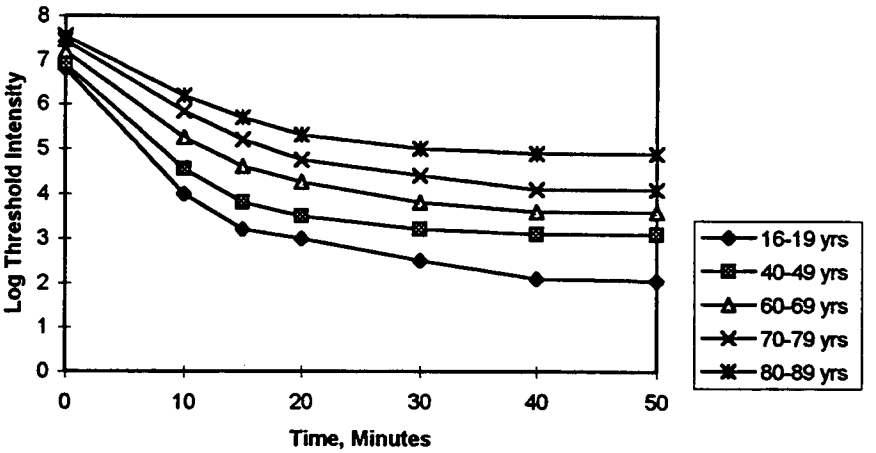


Exhibit 2.4 Dark adaptation as a function of age. Note, after exposure to glare, recovery is very slow.

Darkness and the Older Motorist

As the eyes age, several things make for greatly decreased vision at night:

- The crystalline lens thickens and darkens (turns yellow-brown)
- The pupil doesn't open as wide (dilate) (see Exhibit 2.3)
- The jelly-like filling (vitreous humor) of the eye becomes milky
- Sensitivity adjustment (dark adaptation) is slower (see Exhibit 2.4)

Industrial standards call for twice as much illumination at daylight levels for the older worker to compensate for these losses in light transmission and sensitivity. 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 gets to the retina in a 20 year old gets to the retina of a 60 year old. This becomes much worse at night (as little as 1/16 or only 6 percent), and is made worse by the scattering effect of the optic train. What this scattering means is that point of bright light are seen as surrounded by haloes that effectively mask less bright objects in proximity.

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.

Glare and Glare Recovery

The problem with glare for the older motorist is not, as is sometimes thought, that he or she sees the glare as brighter than a younger motorist, but rather that the older motorist has to have a more distinct (higher contrast) target to have a chance of seeing this target through the veiling glare or halo. If the glare source puts an after-image on the motorist's eye, that after-image takes longer to fade for an older person, and until it does, he or she is blind in that area.

A 55 year old person requires more than 8 times longer to recover from glare if their eyes are dark 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 conditions of loss of dark adaptation must be considered. An older motorist who does not use some strategy such as looking to the right and shielding his or her vision from oncoming headlamp glare is literally driving blind for many seconds after exposure. Scatter in the optic eye make distinguishing any marking or traffic control device difficult even impossible until re-adaptation to the prevailing light level before glare occurs.

	Horizontal Target			Vertical Target (obstacle)			Vertical Target (reflectorized)		
Glare Condition	Clear	Rain	Fog	Clear	Rain	Fog	Clear	Rain	Fog
No opposing traffic	Moderate	Severe	Moderate	Severe	Severe	Slight	Moderate	Slight	Slight
Opposing traffic on multi-lane roadway*	Severe	Extreme	Moderate	Severe	Severe	Moderate	Moderate	Moderate	Slight
Opposing traffic on two-lane roadway	Extreme	Worst Case	Severe	Extreme	Extreme	Extreme	Severe	Severe	Moderate

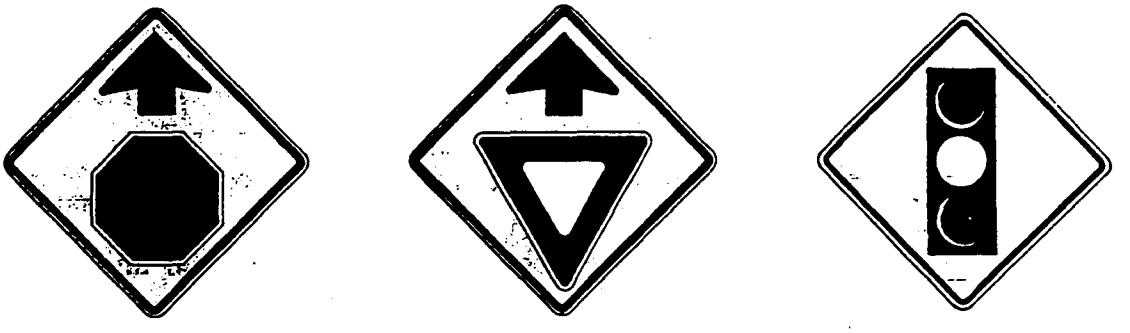
* Opposing traffic streams are separated by at least 12 feet.

Exhibit 2.5

Older Motorist and Detection

Exhibit 2.5 gives a qualitative assessment of the relative decrements experienced by older motorists versus young motorists in detecting different target types under deteriorating nighttime driving condition. As indicated in the table, for the older motorist, opposing traffic on a two-lane roadway causes extreme to worst case decrease in the ability to detect a target. As probably expected, the glare condition of rain poses the most challenging driving condition for older motorists.

MUTCD Advanced Warning Signs



W3-1a W3-2a W3-3

Exhibit 2.6

Changes in Mental Performance with Age

Perception - Reaction Time

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. Studies do show some lengthening of time to simple signals in older persons, although there are very great individual variations. Certain medications and disease (for example, Parkinson's Disease) result in slower reaction times. But studies of motorists under realistic driving conditions show little, if any variation in simple reaction time as a function of age.

As reaction time begins to involve more complex choices and decision-making, older people tend to be (with a great deal of individual variability) slower than younger people. Although the AASHTO standard lag time of 2.5 seconds for stopping and decision sight distance allowances remains a good, conservative guideline, unnecessarily complicated or cluttered driving situations can put the older motorist at a great disadvantage.

Some of the slowing of decision time seems to relate to perceptual changes that have been described. But the older motorist can also take longer to weigh each alternative and choose a course of action. Once the motorist decides what to do, the actual motor response is little affected by age in most people, who are healthy enough to drive.

Older motorists can experience problems in ignoring irrelevant information and correctly identifying important objects or signs. Due to a decrease in cognitive abilities in older motorists you need to:

- Make traffic control device (TCD) sign panels larger to increase their conspicuity in complex urban backgrounds.
- Repeat and distribute displays, like advanced signing (Exhibit 2.6).

Motorists may not be able to discriminate actual delineation from roadside advertising or distant lights, for example. In work zones, traffic control devices (TCDs) and markings that are meant to override the pre-work TCDs may be missed.

The safety problems associated with older motorists relate to the tasks that are heavily dependent on central processing. These tasks involve response to traffic or to roadway conditions. In tasks that require fine control, steadiness, and rapid decisions heavy traffic demands may break up the performance of older motorists, since the traffic forces them to maneuver at the pace of the stream. They attempt to compensate for this by slowing down thus going into a "self-paced" mode. Older people drive better when they can control their own pace.

Problem Category	Problem Description
Traffic Signals	Missing, damaged, or displaced signals not replaced promptly by maintenance authority: results in uncertainty and indecision at intersection about when to proceed.
Traffic Signs, general	Signs that are dirty, defaced, have faded (reflectivity), or are missing paint or reflective material: often results in inadvertent violations. Signs at curbside obscured by trees, telephone poles, billboards, etc.: prevents motorist from seeing sign in time to respond "smoothly", and leads to erratic driving. Traffic signs with too much information in too small an area, and/or with too small a type face: results in erratic driving as motorist must slow down or stop to respond to sign's message. Too many signs, spaced too closely together: motorist must either slow down or stop to read all signs, or keep pace with traffic and simply miss some of them.
Traffic Signs, regulatory	Four-way stop signs; very hard to know who should go first at intersection. Stop signs mounted on left side of road: unexpected location results in motorist not seeing sign and/or being slow to respond to sign. Black-lettering-on-white-background format: not conspicuous enough to catch your eye in "cluttered" environments. Symbol signs without accompanying verbal message: difficult to understand, with the result that the motorist must "pause" in traffic to decide upon an appropriate response in some situations.
Traffic Signs, warning	Lack of sufficient advance notice of road work: results in not knowing when and where to prepare to stop or maneuver, sometimes producing sudden stops when work site is reached, with motorist unsure about what to do next.
Traffic Signs, guide	Expressway signs that contain too little or too confusing information: motorists can't always be sure what exit is next, and what towns and roads a particular exit leads to. Signs identifying cross streets: either they are located too close to the intersection to which they refer (not allowing time for safe turns), or they are located so that one or more minor streets fall between the sign and the intersection it refers to, which is confusing.
Roadway Delineation	Pavement markings faded or missing on road edges, lanes (esp. turning), and islands: difficult to know where to drive, especially in bad weather. Undelineated "target" lanes for left-turning traffic: causes uncertainty about where to "aim" vehicle, and hesitation during turn.

Implications of Performance Differences for Traffic Engineering

Exhibit 2.7 shows the problem areas that have surfaced in older motorist focus groups. Each category of TCD or delineation can be improved. These considerations are just a few of many factors that must be considered in present-day approaches to signs and traffic control systems for the guidance of the older motorist. Somehow, when the motorist is doing the very best that he or she can, given all the abilities, constraints, and information available, an accident or incident occurs. The information may be inadequate because:

- There is too much information
- There is too little information
- The information given is ambiguous
- The information is conflicting
- The information is in the wrong place
- The information is not visible (no transfer can take place)

In other words, the motorist is not at fault, but rather he or she has not been displayed the right information at the right time under prevailing operational conditions to do the job of system controller in the personal transportation system. The concept of *positive guidance*, to be discussed in the next section of this manual, presupposes a "reasonably competent" motorist that is not impaired. At some point the aging process renders all motorists impaired beyond the limit of "reasonable competence". Our business is to delay this ultimate impairment as long as possible to permit the growing numbers of older people to continue to participate in the primary transportation system (often the only transportation system) available in this country. At any given point on the roadway, older motorists must be given adequate decision sight distance: "The distance at which a motorist can detect a signal (hazard) in an environment of visual noise or clutter, recognize it (or its threat potential), select appropriate speed and path, and perform the required action safely and efficiently...".

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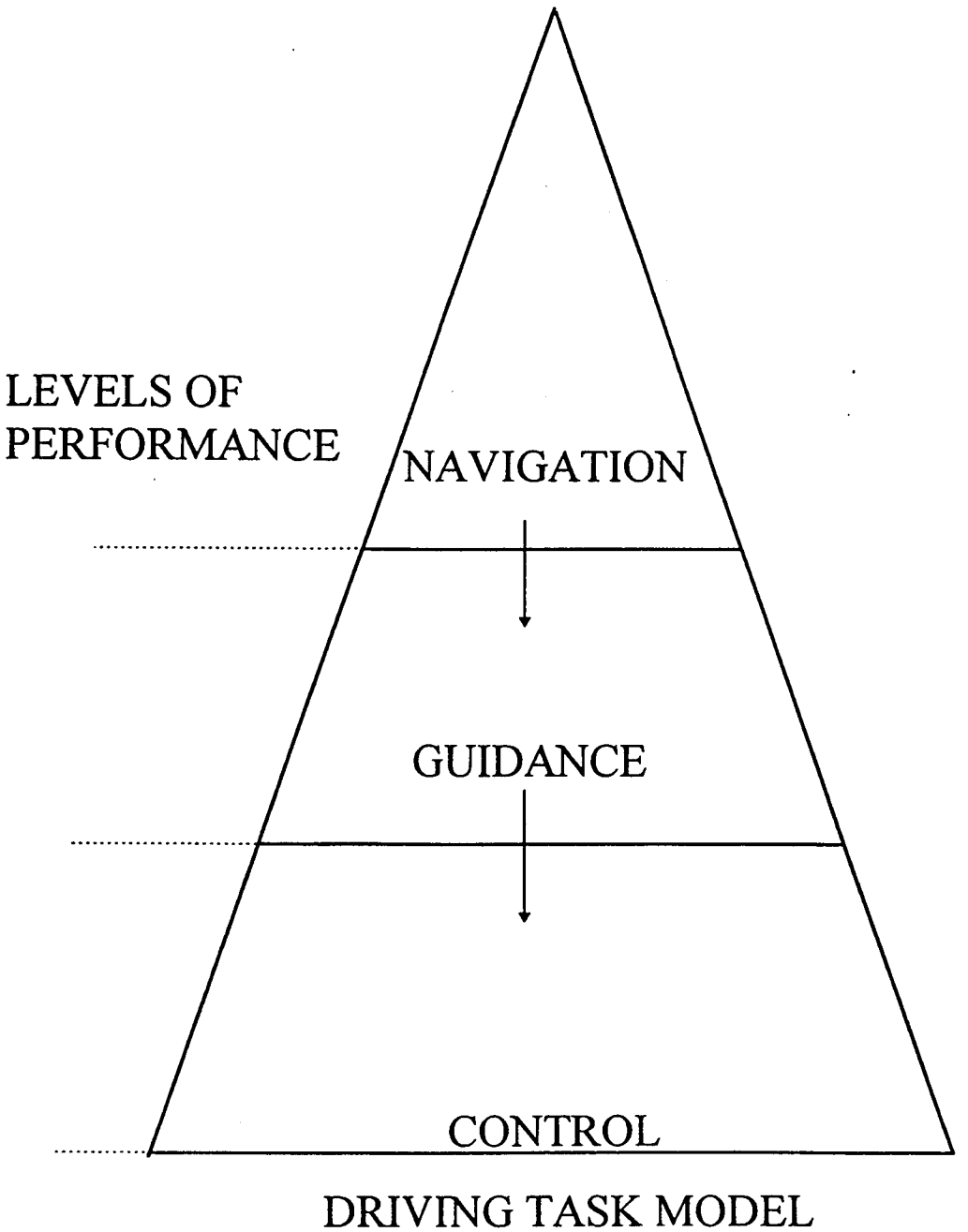
The Elderly Motorist of the Past or Even of Today is Not the Older Motorist of the Future

The cohort of motorists who will be 65 in the year 2000 were born in the 1930's. Unlike the subjects of gerontology studies done just a few years ago featuring people who came of driving age in the 1920's or even before, when far fewer people had cars and traffic was sparse, the old of tomorrow started driving in the 1940's and after. They are and will be more affluent, better educated, in better health, resident in the same communities they lived in before becoming "older motorists", and they have driven under modern conditions and the urban environment since their teens. If many older motorists in the past have had problems reading the code of broken vs. solid lines with regard to movement out of the lane, most of the older motorists of the immediate future have had motorist education and Defensive Driving. They will likely continue driving on a routine basis until almost the end of their natural lives, which will be happening at an ever advancing age.

