

OLDER DRIVER'S COLLISIONS COUNTERMEASURES

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Older Drivers

- A critical subset of driver population
 - Aging affects a variety of skills
 - Physical
 - Strength, flexibility, and range of motion diminish
 - Visual abilities
 - Static visual acuity, dynamic visual acuity, contrast sensitivity, and glare sensitivity deteriorate
 - Cognitive changes
 - Working memory, selective attention, and processing speed are impaired

EXHIBIT III-1

Projected Growth in U.S. Population Age 65+
 (Source: Administration on Aging, "A Profile of Older Americans," 2000,
 www.aoa.gov/prof/statistics/profile/2002/2.asp)

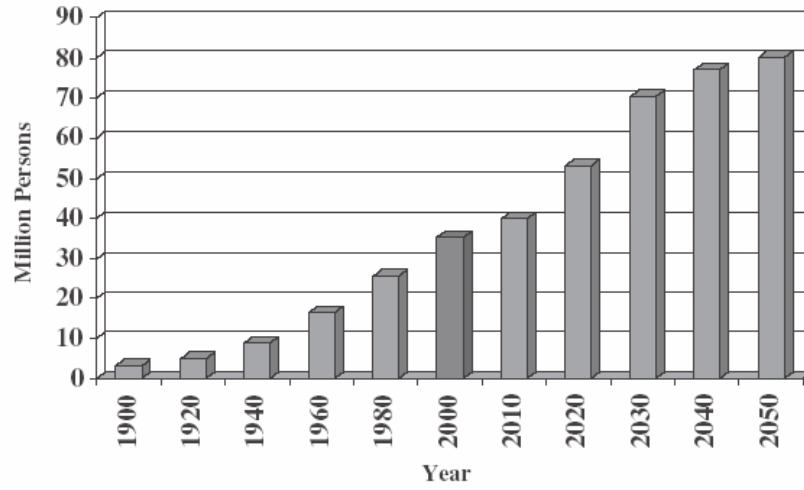


EXHIBIT III-2
 Annual Crashes per 1,000 Licensed Vehicle Drivers
 by Age of Driver
 (Source: Cerrelli, 1998)

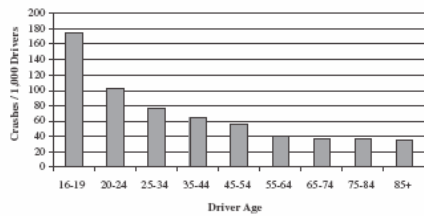


EXHIBIT III-3
 Crashes per Million Miles Traveled by Age of Driver
 (Source: Cerrelli, 1998)

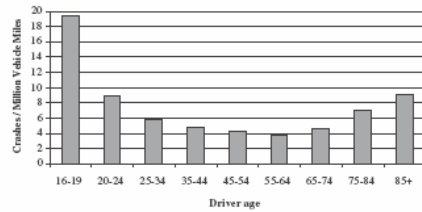


EXHIBIT III-4
 Fatalities per 1,000 Licensed Drivers by
 Age of Driver
 (Source: Cerrelli, 1998)

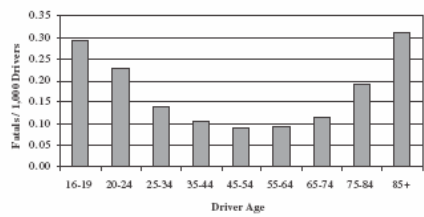


EXHIBIT III-5
 Fatalities per 100 Million Vehicle Miles Traveled by
 Age of Driver
 (Source: Cerrelli, 1998)

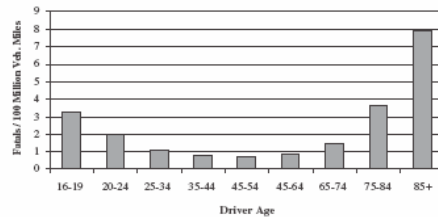


EXHIBIT III-6
Of People who Died in Collisions, Percentage who Died in Angle Collisions
(Source: NHTSA, 1997)

