

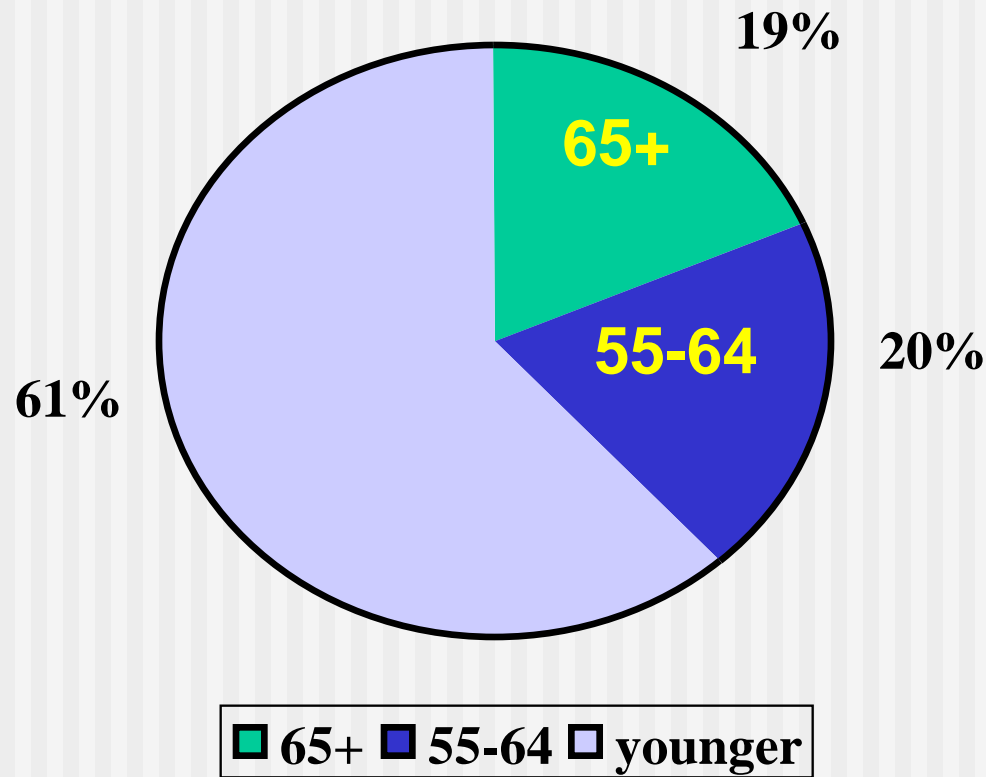
Making Vehicles Safer for Older Drivers

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Traffic Safety
Administration**

Age of New Passenger Vehicle Buyers



Source: 2002 Wards
Automotive News

Older Driver Limitations

- **Slower response time**
- **Problems with glare and vision**
- **Restricted head/neck movement**
- **Can't focus close**
- **Difficulty attending to multiple tasks**
- **More variable in performance**

Percent Crashes/Age Group

| | 16-24 | 25-64 | 65+ |
|--------------------------|--------------|--------------|------------|
| Night | 33 | 25 | 10 |
| Intersection | 50 | 50 | 60 |
| Straight | 60 | 55 | 50 |
| Turning Left | 10 | 9 | 11 |
| Rear-End Striking | 17.9 | 13.4 | 13.6 |
| Lane Change Merge | 2.7 | 2.6 | 4.8 |
| Backing | 2 | 2 | 4 |