The cognitive trends briefly discussed above are very variable in incidence and in their actual effect on driving performance. The future older motorist may well exhibit much less decline in many of these performance areas in which central processes are dominant. The perceptual decline outlook is less hopeful, but even the replacement of cataract-scarred crystalline lenses with plastic substitutes is a routine office procedure for ophthalmologic surgeons, as is replacement of corneas, laser fixation of detached retinas, and much else besides. *We must be careful not to overdesign for elderly of yesterday!*

Chapter 3 Positive Guidance & Older Motorist Applications



DRIVING TASK MODEL

Exhibit 3.1

Chapter 3 Positive Guidance & Older Motorist Applications

The Driving Task Pyramid

There are many ways to think about the driving task, but one of the most useful in recent years has been the concept of Positive Guidance. First formulated by Alexander and Lunenfeld of the Federal Highway Administration, the ideas of Positive Guidance have taken hold in traffic engineering. Exhibit 3.1 shows one of the basic ideas behind Positive Guidance.

Alexander and Lunenfeld said that driving has three aspects, which build upon one another. Think of these aspects as levels of performance.

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, as reports 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. Judgment, 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 changes 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 level of performance, seen at the bottom of the pyramid. This level has all the components of driving concerned with operating the controls and reading the instruments (displays). The kinds of things that you learn very early from your parents, older brothers or sisters, or from a motorists education class. Information for the *Control* level of performance comes from the roadway, the vehicle displays, and the "feel" of the vehicle. Very soon, for most people, the *Control* level of performance becomes almost automatic. For some older motorists, some of the skills mastered for so many years of driving may slip a little, and require more attention.

Chapter 3 Positive Guidance & Older Motorist Applications

Time-Sharing All the Levels of Performance

The three levels of the driving task pyramid shown on the earlier page are not done in isolation, but rather build upon one another. The vehicle must be controlled at all times, but for a moderately skilled motorist this performance does not use much of his attention unless a hazardous situation occurs. For example, if a motorist hits ice on a bridge, all of his attention will be diverted to trying to keep his vehicle under *control*. He forgets, for the moment, why he is making the trip and where he is going (*Navigation* level). Our motorist will also pay much less attention to lane lines and warning signs until he regains control (*Guidance* level). He should have paid more attention to the ICE ON BRIDGE sign at the *Guidance* level before he hit the ice! He is spending all of his energies in the *Control* level, trying to limit or minimize the consequences of his encounter with the ice.

Information -- Decision -- Action !!

Driving is an "information ⟶ decision ⟶ action" kind of task. Motorists take information from the roadway, traffic control devices, and the vehicle itself and compare that information with plans and past experience. They have *expectancies* about what information they will get, based on planning and their past experiences. Motorists are doing many things at the same time, some not even concerned with driving. They have overlapping information needs which require them to search the environment, process the information received, and then do control actions in a continuous feedback operation.

Motorists are "Jugglers"

Strictly speaking, a motorist can only attend to one thing at a time, but he can seem to be doing a lot of things at once. The motorist is quickly moving his attention from one source of information to another, and is quickly moving up and down the Positive Guidance pyramid. This becomes quite a "juggling act", particularly as the motorist gets older. Motorists rely on judgment, estimation, prediction, and memory to fill in the gaps.

Unexpected Information Upsets the Juggler

Expectancies are found at all three levels of performance. The motorist expects the brakes to apply when he presses the pedal at the *Control* level. The motorist expects a red signal to follow an amber indication at the *Guidance* level. The motorist expects that the next guide sign he encounters on a given route will name the next town at the *Navigation* level. Many much more complex expectancies are present at any time during any trip. When expectancies are met, the information "load" on the motorist is reduced, and the motorist can cope with juggling all of the tasks he has. When a motorist is "surprised" , that is - an expectancy is NOT met, that surprise can result in longer decision times and mistakes. Mistakes can, unfortunately, sometimes lead to accidents.

Long and Short Term Expectancies

Some expectancies are long-established by experience in driving. We expect right exits off of freeways, we expect opposing traffic on the left side of the road, and we expect the vehicle path to go right if we turn the steering wheel to the right. Other expectancies are short-term. They apply to the specific area being traveled. Both kinds of expectancies can disrupt the juggler when they are not met. Older motorists can have considerably more trouble than younger motorists in coping with surprise situations, because their decision processes are slower. They are less able to shift rapidly from attending to one thing and then to another, and they are more intent on the *Control* level of driving performances than younger motorists.

Shifting Priorities

The importance of different information at each level of the Positive Guidance pyramid and within the levels as well, changes from moment to moment as the motorist proceeds down the roadway. Priority is assigned on the basis of what happens if an information source is not attended to. When a motorist is said to "lose control", what we mean is that the basic information at the *Control* level information has the highest priority. A motorist will tell a companion to be quiet, or turn down or off the radio so that he can concentrate on the car. He may also not attend to an exit guide sign and miss his route. In this case, he has "shredded off" the *Navigation* level of performance to concentrate on the *Guidance* level, all the while tightening up his steering and throttle control at the *Control* level. If the exit sign had been repeated several times along the urban freeway, was properly sized and placed, and relevant to his route planning he might not have missed his exit at all.

Positive Guidance Information

Any device or roadway feature, including the roadway itself, that assists or directs the motorist in making speed or path decisions provides *guidance information*. Positive Guidance Information is provided when <u>needed</u> information is presented.

- So that it can be SEEN by ALL motorists.
- In a manner so as NOT to MISLEAD.
- In a manner so that it can be UNDERSTOOD by ALL motorists.
- SOON enough to be acted upon WITHOUT DISRUPTING the juggling act.

Chapter 3 Positive Guidance & Older Motorist Applications

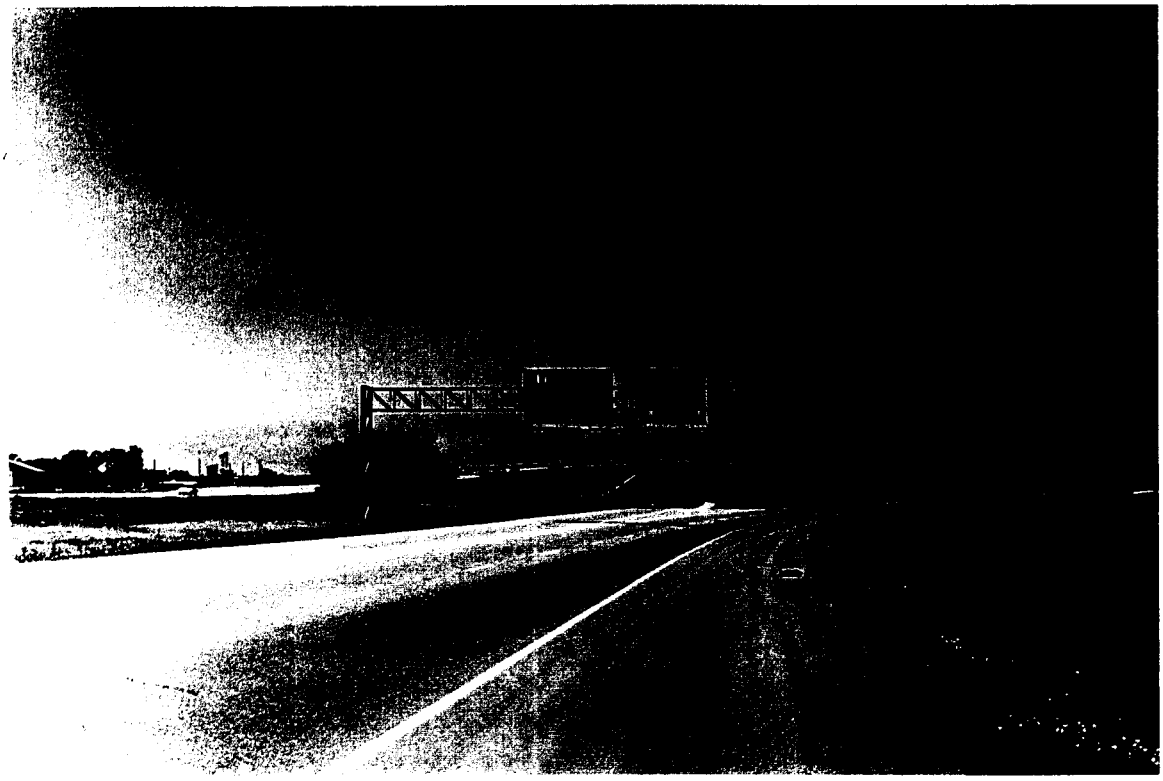


Exhibit 3.2 Consider this situation: on this freeway-like facility the business route exit is to the left. Often there is no advance warning of this departure from convention. The roadway to the right resembles an exit ramp, whereas the roadway to the left looks like a continuation of the freeway. Could this situation confuse a motorist new to the area? Which general principles of Positive Guidance have been violated?

- #5 Maintain Compatibility between Roadway and Information
- #6 Avoid Surprises and Expectancy Violations

Fix the signing: make the highway guide sign the same size as the exit sign, highlighting the fact that it is the main thoroughfare.

Chapter 3 Positive Guidance & Older Motorist Applications

Some General Principles of Positive Guidance

We will be using these principles in one way or another throughout this Manual, but it would probably be a good idea to briefly summarize and illustrate each of them here. Many of them sound like common sense, and indeed that is all 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 technical concepts relating 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 that may need special design consideration, more in some locales than in others. Older motorists are a special focus of this manual, 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' attentional demand may be, and how well a motorist can meet those demands. Motorist information needs are certainly markedly different on a crowded freeway at rush hour like I-10 in Houston than on I-10 near Flatonia, Texas at any time of the day or night. (Flatonia is an isolated small town halfway between Houston and San Antonio). 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 motorist 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 mockup 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, directional guide sign arrows can be confusing and not reflect actual geometrics at an intersection Exhibit 3.2. No wonder we are confused as motorists!!

Chapter 3 Positive Guidance & Older Motorist Applications

Missing Information?

Exhibit 3.3

6. **Avoid Surprises and Expectancy Violations** When motorists are suddenly confronted with unexpected features, hazards or choice points without previous advanced information nasty 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 a device or marking too close to the hazard or choice point and obsolete or nonstandard devices. Exhibit 3.3 shows an all too common situation with signing.

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 PG pyramid. Peaks (overload) and troughs (not enough information: motorist starts guessing) should be avoided.

9. **Where Information Needs 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 principles, it can be difficult to satisfy this principle for all motorists.

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Why Concept of Positive Guidance is so Critical for Older Motorists

Cognitive Abilities

Decrements do occur in cognitive abilities with advancing age. These must be tackled on the road by efforts to:

- increase the visibility of sign panels to improve older motorists' ability to pick them out of a complex urban background with lots of clutter of other signs, lights, billboards, etc.
- give motorists repeated and distributed presentation of appropriate signs, traffic control devices.
- allow motorists to extract the highly critical information in areas where there are multiple highway signs by making the message size larger.
- with changeable message signs, make the messages redundant, especially in situations where there is a high cognitive workload - multiple lane, high speed traffic.

R6–1

R6–2

R5–1

Exhibit 3.4

Older Motorist Violations

Most analysis which examine the types of incidents involving older motorists shows the following violation types:

- Failure to yield to an oncoming vehicle when turning left at an intersection.
- Failure to yield to approaching vehicles when entering or crossing a roadway at any place other than an intersection.
- Failure to yield to a vehicle on the right at an intersection.

Also, for two additional types of violations the proportion of convictions by motorists 65+ was approximately equal to the proportion of total miles driven accounted for by this group -- improper backing, and failure to stop when entering a roadway from an alley, building, private road, or driveway.

Problem Areas for Older Motorists

When considering traffic control devices and motorist information requirements, it is important to identify which TCD's are not satisfying older motorist requirements. Clearly, intersection control elements are of strong concern:

- traffic signals
- left turn displays
- stop, yield
- no left turn signs
- left turn lane
- median delineation

In addition, elements that inform the motorist of improper turning movements -- such as DO NOT ENTER and ONE WAY signs -- and elements which control entry into a potential conflict situation other than an intersection (including no passing and center lane left turn control signs) are contributing factors to the disproportionate difficulties experienced by older motorists.

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Older Motorist Considerations

As with all traffic control devices, it is important to keep in mind the limiting visual and cognitive capabilities of the older motorist. Older motorists may take longer to perceive and process information presented to them. This, in turn, may slow the total reaction time of the older motorist as compared with others. Whenever possible, signs and signals should be designed and placed such that an older motorist unfamiliar with the location could easily find his or her way.

Focus Group Surveys of Older Motorists

When asked where the strongest perceived inadequacies of the present system of traffic control devices, older motorists responded with:

- Traffic sign placement (42%)
- Traffic sign size (17%)
- Clarity of lettering on signs (16%)
- Message Content (13%)

Difficulty with traffic signs by setting shows problems for:

- Signs on city streets (36%)
- Signs on freeways through cities (31%)

Signing is obviously a fertile area where with larger size and proper consistent placement, we can improve driving conditions for older motorists.

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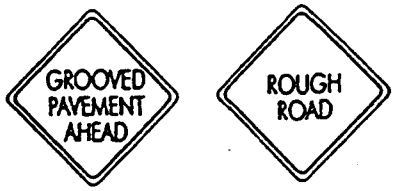
Conspicuity and Legibility

In order for any sign to be effective, the motorist must see the sign. *Conspicuity* is the term used to describe when the sign is DETECTED. How conspicuous the sign is depends on several factors -- how cluttered the background is, are there lots of other advertisement signs, billboards, neon lights, buildings, etc., which make the sign difficult to pick out. The other characteristic of signs that is critical for all motorists, is *legibility*. Legibility depends on how large the letters or symbols are on the sign. The color contrast and brightness all contribute to legibility. The color is dictated in the MUTCD by class of sign. The type of and condition (age, damage) of the reflective sheeting for the sign will determine its brightness. Higher performance sheeting is now available and being used in some states for freeway guide signs to eliminate the need to illuminate those sign panels. The next sections talk about different sign characteristics which contribute to increasing a sign's CONSPICUITY and also making it and its message more LEGIBLE.

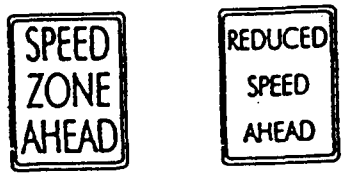
You can overdo high intensity reflective treatments. The sign background or letters can be so bright that they become difficult to read. Be sure and follow the angle-off guidelines on page 4-8 and try to use the larger size signs for critical information (warning and regulatory signage).

Sign Language

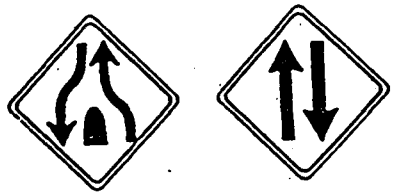
The Texas DOT is in the process of implementing these recommended changes in its signage. Here are a few examples.



ROUGH ROAD sign should replace the GROOVED PAVEMENT AHEAD sign.