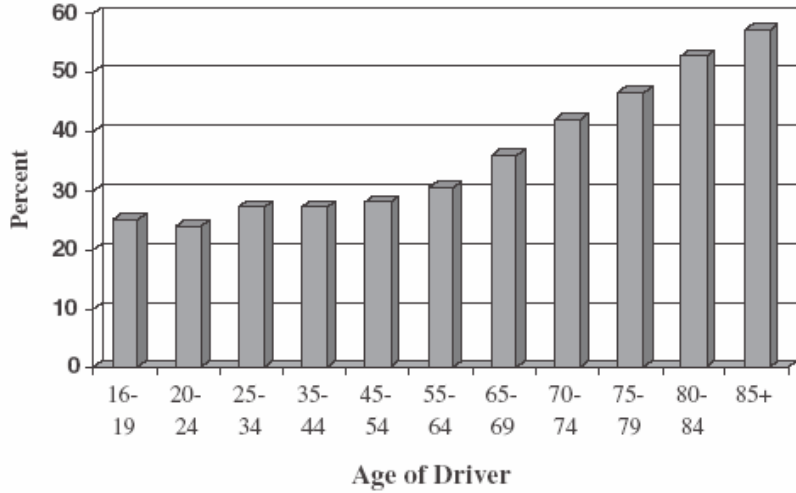
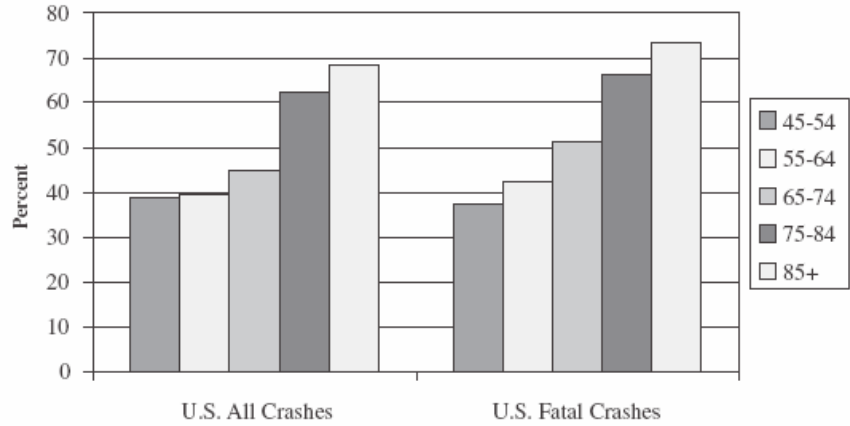


EXHIBIT III-7
Percent of Time Drivers Are at Fault when They Are Involved in a Two-Vehicle Crash (by Driver Age)
(Source: Stewart et al., 1999)



Key Functional Abilities by Aging and their Relationship to Driving

Vision	Reduced visual acuity	Visual acuity is used to see detail, such as road signs
	Reduced visual contrast sensitivity	Contrast sensitivity to see targets that don't differ much in brightness or color
	Increased susceptibility to glare/slower glare recovery	Older persons suffer more from glare due to vitreous changes

Vision	Reduced sensitivity to changes in angular size and motion	Older drivers judgment of speed, rate of closure and gap
	Less efficient visual search	Visual search abilities influence how fast a person can find and identify safety threats
	Reduced area of visual attention	Useful field of vision shrinks with age

Cognition	Impaired selective attention ability	Drivers must filter out important events and information to select critical safety data
	Less efficient divided attention and slower attention switching	Drivers must monitor and respond to multiple sources of information at same time. For example, a driver entering freeway must track ramp curvature, steer appropriately, keep safe distance behind the car ahead, select gap in traffic, accelerate to enter the gap.
	Less efficient working memory processes	Need to recall recently learned information while driving, without lapses in safely controlling one's vehicle

Psychomotor and Physical Skills	Loss of limb strength, flexibility, sensitivity, and/or range of motion	Need to steer, apply brakes, operate accelerator with appropriate speed control
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Objective I

Improve roadway and driving environment to accommodate older driver's special needs

Strategy A

Provide Advance Warning Signs

- Advance warning signs should be used;
 - Where speed may have to be reduced
 - Curves, grades, bumps, dips, approaches to STOP and YIELD signs, to signal, to RR grade crossings

EXHIBIT V-4
Advance Warning Sign in Advance of a Signalized Intersection (Atlanta District, TxDOT)



EXHIBIT V-5
Advance Warning Sign in Advance of a Signalized Intersection (Atlanta District, TxDOT)



EXHIBIT V-6
Advance Warning Sign in Advance of a Horizontal Curve (Atlanta District, TxDOT)



Strategy B – Provide Advance Guide Signs and Street Name Signs

- Guide signs inform driver about location and route, direct driver to destination, identify roadside services

EXHIBIT V-8
Advance Street Name Sign (Tyler District, TxDOT)