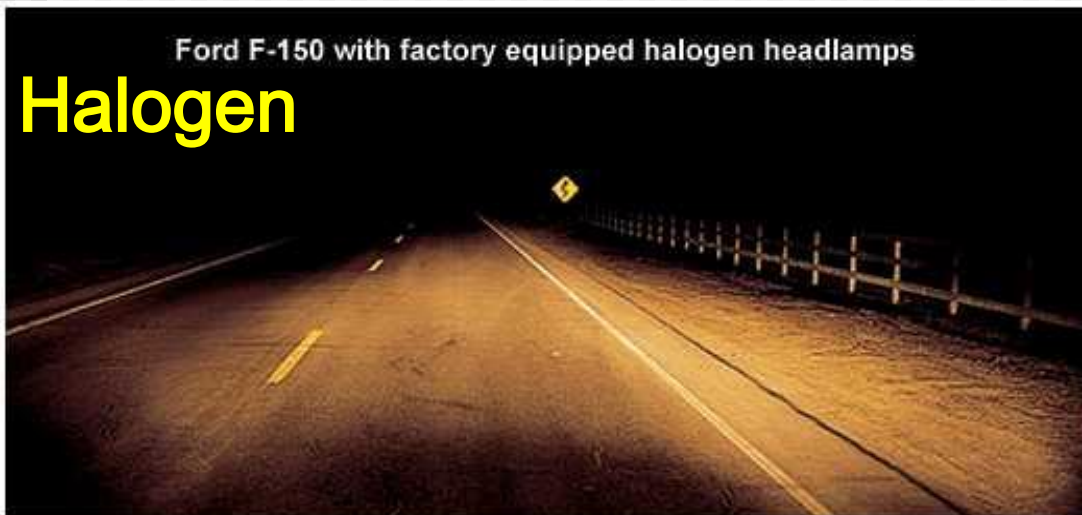
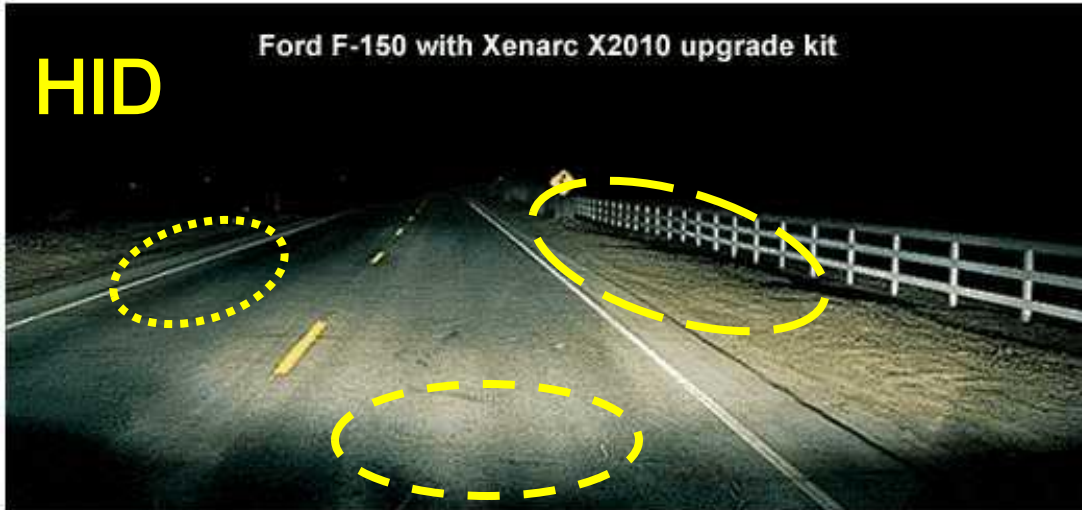
Older Drivers Need to Pay Attention to Car Design

- **Seat belt comfort and ease of using**
- **Visibility through windows**
- **Mirror optics**
- **Minimizing dashboard clutter and confusion**
- **Usability of new technologies**
- **Good headlighting (visibility and glare)**

Glare Complaints Sent to NHTSA

- Causes annoyance and road rage
- Reduces vision
- Increases difficulty of using mirrors
- Distracts drivers
- Limits night driving
- It hurts the eyes

High Intensity Discharge vs Halogen



- Color

Blue/white vs.
Yellow

- Horizontal Intensity

Wide spread vs.
limited spread

Hypotheses/Findings

- **HID Blue color: Novelty attracts attention**
 - ***More attracted to brighter lights***
- **HID Blue color: Eyes more sensitive**
 - ***Affects discomfort not disability glare***
- **Smaller lamps: Brighter luminance**
 - ***Not a significant effect compared to intensity***

Hypotheses/Findings

- **Wider Beam Pattern: Drivers exposed to glare longer during meeting scenarios**
 - ***Intensity influences object detection***
- **Does driver exposure to intensity from different beam patterns affect their glare recovery time?**
 - ***Under investigation***
- **How good is headlamp aim?**
 - ***Under investigation***

Infra-Red Night Vision Enhancement Systems

Positives

- Allows longer object detection distances
- Objects visible next to glare sources

Negatives

- May be difficult for older drivers to shift attention between road and display while driving
- May be difficult to recognize thermal images