REDUCED SPEED AHEAD sign should replace the SPEED ZONE AHEAD sign.



DIVIDED HIGHWAY ENDS symbol sign should be used at the end of a highway and followed by a TWO-WAY TRAFFIC symbol sign.

Size

The MUTCD gives general guidance for size of signs. Keeping in mind the poorer vision of many elderly motorists, it is important to note the MUTCD leaves open the possibility for larger signs than are specified in the manual. For example, the standard size of a stop sign is given as 30x30 inches. However, larger signs can be used. In keeping with the MUTCD's suggestion to increase in increments of 6 inches, the sign could be increased to 36x36 inches, particularly if the intersection is a well traveled one, or the consequences of missing the sign are more serious (such as going from a small county lane onto a state highway).

Similarly, speed limit and minimum speed signs can be 48x60 inches (as specified for expressways) rather than 24x30 inches when the sign is placed after an intersection or where the limit changes.

Overall, it is important to remember one of the purposes of signs: to command attention. If the sign is too small to command attention from all motorists, it is useless.

Graphics or Text

In general, graphics (symbols) are used when information needs to be conveyed quickly, while text is used when greater accuracy is needed. A good symbol summarizes the road conditions and situation and conveys information necessary for the motorist to make safe and timely decisions on the road. There may be a need for written supplemental signing, such as on two-way stops. The catch to all this is that the symbols must be easily understandable. If there is any question as to the meaning of the symbol a text sign should be attached to the symbol sign to clarify.

Roadway Sign Specifics

Across the country, specific signs are being targeted for improvement. Exhibit 4.1 illustrates three situations which are being improved. In the first case, the sign currently in place, GROOVED PAVEMENT, aimed at motorcyclists is confusing and is now being replaced with ROUGH ROAD. The current SPEED ZONE AHEAD does not tell the motorist any thing -- speed up -- slow down. Speed zones are everywhere. The replacement sign REDUCED SPEED AHEAD gives the motorist the information needed -- slow down. Finally, the addition of a TWO-WAY TRAFFIC symbols sign after a DIVIDED HIGHWAY ENDS will help in two ways. First, the graphic symbol of DIVIDED HIGHWAY ENDS is most often confused with its opposite sign -- DIVIDED HIGHWAY BEGINS. The two-way traffic symbol will help to eliminate or at least lower that confusion. Second, the TWO-WAY TRAFFIC sign will give POSITIVE GUIDANCE to the older motorist by providing consistent and redundant (reinforcing) information.

Sign Legibility Distance Requirements- Meters (Feet)

Criticality Ranking		Sign	Travel Speed Km/h (mph)[1] 48.3 (30)	72.5 (45)	96.6 (60)
Low	10	NO LEFT TURN	48.8 (160)	73.2 (240)	97.5 (320)
	10	TWO-WAY TRAFFIC	48.8 (160)	73.2 (240)	97.5 (320)
	10	ONE WAY	48.8 (160)	73.2 (240)	97.5 (320)
	7	DO NOT PASS	62.5 (205)	94.5 (310)	125.0(410)
	7	DETOUR	62.5 (205)	94.5 (310)	125.0(410)
	7	WRONG WAY	62.5 (205)	94.5 (310)	125.0(410)
	5	STOP (w/ advanced warning)	71.6 (235)	131.1(430)	207.3(680)
	4	STOP	96.0 (315)	167.6(550)	256.0(840)
	3	YIELD(w/ advanced warning)	97.5 (320)	172.2(565)	262.1(860)
	2	SCHOOL CROSSING	111.3(365)	192.0(630)	288.0(945)
High	1	YIELD	121.9(400)	207.3(680)	309.4(1015)

Exhibit 4.2

[1] H. McGee and D.L. Mace. Retroreflectivity of Roadway Signs for Adequate Visibility: A Guide. Bellomo-McGee, Inc., Vienna, Virginia, November 1987,pg.40.

Lettering Size and Symbol Size

Just like all motorists, it takes older motorists more time to read and comprehend text messages than it takes to see and comprehend good graphic messages. However for any given size of sign and lettering, since many older motorists have visual problems not associated with young eyes, they often have to be closer to the symbol and text messages to see or read them. This in turn cuts down on the amount of time the motorist has to form the correct response to the sign and can be hazardous to older motorists and those around them, if the lettering sizes are not large enough.

Standard size for symbols is a proportion dependent upon the sign size. Bigger signs mean bigger symbols. The sizes listed in the MUTCD for letter size are given as **minimum** requirements. Those sizes specified should be exceeded where practical. When one considers the fact that a growing segment of the population is nearing the age of 60, it may soon become the rule rather than the exception for increased letter size on signs. Sign letter height has been pointed out to be a problem area for older motorists. Currently the MUTCD Standard for legibility is 50 feet (15.2m) of seeing distance for every 1 inch (2.5cm) of letter height. Many studies have shown that this is not adequate for older motorists, who have legibility distances of only 60-70% that of younger motorists.

Therefore, if a young motorist can see and read a sign at 1000 feet, the older motorist must be 600-700 feet from the sign before he/she has the same ability to see and read the message on the sign. Some researchers have argued that the legibility index should be changed from the 1in : 50ft to 1in : 26ft (7.9m).

Sign Legibility Distances

Exhibit 4.2 shows the recommended distances at which specific signs should be legible before the hazard. These warning signs are shown for legibility distance as a function of vehicle speed. Obviously, as speed increases, the legibility distance required is greater in order to give the motorist time to detect, recognize, read and comprehend the message. The more critical a sign is, and the more decision time it might take, the further away it need to be.

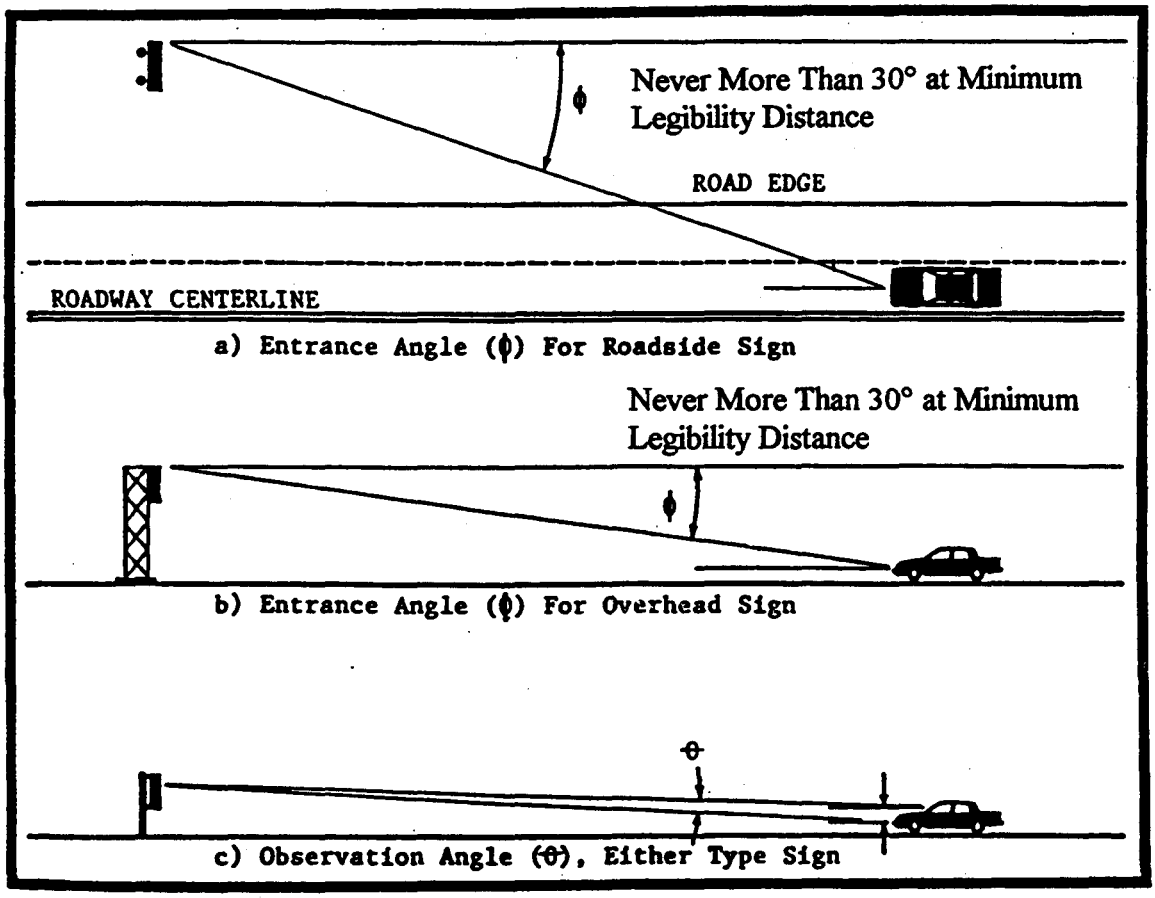


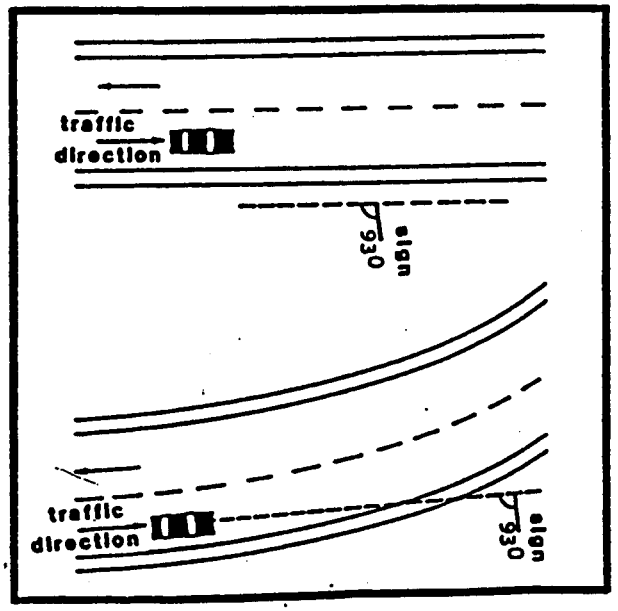
Exhibit 4.3 **Illustration of Entrance (ϕ) and Observation Angle (θ) Under Actual Highway Conditions**

Reflectivity & Illumination - Special Purpose Sheeting & One Size Does Not Fit All!

Most signs are required to be reflectorized or illuminated to show the same color and shape by night as by day. There are a couple of things to keep in mind regarding reflectivity and illumination and the older motorist. Older people often have problems with illumination and glare. Often, the older motorist's eyes allow less light to enter the eye. This, in turn, makes it more difficult to pick out specific things at night. In order to try to compensate, it may be necessary to provide more illumination for older motorists to see signs and information than is necessary for younger motorists. This can be accomplished by adding illumination to signs (particularly those warning of road hazards or unexpected occurrences, such as detours). Another problem for older motorists is glare. Special care must be taken to ensure the reflectivity or illumination of signs is such that motorists can make out the information given.

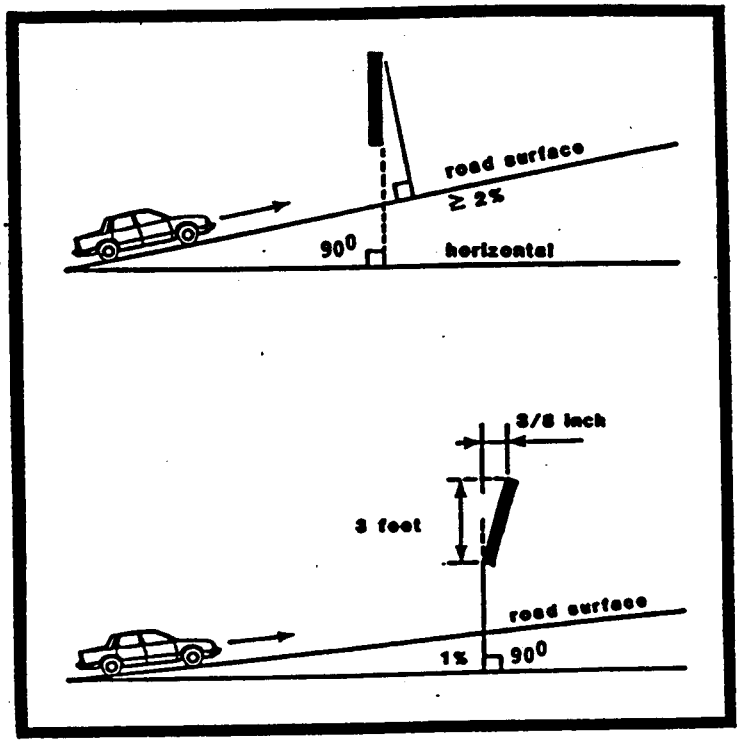
Entrance and Observation Angles Defined

The retroreflectance of sheeting materials is always described in context of another important property, its angularity which is defined by the entrance (of the light) and the observation (of the motorist) angles. These two angles are depicted in Exhibit 4.3 for a roadside, post-mounted sign and an overhead sign. The entrance (or incidence) angle is the angle (ϕ) formed between a light beam striking the surface of a sign and a line coming out perpendicular from the surface. The observation angle (θ) is the angle between the incoming light beam and reflected light beam as it is seen by the motorist. These angles change with distance between the vehicle and the sign and are a function of the location of the sign and the vehicle (for the entrance angle) and the height of the motorist's eye with respect to the vehicle headlamps (for the observation angle). You want to keep the sign from reflecting back like a mirror when the motorist needs to read the information, so signs placed close to the roadway edge should be angled 4° away from a right angle with the line of sight.



Orientation of Roadside Signs

Exhibit 4.4



Orientation of Overhead Signs

Exhibit 4.5

Orientation Angle for Roadside Signs

Except for parking signs, post-mounted signs are mounted at approximately right angles to on-coming traffic. However, to avoid specular glare reflection of headlights off the sign face directly into the motorist's eyes it is necessary to rotate the sign slightly off 90 degrees. An angle of about 93 degrees to the line of approaching traffic is recommended. On curved alignments, the angle should be determined by the course of approach traffic and from the point at which the sign is to be read. The orientation for roadside post-mounted signs as illustrated in Exhibit 4.4.

Orientation Angle for Overhead Signs

Exhibit 4.5 shows the recommended orientation for overhead signs. Depending on the road angle, the overhead sign can be tilted back by as much as 0.95 cm or $^3/_8$ inches from vertical (90°).