EXHIBIT V-9
Internally Lit Street Name Sign at Intersection (Atlanta District, TxDOT)



Strategy C – Increase Size and Letter Height of Roadway Signs

- Loss in visual acuity makes it difficult to read signs
- FHWA Older Driver Handbook recommends increasing letter height by 30%
- For speeds > 35 mph, increase street name signs to
 - 8 in. lower case
 - 10 in. uppercase



Strategy D – Provide All-Red Clearance Interval at Signalized Intersections

- To calculate yellow change interval, Older Driver Handbook recommends
 - Retention of 1 sec PIEV
 - Adding an all-red clearance interval
- Signal change creates extreme processing demand for older drivers

Strategy E – Provide More Protected Left-Turn Signal Phases at High Volume Intersections

- Older drivers are over-involved in left-turn accidents at signalized intersections
 - Accident rates for elderly drivers are higher with permitted left-turn phases than protected left-turns
 - Protected left-turn phase simpler

Strategy F – Provide Offset Left-Turn Lanes at Intersections

- Sight distance for safe stopping provided by offset left-turn lanes
- Offset helps driver judge operations

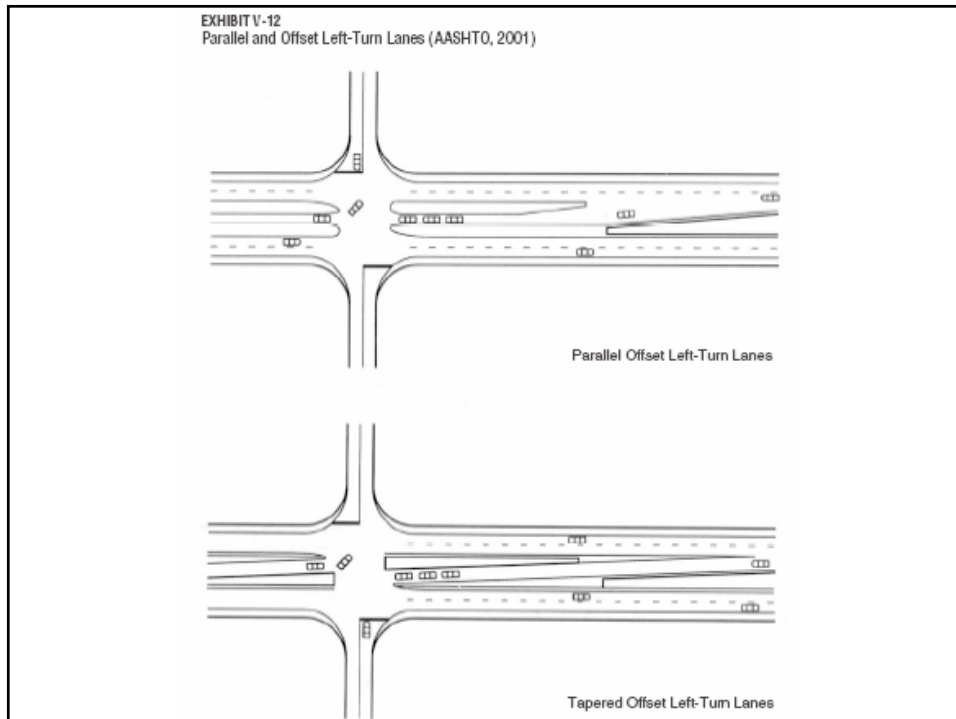


EXHIBIT V-13
Offset Left-Turn Lane (Wisconsin DOT)



Strategy G – Improve Lighting at Intersections, Horizontal Curves & RR Grade Crossings

- Roadway accidents are disproportionately higher at night
- Elderly drivers have more difficulty at night
 - Loss in visual acuity
 - Loss in contrast sensitivity
 - More light needed by elderly
- Increased lighting proven to reduce accidents

Strategy H Improve Roadway Delineation

- Provide elderly drivers with better visual cues
- Older drivers have
 - Reduced visual acuity
 - Reduced field of view
 - Increased decision time
 - Slower response time
- Use
 - Raised pavement markers
 - Raised channelization at intersections
 - Delineators on horizontal curves

Strategy I – Replace Painted Channelization with Raised Channelization

- Raised channelization yields better contrast
- Older drivers have poor contrast sensitivity
- Left-turn channelization benefits slow accident frequency reductions

	Rural	Suburban	Urban
Painted channelization	50%	30%	15%
Raised channelization	60%	65%	70%