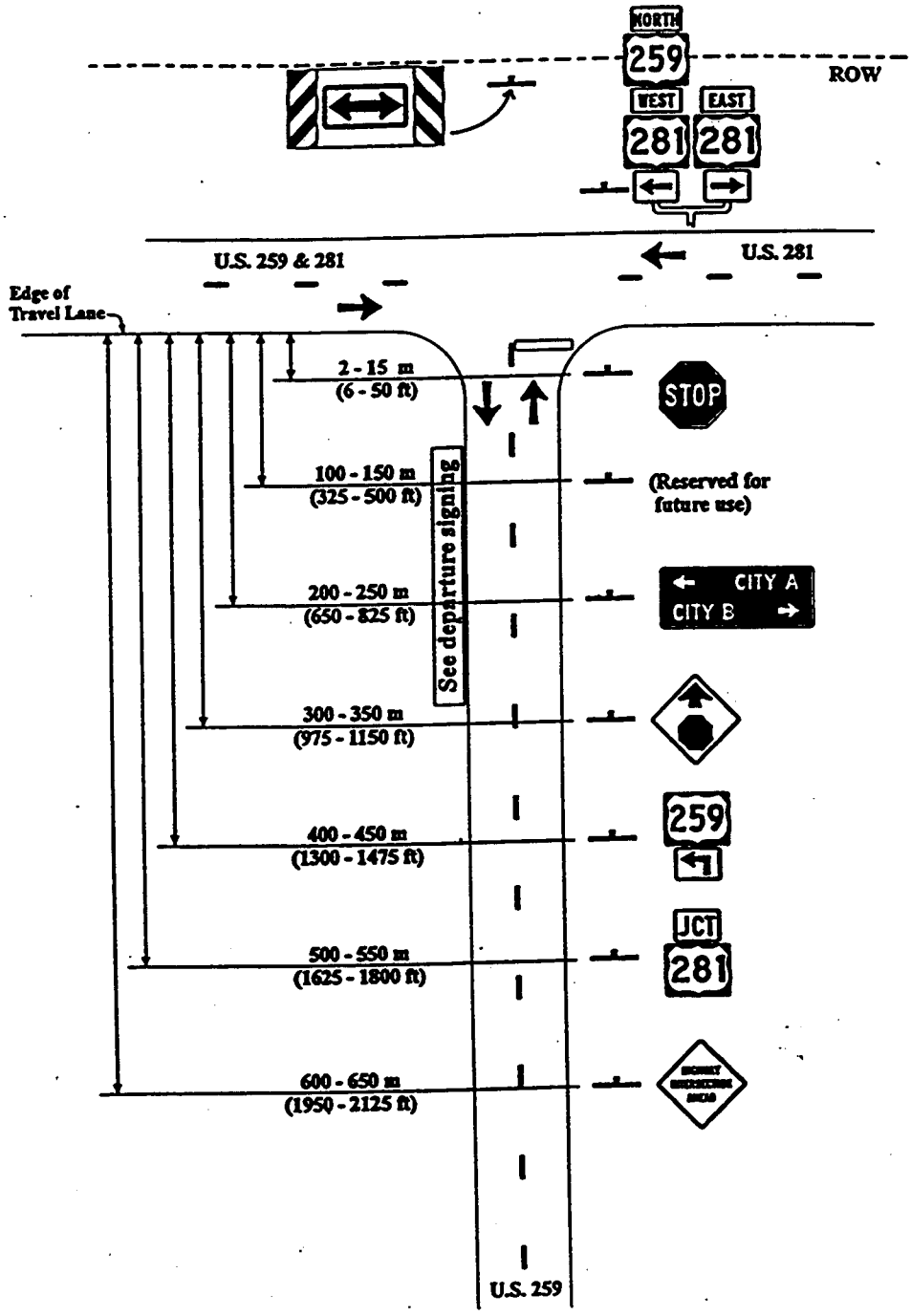


Exhibit 4.6 **Illustration of Convention for Sign Placement Distances**

Basic Sign Placement Considerations

Introduction

The posted speed is the primary criteria for the longitudinal placement of signs. Speed is divided into low-speed roadways (speed <45 mph) and high-speed roadways (speed ≥ 45 mph).

Convention Used in Exhibit 4.6

The illustrations contained in this chapter use several conventions to simplify the information being presented in the figures.

Use of Highway Classifications and Numbers in Illustrations

The highway intersections illustrated in this field book are not intended to represent a specific intersection in any state. For simplicity, only one highway class is used for all highways in the illustrations and no more than three different route numbers are used. The three highway numbers used in the illustrations are odd, three-digit U.S. Highway numbers: U.S. 259, U.S. 281, and U.S. 377.

Reference Points for Placement Distances

The distance shown in the figures is the distance between the sign installation and the near edge of intersecting roadway. Exhibit 4.7 below summarizes the distances for each type of sign that could be used on an approach to an intersection. Exhibit 4.6 shows an application of consistent sign placement.

Special Note: A given sign type should remain approximately the same distance from the intersection in all applications. For example, the Junction assembly should always be 500-550 m (1650-1800 ft) from the intersection. A given type of sign should not be moved closer to the intersection when a sign type closer to the intersection is not used. For example, the Junction assembly should not be moved closer to the intersection if the Advance Route Turn assembly is not used. This is to keep CONSISTENCY in sign placement and, hence, not surprise the motorist, i.e., POSITIVE GUIDANCE principles.

Exhibit 4.7 Approach Placement Distances

Placement Distance for Speed Condition (Distance from near edge of intersecting roadway)				Type of Sign
Low-Speed (<45 mph)		High-Speed (>=45 mph)		
meters	feet	meters	feet	
				Direction Assembly
80-120	260-390	100-150	325-500	Reserved for Future Use
160-200	520-650	200-250	650-825	Destination Sign
240-280	790-920	300-350	975-1150	Advance Traffic Control Sign
320-360	1050-1180	400-450	1300-1475	Advance Turn Assembly
400-440	1300-1430	500-550	1625-1800	Junction Assembly
480-520	1570-1700	600-650	1950-2125	Highway Intersection Sign

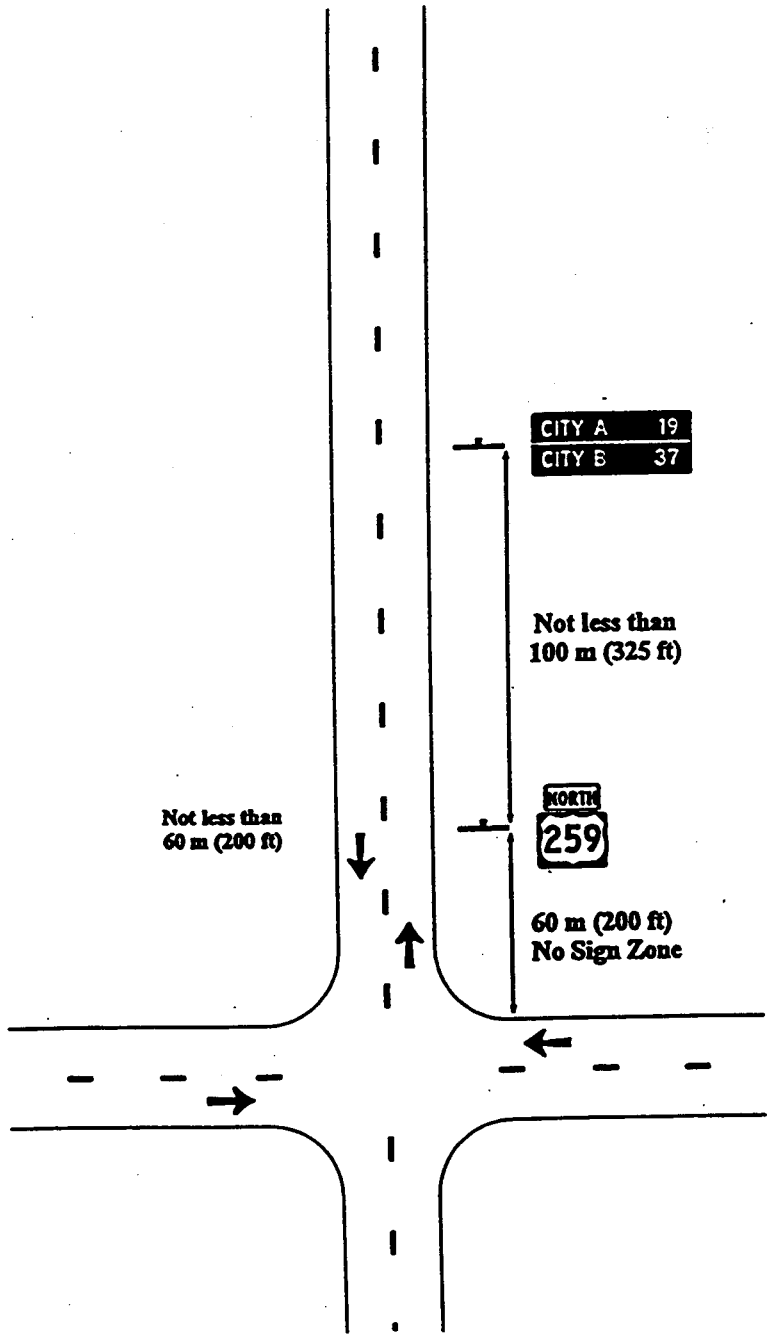


Exhibit 4.8 **Departure Sign Placement, Guide Signs Beyond the No Sign Zone**

Placement

There are certain things people come to expect after having amassed some driving experience. For example, most motorists expect to see road signs on the right side of the road rather than the left side. Obviously, this is not always possible, or even always acceptable. In cases where there are more than 3 lanes of traffic going in the same direction it is necessary to give information on both the left and right sides of the road so that all motorists may note the signs and information. At times, it is better to present information above the lanes through the use of overhead signs. Let's review the guidelines addressed in the MUTCD.

Basic Departure Placement

"No Sign Zone"

A motorist's attention (especially older motorists) is focused on maneuvering through the intersection and surrounding traffic during the time his/her vehicle is passing through an intersection. Once the vehicle passes through the intersection the motorist has to refocus upon the driving task, checking speed, position, guidance and control. Departure signs that are located within this short distance of an intersection may not be seen by the motorist because the motorist's attention may be focused on other items.

To improve the ability of motorists to obtain the appropriate guidance information, a "no sign zone" should be established from the intersection to a point approximately 60 meters (200 feet) beyond the intersection.

Signs should not be placed in this zone, if possible. Exhibit 4.8 shows this "no sign zone" concept for a simple intersection departure.

Introduction

The concept of a "no sign zone" is to improve the probability that a sign will be seen by motorists. Where possible, signs should be located **beyond** the no sign zone. Using the no sign zone concept, the signs on the departure leg of an intersection can be divided into two groups:

- those signs that must be located close to the intersection (in the "no sign zone") and
- those signs that can be located further from the intersection (beyond the "no sign zone").

The two guide sign installations usually located on the departure from a highway intersection, Reassurance/Confirmation Assembly and Distance sign, should be moved beyond the "no sign zone".

Location

Proximity to Intersection - Placement on Approach

Signs most commonly seen at intersections are guidance signs. While it is important that such signs be close to intersections, it would be helpful to the older motorist to place supplemental guidance signs a short distance back from intersection (the distance would be dependent on number of lanes and speed limit). This is because the motorist may need time and distance to get into the correct lane to follow the guidance signs and the motorist has a great amount of information to process at any intersection in addition to guidance signs. The motorist needs to obey the signal light, note changes in motorist behavior surrounding him or her and be ready to respond to these factors. Having to follow guidance signs in addition to this easily leads to hazardous situations.

Effect of Speed on Placement Distances

Unlike the signing requirement on the approach to an intersection, there is not a separate set of placement distances for lower speed departures. The size of the "no sign zone" remains the same regardless of the speed. This "no sign zone" is an area where motorists can regain control, position and begin to think about navigation before being bombarded with many guide signs, cardinal directions and arrows.

Distance Between Departure Signs

The number and types of signs that are placed on the intersection departure can vary significantly from one intersection to another. There is no set distance that a departure sign should be from the intersection. Instead, the departure signs should be placed so that there is at least 100 meters (325 feet) between signs.

Departure Signs Beyond the "No Sign Zone"

As often as practical, signs located on the departure leg of an intersection should be located beyond the "no sign zone". Examples of these signs include:

- Confirmation/Reassurance Assembly - This assembly should be located no closer than 60 meters (200 feet) from the intersection. This assembly is vital to a motorist's navigation task. He must be certain he is on the right highway, going in the right direction.
- Distance sign - This sign should be one of the last in the series of intersection departure signs.
- Speed Limit sign - This sign is typically used when the speed limit on the departure is different from the speed on any of the approaches.

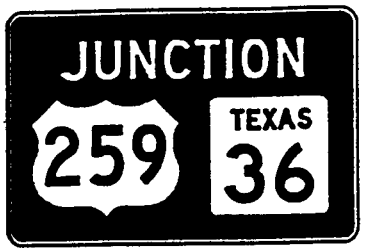
Guide Signing

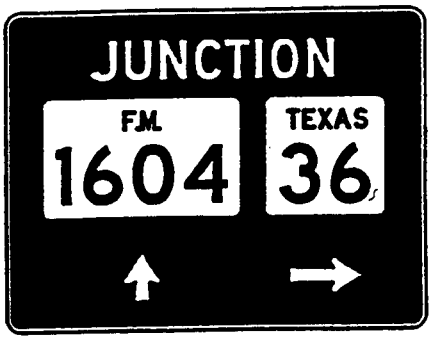
There are numerous changes which could be made to current guide signing techniques to help the older motorist. Guide signs are meant to do just that - guide motorists to their desired destinations. The size of guide signs is usually dictated by the message contained therein. So, larger signs are needed to allow use of large letters and symbols to help older motorists see the messages more clearly and at greater distances. High intensity sheeting could also be used with guide signs to ensure visibility at night, if a narrower stroke letter were used.

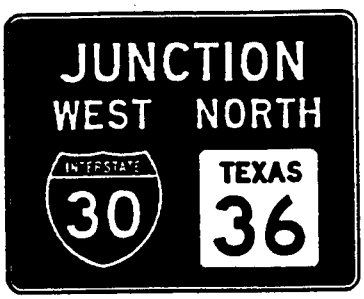
There are a number of other things which can be done to make guide signs more effective. Guide signs should be placed far enough in advance of intersections or exits so that motorists can make required lane changes in a safe and effective manner. If there are left exits off a freeway or expressway, this should be signed well in advance of the exit, as this is a violation of motorist expectancy. Also, it is more helpful to use route numbers, directions, and place names on signs than any of these alone. This helps older motorists confirm they are following the right path.

There should also be additional guide signs after the motorist exits or turns or continues straight confirming to the motorist that he or she made the right choice and is continuing on the desired path.

Exhibit 4.9 **Junction Marker**







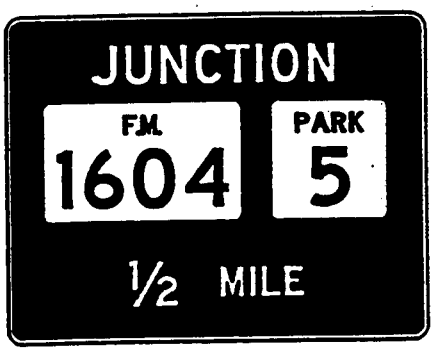


Exhibit 4.10 **Junction Combination Sign**

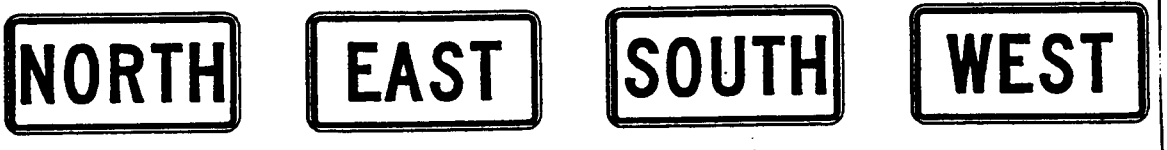


Exhibit 4.11 **Cardinal Direction Markers**

Guide Signing

Guide signs are often listed as one type of signing which gives older motorists problems. Guide sign components are standardized, but can still present a challenge to an older motorist who is searching through a large group of sign assemblies trying to locate the one highway number and direction he/she must follow to get the his/her destination. Let's review the guide sign components, examples of sign arrangements and placement for these signs on the roadway.

Junction Marker

Purpose: Junction markers provide advance notice of an intersection with the indicated highway(s).

There are two different methods of indicating a junction:

- **Junction Marker:** Most junctions are indicated with the JCT marker (Exhibit 4.9). The Junction marker is mounted at the top of an assembly, either directly above the route marker or above an auxiliary marker (BUSINESS or ALT).
- **Junction Combination Sign:** Some junctions may require the use of a combination junction sign. The combination sign contains the word JUNCTION at the top of the sign and the appropriate rout markers below. Other information may also be included in the combination sign, such as the cardinal direction, arrows, destination cities, and distance to the junction (Exhibit 4.10).

Cardinal Direction Markers

Purpose: Cardinal direction markers indicate the general direction of a route. A cardinal direction marker is mounted above the route marker(s) to which it applies.

Each highway has a designated cardinal direction for each either of travel on the highway. For consistency purposes, the cardinal direction for someone traveling on a route should be the same throughout the length on one direction of the highway. However, the designated cardinal direction on a particular section of highway may not be the same as the actual compass direction of travel on that direction. This can be confusing to the older motorist.

For Interstate and U.S. Highways, the cardinal direction is related to the highway number (even numbers are East and West, odd numbers are North and South). However, for highways on the state system in Texas, there is no relationship between the number and the cardinal direction. Examples of the cardinal direction markers are shown in Exhibit 4.11.

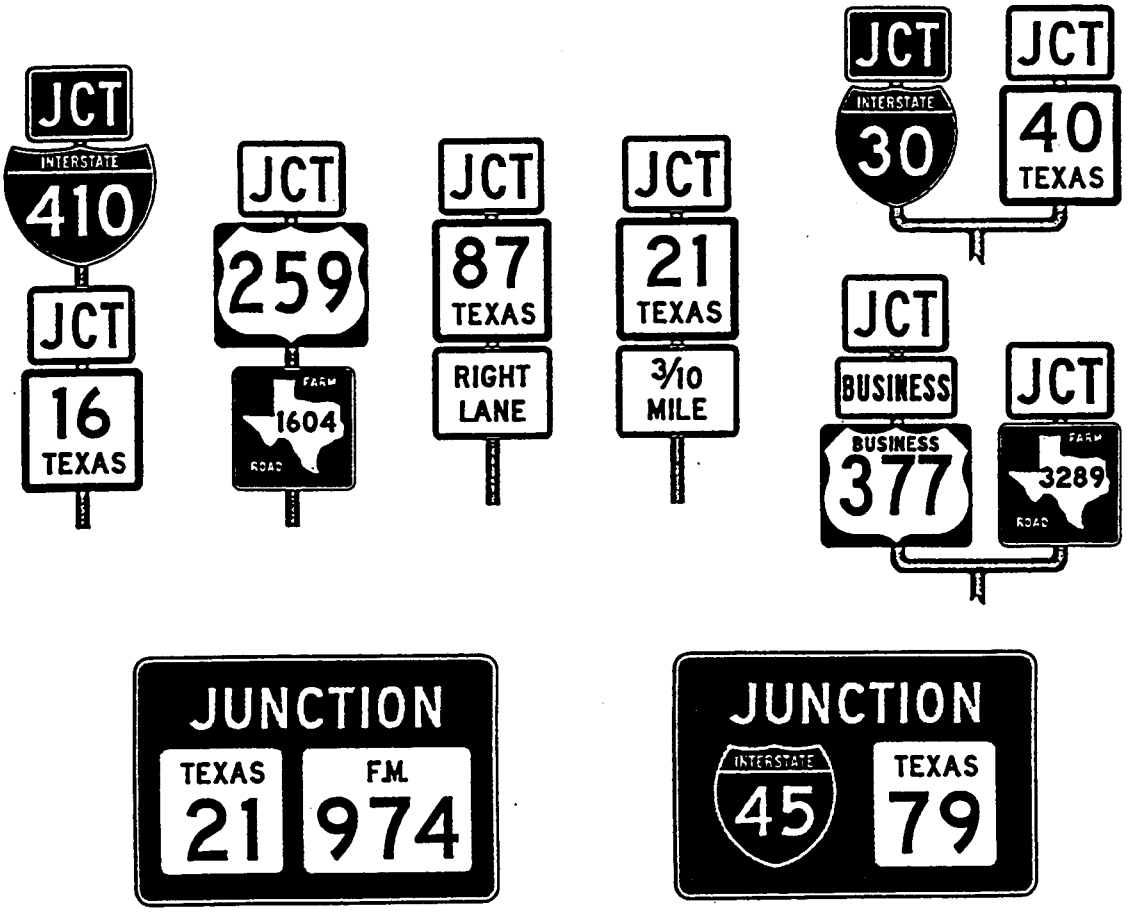


Exhibit 4.12 **Junction Assembly**

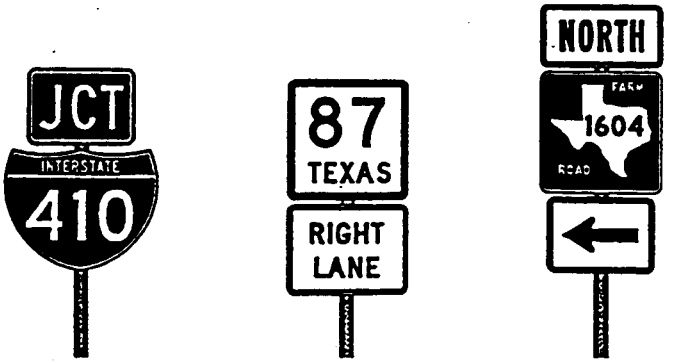


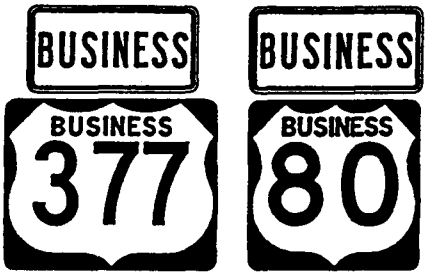
Exhibit 4.13 **Guide Sign Units**

Arrow Markers

Purpose: Arrow markers indicate the direction of turn necessary to travel on the indicated highway in the indicated cardinal direction. An Arrow marker is mounted below the route marker(s) to which it applies. There are two types of Arrow marker: Advance Turn and Directional.

Route Markers

- **Business Auxiliary Marker:** A redundant Business marker should be displayed with the business route marker. The redundant Business marker will aid the older motorist in discerning the correct route.



- **Cardinal Direction Markers:** A cardinal direction marker should be used with a route marker unless the route is the straight through route in an assembly.

Junction Assemblies

An array of different types of Junction Assemblies is shown in Exhibits 4.12 and 4.13. As can be seen, as many as four separate sign components:

- JUNCTION
- BUSINESS AUXILIARY MARKER
- Route Marker
- Arrow

could be displayed together. This is a lot of information for the older motorist to take in, process and decide what to do. The next page gives some suggestions for how to organize this information.

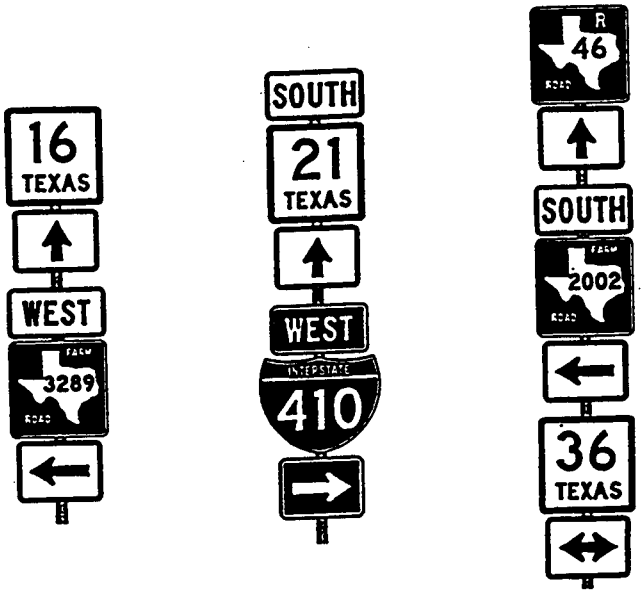


Exhibit 4.14

Vertical Arrangement NOT RECOMMENDED

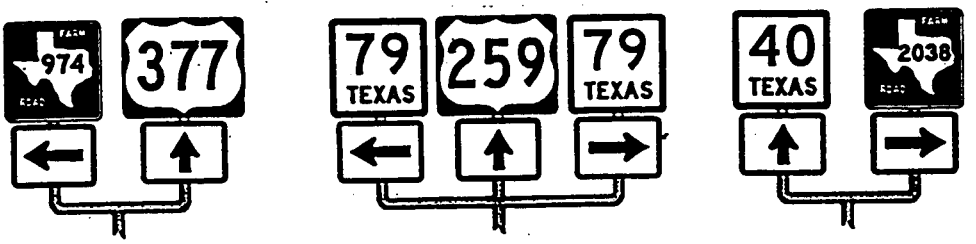


Exhibit 4.15

Horizontal Arrangement RECOMMENDED

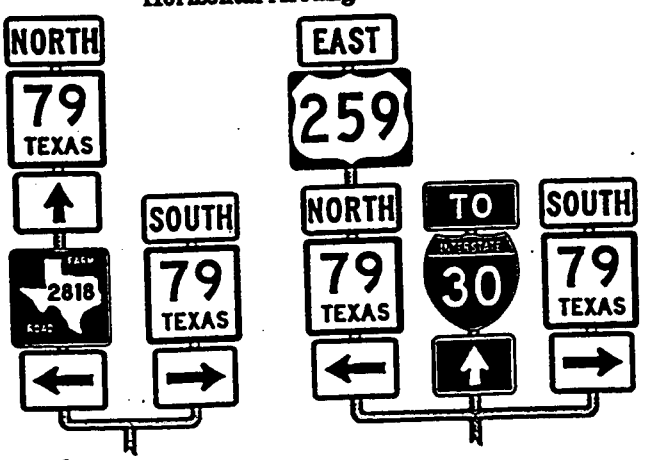


Exhibit 4.16

Combination Arrangement NOT RECOMMENDED

Guide Sign Assemblies

There are three ways that guide signs can be arranged: vertical arrangement, horizontal arrangement and a combination arrangement, which combines both the vertical and horizontal elements of the individual guide sign elements.

These three types are shown in Exhibits 4.14, 4.15 and 4.16. Although there are provisions in the standards for all three arrangements, the vertical arrangement appears as the most confusing. This is because the cardinal direction markers and arrows are being confused with which route marker they are supposed to be identified with. The combination arrangement suffers from the same confusion potential. The horizontal arrangement put one marker with one cardinal direction and one arrow. All the elements the motorists needs to find his/her route number, and direction are paired together and gives an arrow for indicating direction of turn necessary to follow that route.

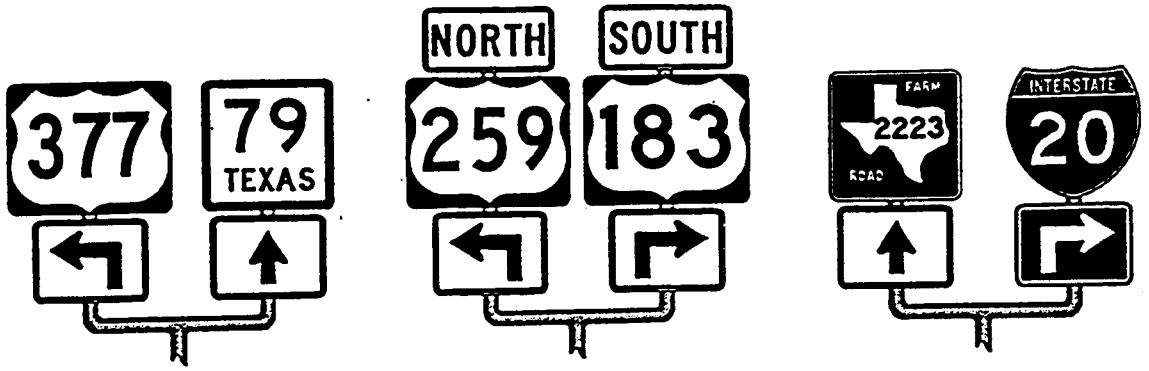


Exhibit 4.17 **Advance Route Turn Assembly**

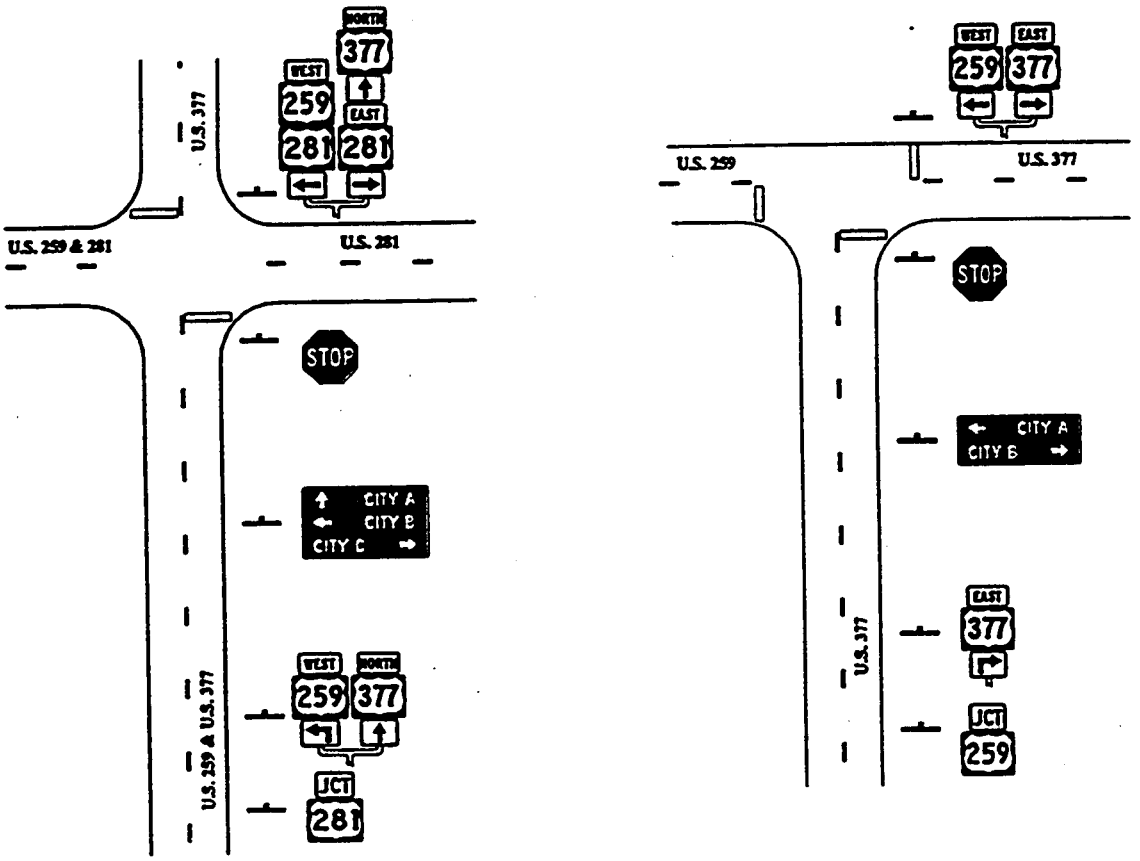


Exhibit 4.18 **Applications of Advance Route Turn Assembly**

Advanced Signing

Older motorists may need more time when presented with a number of choices. Motorists need to be given enough advanced warning of lane endings. speed changes, guidance signs, exits, etc. to be able to make a timely response to continue safely and on course. It is also a very good idea to provide reassurance the right path was taken through the use of confirming signs (such as route guidance signs before and after an intersection). If there is a great distance between confirming route signs, older motorists on unfamiliar roads may become confused and, fearing they are on the wrong road, make maneuvers which could create a hazardous situation for themselves or other motorists. The guidelines for the "no sign zone" and Reassurance/confirmation assemblies are given earlier.