(McFarland, 1979)

Objective II

Design geometrics to
accommodate the elderly driver

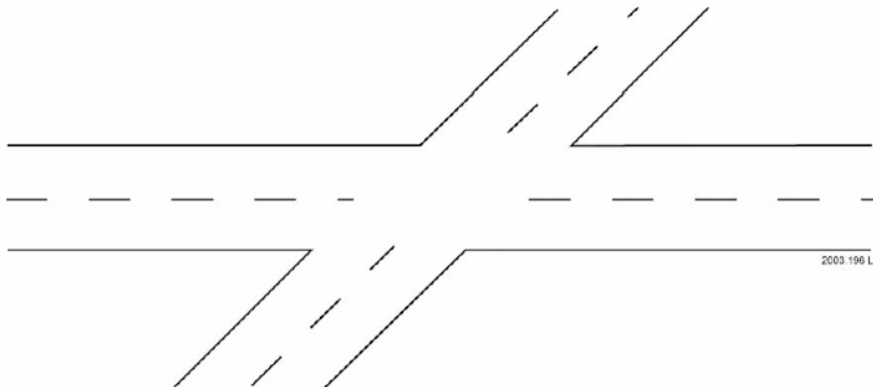
New Design Driver

“Senior Citizen!”

Strategy J – Reduce Intersection Skew Angle

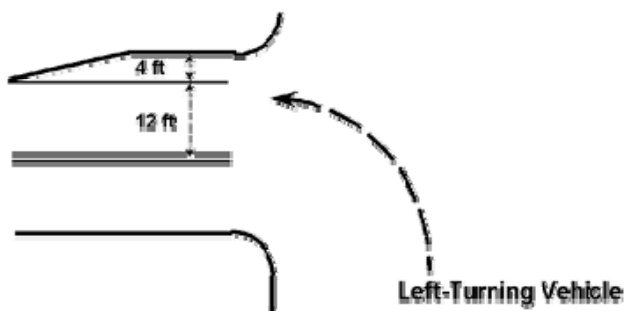
- Intersections with skew angle between 60-75° are undesirable
- Older drivers lose flexibility and head/neck mobility
- Restricted movement makes it difficult to
 - Judge gaps
 - Recognize conflicts
 - Analyze sight distance

EXHIBIT V-17
Skewed Intersection



Design Element: Receiving Lane (Throat) Width for Turning Operations

- Minimum Receiving Lane Width of 12 ft.



- Accompanied by a 4 ft. (1.2m) shoulder

Design Element: Channelization

- Raised channelization with sloping curbed medians is recommended over use of flush pavement marking
 - For: Left and right turn lanes operating less than 40 mph.
 - For: Right turn lanes operating ≥ 40 mph.
- Use sloping curbs rather than barrier curbs, except for pedestrian refuge or access control

Design Element: Right Turn Channelization

- Where right-turn channelization is used at intersection, an acceleration lane is recommended
- With right-turn channelization, an adjacent pedestrian refuge island is recommended

Design Elements: Raised Median vs. TWLTL

- Use channelized left turn lanes with continuous raised-curb median rather than TWLTL's
 - Where ADT's exceed 20,000
 - To improve a demonstrated crash problem
 - Based on engineering study

Raised Median vs. TWLTL: Support

- Older drivers feel TWLTL are confusing, risky, and uncomfortable
- Seeing pavement markings in poor lighting (night, fog, rain) difficult
- Older drivers do not always use TWLTL for turning, and enter TWLTL too soon



Intersection Sight Distance (ISD): Design Element

- Should provide at least 2.5^s perception reaction time
- Where ISD is based on “gap”, use a gap of – 8.0 sec., plus 0.5 sec. for each additional lane, for slower decision times of older drivers



Intersection Sight Distance (ISD)

- Older drivers don't react much slower, but take significantly longer to make decisions, especially in complex conditions
- Older drivers are affected more by short ISD, due to difficulty in head movement, longer decision time, and longer response time



Objective III

Improve work zone design and operations for the elderly

Strategy K – Improve Traffic Control at Work Zone

- Work zones often violate driver expectancy
- Virtually all drivers are unfamiliar
- Vision and cognitive deficiencies from aging compound the problems in work zone
- Recommendations
 - Advance signing for lane closures
 - Variable message sign to better inform
 - Use clear channelization
 - Delineate crossovers
 - Remove permanent marking where not applicable; replace with temporary markings