Existing advance signing may not be adequate for all motorists' needs. For example, letting the motorist know Smith Street is the next exit may not help the motorist who is looking for the Sports Arena (which just happens to be located on Smith Street!). Another practice, putting city names on exit signs without route numbers also confuses older motorists. It is necessary to keep in mind advance signing (and all signing, for that matter) should be done with the unfamiliar, older motorist in mind. Consistency in signing is important. All signs should have all necessary information.

Advanced Route Turn Assembly

Consistent, reliable information must be communicated to the motorist. The advance turn assemblies shown opposite give the needed information whether or not the route of interest requires a turn at the next intersection or is a through route. Giving this information in advance of the intersection, in a consistent placement is a big help to the older motorist. If a turn is needed, a lane change may be required.

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Special Problems of Older Motorists

Older motorists often have reduced peripheral vision. It is more difficult for them to detect things outside their line of vision. It is especially important, then, to make sure sign placement is predictable and follows their expectations. Otherwise, there is a chance the motorist may never even notice the sign. What this breaks down to is placement of necessary information should be done on the right hand side of the road and possibly overhead (which should be in the line of sight). Signs on the left hand side of the road may need to be reinforced with the use of overhead signing.

Also, older motorists may miss signs due to passing of large or heavy commercial vehicles. Heavy trucks tend to intimidate many older motorists and they concentrate more on the roadway when driving alongside these vehicles. This may lead them to keep their eyes more closely aligned to the road so that they do not glance over far enough to see a sign; or, the truck may be traveling alongside them for a period of time and may obstruct their view of signage. The best remedy for these instances is overhead signage.

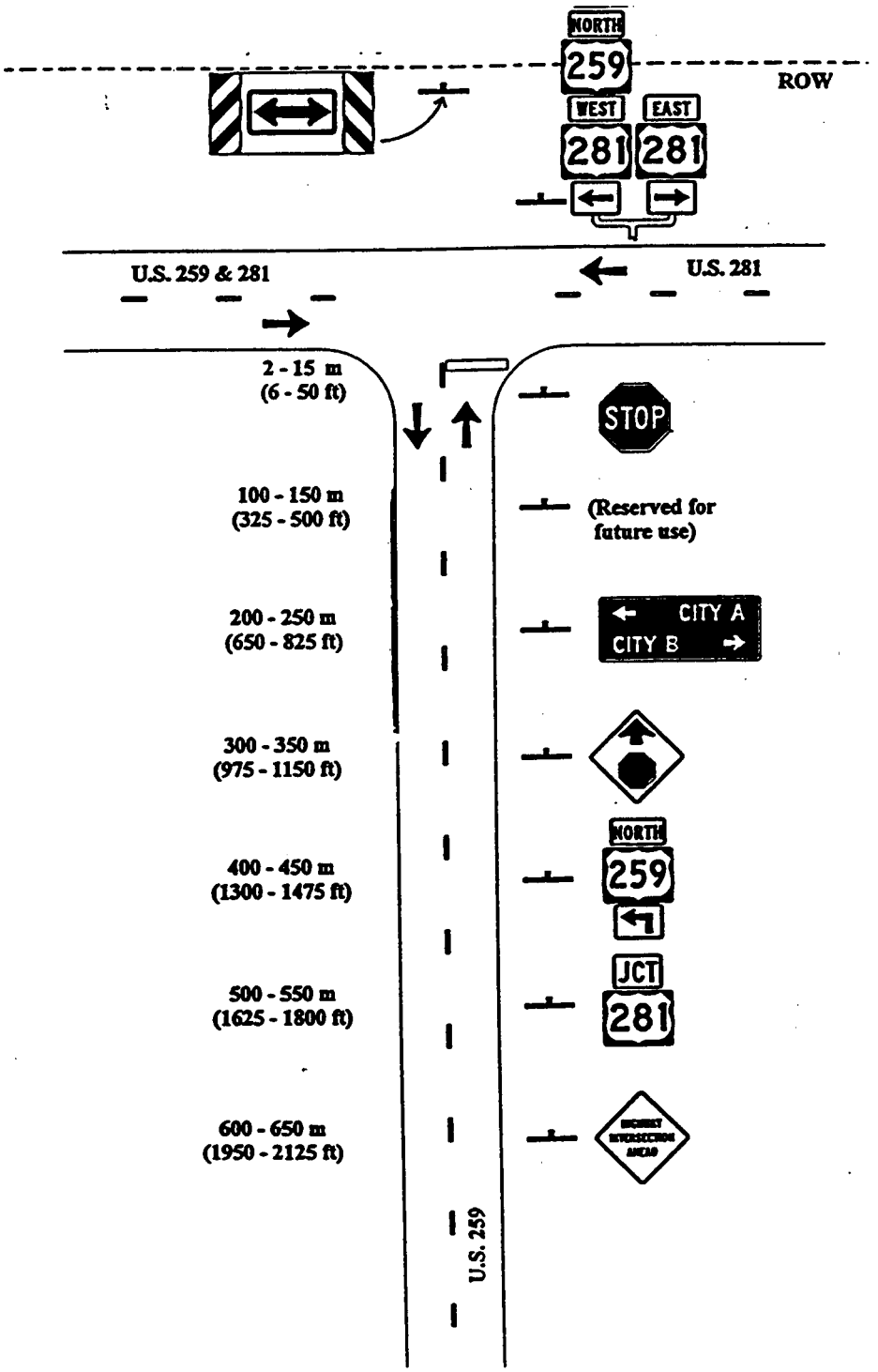

NORTH
259
ROW
WEST
EAST
281
281
U.S. 259 & 281
U.S. 281
2 - 15 m
(6 - 50 ft)
STOP
100 - 150 m
(325 - 500 ft)
(Reserved for
future use)
200 - 250 m
(650 - 825 ft)
CITY A
CITY B
300 - 350 m
(975 - 1150 ft)
400 - 450 m
(1300 - 1475 ft)
NORTH
259
500 - 550 m
(1625 - 1800 ft)
JCT
281
600 - 650 m
(1950 - 2125 ft)
U.S. 259

Exhibit 4.19

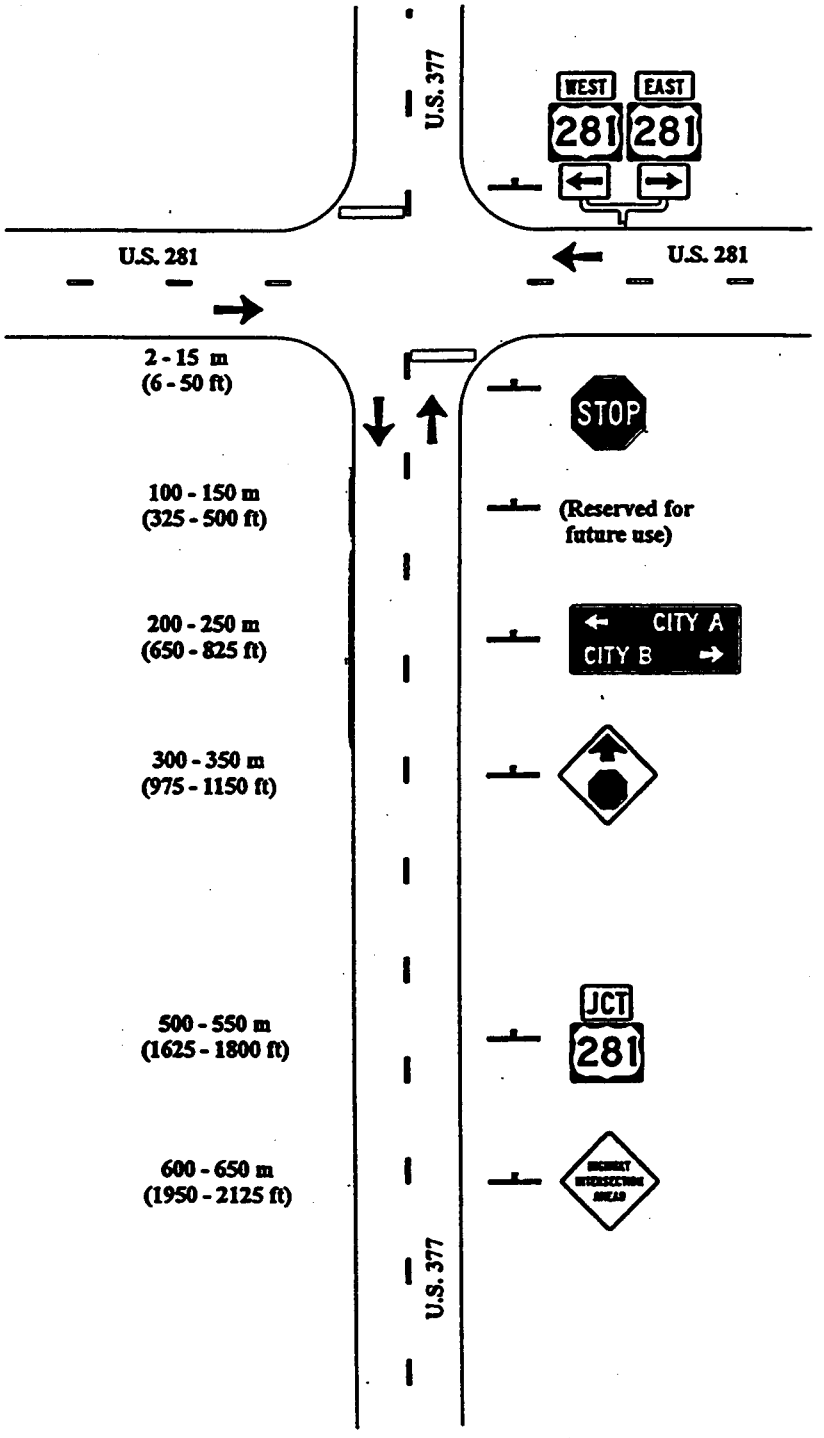

U.S. 377
WEST
EAST
281
281
U.S. 281
U.S. 281
2 - 15 m
(6 - 50 ft)
STOP
100 - 150 m
(325 - 500 ft)
(Reserved for
future use)
200 - 250 m
(650 - 825 ft)
CITY A
CITY B
300 - 350 m
(975 - 1150 ft)
500 - 550 m
(1625 - 1800 ft)
JCT
281
600 - 650 m
(1950 - 2125 ft)
U.S. 377

Exhibit 4.20

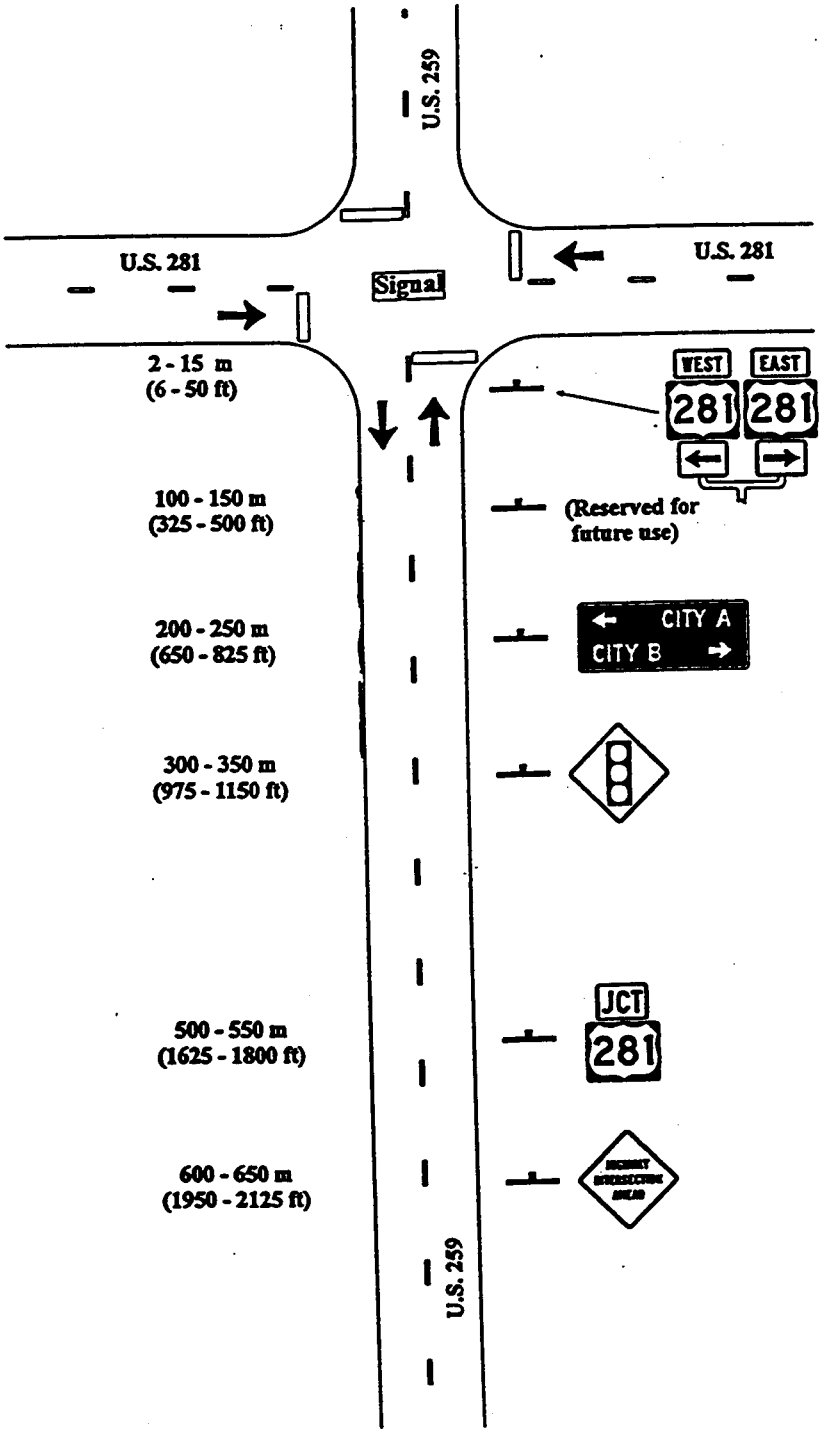

U.S. 259
U.S. 281
Signal
U.S. 281
2 - 15 m
(6 - 50 ft)
WEST
EAST
281
281
100 - 150 m
(325 - 500 ft)
(Reserved for
future use)
200 - 250 m
(650 - 825 ft)
CITY A
CITY B
300 - 350 m
(975 - 1150 ft)
500 - 550 m
(1625 - 1800 ft)
JCT
281
600 - 650 m
(1950 - 2125 ft)
U.S. 259

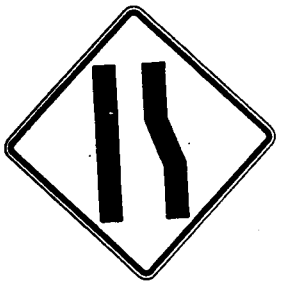
Exhibit 4.21

Consistency Examples - Sign Placement

Exhibit 4.19, 4.20 and 4.21 demonstrate the consistency in both sign placement and distances before the highway intersection.

- An advance warning sign HIGHWAY INTERSECTION AHEAD at 600/650 m from the intersection.
- Highway Junction sign at 500-550m.
- STOP AHEAD advance warning sign at 300-350m.
- Destination city names and arrows at 200-250m.
- Route marker assemblies across intersection with cardinal direction, shield/route marker and number and arrow marker.

Consistency is the key to positive guidance. Consistency leads to expectations and confidence in the information the motorist will receive and where that information will be located.

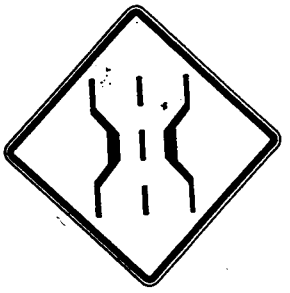


W4–2

W9–1

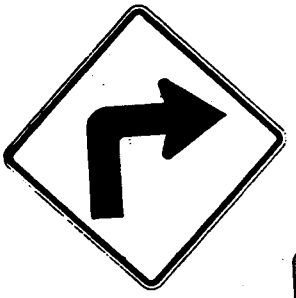
W9–2

W5–2



W5–2a

Exhibit 4.22



W1–1R

W1–2R

W13–1

Exhibit 4.23

Warning Signs

Warning signs are used to call attention to specific hazards or potential hazards associated with that area of road and so are extremely important for motorists. These signs have yellow backgrounds and are generally diamond shaped (with a few exceptions), with black legends and borders. As mentioned in earlier sections, the bigger the sign (and symbol or text) the better. Against some backgrounds, such as fields of wheat or brown grass, the yellow sign tends to blend in with the surroundings. It is particularly important to make certain the colors on these signs have not faded dramatically or lost their reflectivity. It may be necessary to expand the width of the black border so the signs do not fade into the background. The MUTCD allows for the border to be the same width as the stroke width of the major lettering on the sign. When using higher performance sheeting, expanding the width of the border helps with nighttime visibility.

Another important consideration with warning signs is whether the symbol sign is easily understandable. Exhibit 4.22 shows examples of signs where the text sign is preferred over the symbol sign.[2] It may be necessary to provide supplemental text on the sign. Also, if a new sign is being placed in an area, a supplemental text sign should be used if possible for a short period of time while the regular motorists on the route become familiar with the sign.

An advisory speed plate should be used whenever a "Curve" or "Turn" symbol sign is used. This is based on research which shows people cannot correctly distinguish between the two signs and the associated hazards with each. People do not recognized the need to slow to 30 mph or less in order to make a turn versus driving the speed limit posted to safely maneuver a curve.

Regulatory Signs

Minimum standards vary for the different regulatory signs. All the signs, however, can and should be enlarged by increments of six inches. It may also be necessary to use larger borders on white signs so they stand out from the background. Use special care to orient regulatory signs properly (see page 4-8) because reflectance of the white background can produce unacceptable glare.

[2] D.L. Picha, H.G. Hawkins, Jr., and K.N. Womack. Motorist Understanding of Alternative Designs for Traffic Signs. Research Report 1261-5F, Texas Transportation Institute, College Station, Texas, November 1995.

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Construction Zones

It is important for the safety of the motorists, as well as the construction crew, to make sure motorists understand the constraints and demands of construction zone driving. While the majority of motorists tend to pay more attention to signs and traffic control devices in construction zones than other situations, it is helpful to keep the following in mind.

- Use signs to indicate merging lanes. Even when using tapers, the use of signing is a help to older motorists who may find the tapers confusing (particularly pavement markings).
- Use signs in conjunction with barriers. This allows easier detection by older motorists.
- Give plenty of advance warning of work zones.
- If the work zone is long, let the motorist know how many more miles are under construction and update as the work proceeds
- Do not reduce speed unless it is actually necessary for safety reasons. Reducing speed for a long stretch where no workers are visible leads to motorist confusion.
- All signs should be placed on the right side of the road. However, if there are multiple lanes or high speeds, supplemental signing on the left hand side of the road or overhead may be necessary.
- As with all signs, the construction zone signs may be increased in increments of six inches so that older motorists may easily detect and read the signs.
- An advance warning sign should be used with any temporary traffic control device (such as a stop or signal light).
- Warning should be given when a shoulder ends due to construction.
- Motorists should be notified of closed exits ahead and limited access to streets off highways and freeways and given alternate path information.

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Larger Signal Lenses

There are a variety of situations where the MUTCD prescribes 0.31m (12") lenses as opposed to 0.2m (8") lenses. However, to improve visibility for older motorists, 0.31m (12") lenses should be used in all traffic signals. The larger lens will more easily draw the attention of motorists and because of the larger surface area, will allow the motorist more time to determine the signal color and make the correct response. Also, the larger area of light will make the light appear brighter to the motorist and will be seen more easily.

Placement

The first consideration for placement of a signal is visibility. Keeping in mind the fact that many older motorists do not notice or see things well when they are outside the line of sight, it would make sense to place signals above the roadways rather than on the side of roads whenever possible.

Backplates

Backplates, visors or louvers are used when the signals are viewed against a sky or a bright or confusing background. The use of backplates, louvers, or visors is therefore recommended for all traffic signals. The more easily seen the lenses are, the more likely all motorists will be able to respond to the signal in a timely and correct manner.

Visibility and Discriminability

Warning Signs and Signals

Warning signs or flashing yellow signals are used when motorists cannot see traffic signals for a given distance. The warning sign or signal must catch the motorist's attention and allow sufficient time for the motorist to process the warning and slow down (or stop). Since older motorists may take longer to detect the warning and process the information presented, it may be helpful to have warnings placed a greater distance from the actual signal. This would give all motorists adequate time to prepare for the signal and a possible red light.

Signal Luminance

To date, traffic signals have received even less attention than signs as the target of research with older motorists. A study to determine the impacts of dimming traffic signals at night found that the aged have reduced levels of sensitivity to intensity and contrast, but not to color. Older motorists need increased levels of signal luminance and contrast in certain situations to see traffic signals as efficiently as a 20-to-25 year old, but higher signal intensities may cause disability glare. In general, simple background settings at night indicated that reduced signal luminance did not cause declining performance of older motorists.

Left Hand Turns & Older Motorists

Overall, research has found older motorists tend to be involved in more accidents while making left turns or failing to yield the right-of-way to other traffic. Therefore, it is extremely important for these motorists to be able to determine the correct flow of traffic at all intersections. This can be accomplished through the following.

Left Turn Lanes

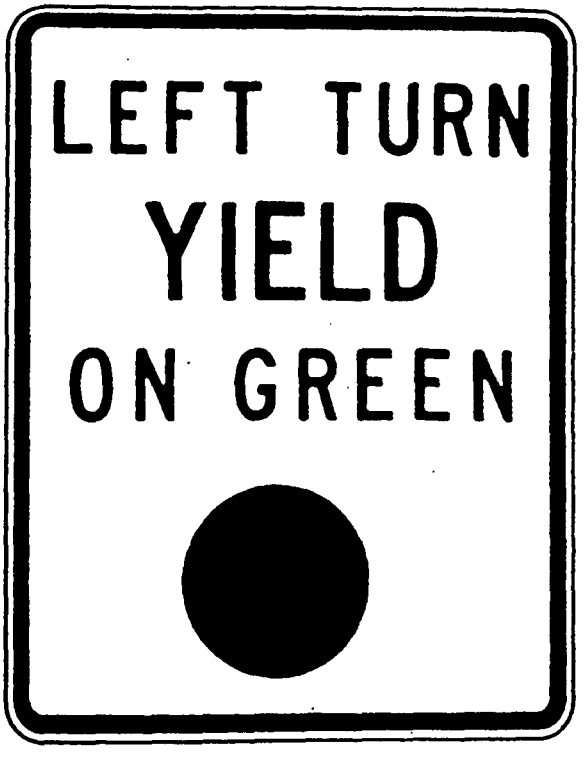
Safety is an important benefit when left-turn lanes are provided, thus reducing opportunities for rear-end collisions. In addition to safety benefits, left turn lanes also reduce vehicle stops and delays and make the intersections simpler to use, thus benefiting older motorists. In fact, it would appear that the only reasons for not providing a left-turn lane are either that the right-of-way is not available or is too costly or that the road space is needed to carry through traffic. Although AASHTO does not provide guidance beyond recommending that left-turn lanes be installed where volumes are high and speeds fast, several jurisdictions have warrants based on volumes and approach speeds.

A considerable body of information already exists about the safety effects of left-turn lanes. Thus, ITE guidelines suggest that "studies have demonstrated that accident experience is significantly reduce when left-turn storage lanes are provided at intersections of 2-way major streets".

An FHWA report (26) suggests that the provision of left-turn channelization at nonsignalized intersections, if combined with curbs or raised bars, will reduce accidents by 70 percent in urban areas and by 65 and 60 percent in suburban and rural areas, respectively. If channelization is painted, accidents will be reduced by 15 percent in urban areas and by 30 and 50 percent in suburban and rural areas, respectively. At signalized intersections, it is suggested that left-turn channelization with a left-turn phase will reduce accidents by 36 percent; without the left-turn phase, by 15 percent. It is also suggested that adding left-turn lanes without signals can decrease accidents by 19 percent on urban two-lane roads, and by 6 percent on urban roads with more than two lanes.

Flashing Red and Yellow Lights

Older motorists often have problems at intersections with flashing red and yellow lights. In many instances, the motorist approaching a flashing red light assumes the cross traffic has a flashing red light as well. However, those perpendicular lanes of traffic often have yellow caution lights. It is helpful for all motorists to see supplemental stop signs with additional text signs reading "Two Way Stop" or "Four Way Stop".



R10-12

Exhibit 5.1

Signalization of Left Turns - Protected Left Turns

Whenever possible, left turns should have a dedicated turn lane and should have a dedicated signal. Most older motorists do not have a problem with the turn arrows used, or with those signals which are signed as "Left Turn Yield on Green". However, many have difficulty understanding the proper course of action when a circular light is signed "Protected Left on Green" (this is true for all motorists). They either assume they should wait for a green arrow to provide the protected left turn or they assume oncoming traffic has a green light also. Clearly, this sign is not adequate for that type of signal and situation. The best course of action here is to use left turn arrows as opposed to circular light signals alone.

Lagging and Leading Greens

Many older motorists become confused with lagging green turn signals. If they are unfamiliar with these signal phases, they may think the light is malfunctioning and make dangerous, illegal left turns in front of oncoming traffic. Leading greens may be better because older motorists are usually more familiar with leading green turn signals. Of course, if there is an established order for signal lights in a town or county this order should always be followed. Changing the order to accommodate traffic may seem advantageous, but could easily result in a greater number of accidents at the intersections.

In the permitted left turn stage of the cycle, motorists should be consistently informed of the correct maneuver by the use of the R10-12 sign (Exhibit 5.1). LEFT TURN YIELD on Green • both at the intersection near the signal bead and in advance of the intersection.

R10–6

Exhibit 5.2

Timing Cycles

A primary concern for older motorists is the timing cycle of the amber signal. Older motorists usually take longer to perceive and process information than younger motorists. It would be helpful to them to have longer amber signal times so that they have time to process the change in light and make the correct response. Of course, the amber signal time is dependent upon a number of things, such as speed of approaching traffic, sight distance, etc. However, adding an additional few seconds could significantly reduce the accident incident at signals.

Right Turn on Red

One of the biggest complaints voiced by older motorists is the disregard of other traffic shown by younger motorists turning right on red. Older motorists feel the younger motorists turn right on red without actually stopping to assess the traffic situation. Signing intersections when possible could help older motorists feel more secure about this situation by constantly reminding motorists of the need to stop before proceeding on red. Use R10-6 to fill this need (Exhibit 5.2).

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Pavement Markings

In general, using raised pavement markings to supplement paint markings between opposing traffic lanes is helpful for most motorists. In bad weather conditions, raised pavement markings can better alert motorists who may unintentionally be crossing over into oncoming traffic. Older motorists have sung the praises of the raised pavement markers to return more headlight illumination for delineation.

Retroreflective markings should be used whenever possible. In the dark or in poor weather, it can be difficult to see non-retroreflective markings. Retroreflective edge lines would also be helpful for motorists in most instances (an exception being on narrow rural roads, where the tendency of the motorist to overcorrect may lead him/her across the centerline). Older motorists, in particular, would benefit from the use of retroreflective markings because they are more easily seen in all instances.

For a 10 cm (4") wide white highway striping and edge lines, an increase in brightness of 30% must be achieved and maintained to bring downstream detection/recognition performance of older motorists equal to that of younger motorists. To accommodate everybody, a triple increase in stripe brightness (300%) using high reflectance tape may be necessary for critical pavement markings.

Brighter striping has been shown to help older motorists discriminate the road's direction of curvature. Where older motorists suffer compared to their younger counterparts is in their ability to determine downstream roadway heading at nighttime on a non-illuminated highway.

Painted pavement markings should be the maximum width of 0.2m (8") wherever possible. This helps older motorists to more easily see the markings, especially when painted markings become worn and faded. Reflective beads in paint will last longer and be brighter than paint alone.

Supplemental signing may be necessary as well to confirm information on lane markings in adverse driving conditions. Such signing reduces uncertainty and allows older motorists to feel more confident of their actions. For example, lane control markings should be supplemented with signs explaining the markings and the word "Stop" written on the pavement should be supplemented with a stop sign or flashing red light.

A need exists for pavement markings for divided highway crossovers. With no markings, some motorists drive on the wrong side of the road in the median, which can be particularly confusing to older motorists. Since this occurs against expectations of older motorists, it may lead to hazardous situations.

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Lighting

Illumination on roadways is accomplished by two general means: street lighting (luminaires) and sign lighting. Regardless of which of the method is being used, one of the most important things to strive for is the elimination or reduction of glare. Methods for reducing glare include:

- higher mounting heights for luminaires;
- reducing luminaire brightness;
- increasing the background brightness by raising the general level of illumination; and
- making certain the lights being used for externally illuminated signs are angled so as to reduce possible glare.

It is also important to keep in mind the type of roadway surface being used and adjust accordingly. For dark surfaces it is necessary to provide more illumination and for light surfaces, less illumination.

The following are other general items to keep in mind.

- A single luminaire used to call attention to a point in the road is almost useless. For the motorist to be able to make out all necessary information regarding the road at a point, he or she must be able to see the roadway leading up to the point. Two or more luminaires are usually necessary for motorist safety.
- Intersections and intersection approaches should be adequately lighted to allow the approaching motorist to make out informational signs, other vehicles, pedestrians, etc. in the total area of the intersection.

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Railroad-Highway Grade Crossing

- Crossbucks should be installed close to the roadway so that they are in the area illuminated by a vehicle's headlights.
- High intensity sheeting should be used on crossbucks and advance warning signs for rail crossings.
- Reflective tape strips should be taped to all sides of crossbuck sign posts for better visibility.
- Illumination at and near the crossing should be used whenever possible (especially where passive traffic control systems are used).
- "Do not stop on tracks" signs should be used wherever financially feasible.
- Use some form of active traffic control system wherever possible.
- Use 0.31m (12") lenses for flashing light signal units in active traffic control systems.

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Chapter 7 Review of General Recommendations for Accommodating the Older Motorist

Traffic Control Devices

People vary a lot in how well they understand and use traffic control devices (TCD). But none vary as much as the older motorist. Some older motorists are actually better than their younger counterparts. They have driving experience on their side. However, others have lost that skill and knowledge, in spite of their lifetime of driving.

Research findings on older motorists' performances tend to underestimate the amount of change in ability to use available guidance information. This underestimate comes from the fact that only reasonably able motorists will volunteer to be tested!

Only part of the decline in performance is due to poorer eye sight. There are older motorists on the roadway who are really very incapacitated. These motorists should restrict or end their driving; not just because of failing eye tests. We, unfortunately, do not know how many individuals fall into this category.

Here are some well-established facts about older motorists:

The SIGNS on the Roadway:

- The size of characters on all signs must be increased by at least 30 percent, which means 1 inch of character height to 38 feet of sight distance, versus the MUTCD standard of 1 inch for 50 feet. This change would accommodate motorists testing 20/30 on the standard eye chart, but it should be noted, that many states do not restrict driving unless the motorist scores poorer than 20/40 (1 inch/ 25 ft). In these states, that would mean doubling the size of all characters' height.
- When traffic control device signs must be erected in a cluttered visual environment (commercial signs, strip developments) pay special attention to the background against which the sign will be seen. Older motorists have trouble picking out regulatory signs, diamond warning signs, and the School Crossing signs (7B-9 and 10) form a cluttered background. Research has shown that a green border on a warning sign had the best chance of being picked up by older motorists, especially in an urban environment. The use of colored borders and increasing the size of such signs under these conditions must be considered.
- Less commonly used MUTCD symbol signs such as Pavement Ends (W8-3A) or any of the crossing signs (e.g., the Tractor Crossing (W11-5)) should be larger by at least 1 size (36 inch vs 30 inch) to make it easier to detect and have time to think about its meaning.

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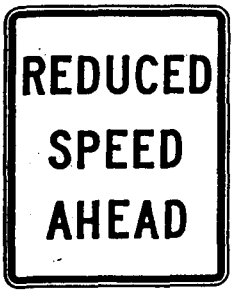
- Research on comprehension of traffic control devices by older motorists has shown:

-use 

vs. 

to indicate a lower speed limit.

- Supplemental sign plaques on warning signs will aid understanding.

Chapter 7 Review of General Recommendations for Accommodating the Older Motorist

Particularly bad warning signs, from the standpoint of correct motorist comprehension are:

(a)

W8–5

(b)

W8–3a

(c)

W1–2R

(d)

W1–1R

(e)

W6–2

Sign (a), W8-5, Slippery When Wet is confused with Winding Road. Attempts have been made and researched to improve this symbol sign. However a text sign might be best:

Sign (b), W8-3A, Pavement Ends, is intended to warn where a pavement changes from hard surface to a low-type or earth. Granted, perhaps not a frequently used sign, however, the text version is better.

Signs (c) and (d), W1-2 and W1-1, are often confused and do not communicate the speed restrictions. The Turn Sign (W1-1) has a recommended speed on a turn to be ≤ 30 MPH. It is recommended that Advisory Speed Plates be added to both signs, or especially to the Turn (W1-1) to ensure the older motorist negotiates a turn at a safe speed.

Sign (e), Divided Highway Ends (W6-2) can be confusing for motorists. The Divided Highway Ends (W6-2) is confused with Divided Highway (W6-1) by almost one-half of the motorists surveyed. It is suggested that a Two-Way Traffic (W6-3) sign be placed as a supplement to this Sign. By adding the supporting sign of Two-Way Traffic, the message of the Divided Highway Ends will by reinforced.

Chapter 7 Review of General Recommendations for Accommodating the Older Motorist

Roadway Delineation

Roadway delineation must be made much more obvious and brighter (higher contrast against its background) to support the Guidance level of older motorist performance. Retroreflective raised pavement markers can go a long way toward satisfying this requirement. An increase of up to 3 times the present-day maintained levels of brightness of delineation is necessary to accommodate nearly all motorists.

High Performance Materials

Glare is the biggest enemy of the older motorist. Both daylight and nighttime glare keep motorists from distinguishing much of anything inside a glare pattern. The high performance (high intensity) materials available now for guide signs, construction signs, school crossing signs, etc. have the advantage of increasing the distance at which they are seen. However, a phenomena known as "irradiation" or "overglow" results at night from headlamps hitting the sheeting. The drawback is a glare source from the sign, as well as the irradiation causing the words or symbols on the sign to appear blurred and illegible. Given the constraints of MUTCD and your own agency standards, the only cure is the use of as large a sign as practicable where critical information must be conveyed to the motorist.

More Sign Guidance

In multiple traffic sign applications, code criticality by size: the bigger the sign, the more critical the information

In multiple traffic sign applications, group noncritical information by similarity in size and appearance, consistent with MUTCD. Make critical information stand out by marking those signs as different as possible in color, size, and shape.

Variable Message Signs

Where variable message signs are used, consider presenting the entire message several times, either on a very large array, or by the use of 2 or 3 redundant arrays located at strategic points along the roadway. Older motorists do better with such a presentation, as compared to presenting the message in a segmented fashion, one or two chunks at a time.

Chapter 7 Review of General Recommendations for Accommodating the Older Motorist

Role of Conventional Guide Signs

There are two types of guide signing described in the Texas MUTCD. Guide signing for conventional highways (Chapter IID) is used on highways without access control. Freeway/expressway signing (Chapter IIE/F) is used on highways with access control. Not only are there two different types of guide signs, they are based on different philosophies.

Philosophy of Guide Signs

Freeway Guide Signs - The major emphasis of freeway signing is on destinations. Control sites and street names provide the primary exiting information for all motorists. Route shields and cardinal directions are used in freeway signing, but they are not emphasized to the same extent as control cities and street names. This philosophy assumes that the motorist is navigating by the name of a particular city, like Dallas or perhaps a highway like State Highway 6. Guidance information such as the destination (control city, street, or highway) are provided well in advance of the exit. Information is shown in advance guide signs and repeated in exit direction signs.

Conventional Guide Signs - The major emphasis of conventional guide signing, as described in the MUTCD, is on highway class, number, and cardinal direction. This information is provided at the intersection where the maneuver is performed. Destination information (cities) is provided in advance of the intersection and is not repeated at the intersection. However, because motorists have become accustomed to using destination information to navigate on freeways they have carried that preference onto conventional highways. Therefore, while the emphasis of conventional guide signing remains on class, number, and direction, destination information is a critical element of the signing system and must be given equal consideration and repeated at the intersection, like Freeway Guide Signs.

Guide Signs

Although, in general, spacing out guide sign information on a succession of signs rather than placing a lot of information on a single (large!) sign is a good idea, it can backfire. Older motorists may not be able to recall pertinent information on an early sign if they get a lot of irrelevant information on succeeding signs. Tie the successive signs together with redundant information. For example, if an upcoming interchange has a lot of different destinations, but one is particularly important, that destination should appear on each successive sign.

In multiple traffic sign applications, use overhead signs when possible for critical information. They have a better chance of being noticed that if they are placed at the sides of the facility.

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Criteria for Testing Adherence to Signing Principles

Use the following checklist to see if your sign will meet the test criteria.

I. INTERPRETATION

A. Is the message complete and clearly stated?

1. Is the message free of unusual abbreviations?
2. Are cardinal directions used with route numbers or names clearly separated from place names?
3. Do directions on signs have route numbers so there are 2 ways of giving motorists a sense of where they are.
4. When lane arrows are used, is it clear as to which lane is being indicated?
5. When directional arrows are used:
   a) Are they used at the point where the turn is to be made?
   b) Is the slope of the arrow indicative of the severity of the turn?

6. If routes with similar names or numbers are in close proximity to each other, is the distinction between them clearly indicated?
7. Can the absence of a place name or route direction, or the use of a lesser known place name, cause the motorist to make assumptions which will lead him astray?
8. If a route is restricted to types of vehicles or destinations which may be reached, is this fact clearly indicated and alternate routes specified?
9. When cardinal directions are used, are they free of misinterpretation caused by the nature of the route?

B. Is the difference between alternatives clearly indicated?

1. At the point where a choice must be made is the choice limited to two alternatives?
2. Are the alternatives which are presented things of the same kind? For example: do not mix guidance information types.
3. If several kinds of information are presented at a point of choice, is it possible to select alternatives between each kind independently of the others?

C. Is the length of message on a single sign or the combined message on a group of signs at the same location such that they can be read and comprehend at the designed speed of the highway?

II. CONTINUITY = EXPECTANCY

A. Is there continuity of all parts of a sign message (route name, route number, cardinal direction, exit number, destinations) throughout a series related to a particular interchange?

1. Is the message presented in the same order through the entire series?
2. Is each part of the message presented on each sign in the series?
3. Is the form of presentation of each part of the message the same throughout the series?

B. Is there continuity of signing along a route and throughout a system of routes of equal standards?

1. Are mileage signs and route markers used consistently to reassure the motorist of route continuity?
2. Is the terminology on route mileage signs selected from a part of and in the same form as that used on the signing for interchanges?
3. Are mileage signs an extension of destination information shown on crossroad signing at interchanges?
4. Are the destinations selected for through route signing of major importance?
5. If the major destination is reached only by exiting to another route, is this fact clearly indicated?
6. If a series of exits serve the same direction:

   a) Has a single best route been preselected for the motorist unfamiliar with the area, or

b) have his alternatives as to the principle exit to center of a place or a major point of interest and secondary exits been clearly defined?

7. Is the sequence of signing and the presentation of the messages consistent among locations where similar decisions must be made?

8. Are the destinations which are selected for each interchange in accordance with the classification of the route and the areas which it serves?

C. Does the signing of cross routes at interchanges with the route being studied encourage integration as a part of the overall highway system?

1. Is the signing on the cross route appropriate to the composition of the traffic using it?

a) If the cross route is part of the primary system does the signing provide full information for the motorist who:

1) want to by-pass a central city?

2) want to go to or through a central city?

3) want to reach destinations around the perimeter of the central city?

b) If the cross route is a secondary route, does the signing lead the motorist who is unfamiliar with the area to the primary system?

2. Is the signing of cross routes to two or more interchanges complete enough to enable the unfamiliar motorist on the crossroad to select routes to the interchange?

3. Are there sufficient "To" signs on the primary routes and from major points of attraction motorists unfamiliar with the area to permit intelligent use of the highest quality road system?

IV. RELATABILITY

A. Have the materials commonly available to the motorist been reviewed to insure translatability between the signing and these materials?

1. Is the motorist provided with:

a) Information as to the number of exits serving a particular city of point of interest?

b) Instruction as to which is the principle exit for center of the town or point of principle interest?

2. At interchanges which do not serve all directions of travel, is the motorist led to the alternative route designed to serve the same areas as that served by the route at the incomplete interchanges?

3. Are the through route destinations which are selected the same as those which are major points on typically available road maps?

V. PROMINENCE

A. Have the size, position and number of signs been selected with proper consideration of the background, type of area, number of lanes, and expected traffic volumes?

1. Are there competing commercial signs in the background which require the highway sign to be mounted over the road?

2. Is the number of lanes or are the expected traffic volumes of such magnitude that the message should be repeated more often than usual?

3. Are all the signs in a series of a size which is in direct relation to their importance?

B. Are the individual components of a message given emphasis in accordance with their importance?

1. Are the various items of information relative to the particular location emphasized in accordance with their importance to the motorist?

2. Is there one very long message which dominates the sign to the detriment of more important information?

VI. UNUSUAL MANEUVERS

A. Do the conditions at a particular location demand custom-designed signing because unusual, unnatural, or unexpected maneuvers are required of the motorist?

1. Has a clear distinction been made between interchanges which have:

   a) a single exit from the through lane for one direction of travel?

   b) a single exit from the through lane for two directions of travel with no return to the through lanes?

   c) a single exit from the through lane for two directions of travel with the possibility of return to the through lanes?

   d) two exits for two directions of travel?

2. When certain movements are not provided has specific information been provided for alternate routes?

3. Is the through motorist given sufficient information to determine if he can leave at a particular interchange and:

   a) return to continue in the same direction?

   b) return to continue in the opposite direction?

4. Are left exits clearly indicated far enough in advance so that the motorist is in the proper lane when the decision point is reached?

5. Are left entrances clearly indicated to motorists on both the through lane and the entering lane so that they are prepared for an unusual merge?

6. Are locations where a route takes an unnatural turn signed so that the unfamiliar motorist will be confident that he is on the through route?

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May 30, 1997
Update

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