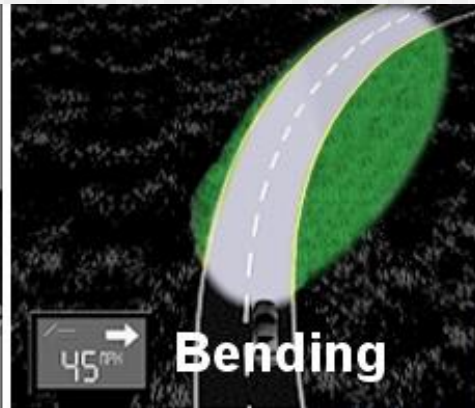
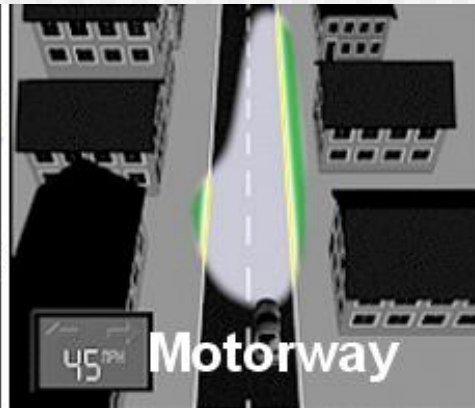
Object Detection While Driving and Using an Infrared Night Vision Enhancement System (NVES)

- **14 Subjects (20-50, 66-83) asked to respond when they detected and recognized targets**
 - **heated traffic cones**
 - **pedestrians**
- **Subjects also asked to detect speed limit signs and stay within 5 mph of speed**

Preliminary Findings

- For Older Drivers without oncoming glare, pedestrian detection distance increased but not percent of pedestrians detected
- For detecting pedestrians in the presence of oncoming glare, NVES did not help Older Drivers
- Older Drivers used NVES less often than younger drivers

Adaptive Forward Lighting



The Effects of Driver-Side Mirror Curvature on Gap Acceptance and Vehicle Detection

Flat



Aspheric

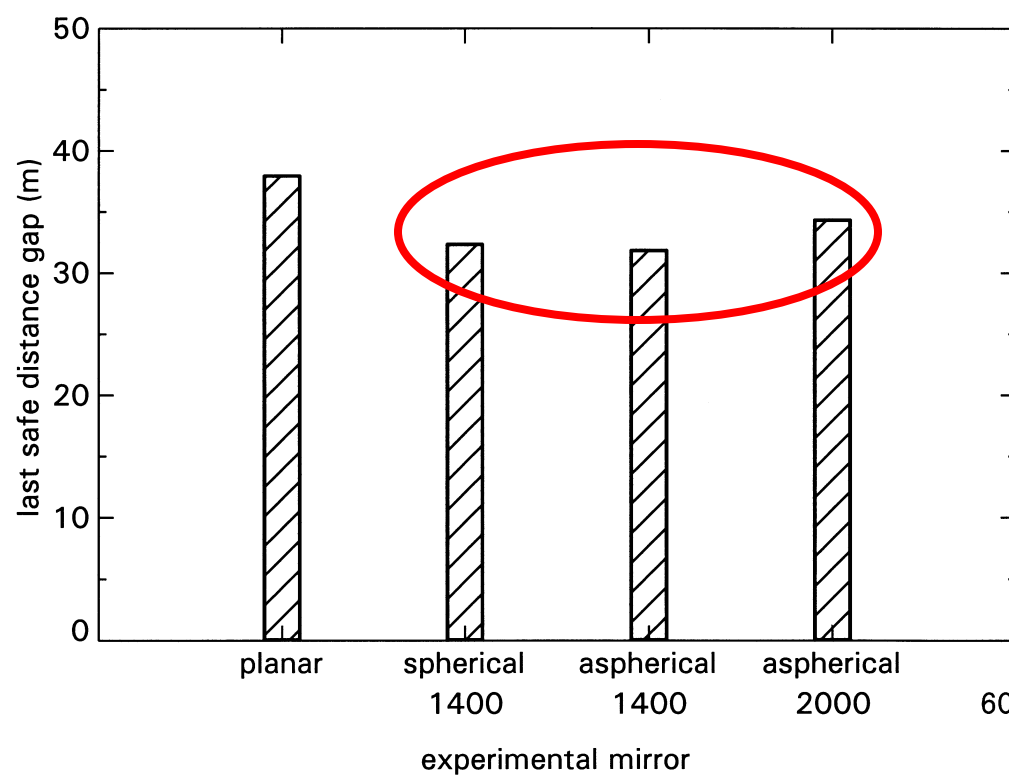


- NHTSA requires flat optics
- Field of view limited--requires head turns or time sharing with inside mirror
- Curved mirrors increase field of view but minify image and require visual accommodation

Mirror Test Protocol

**Measured last safe gap
for lane change**

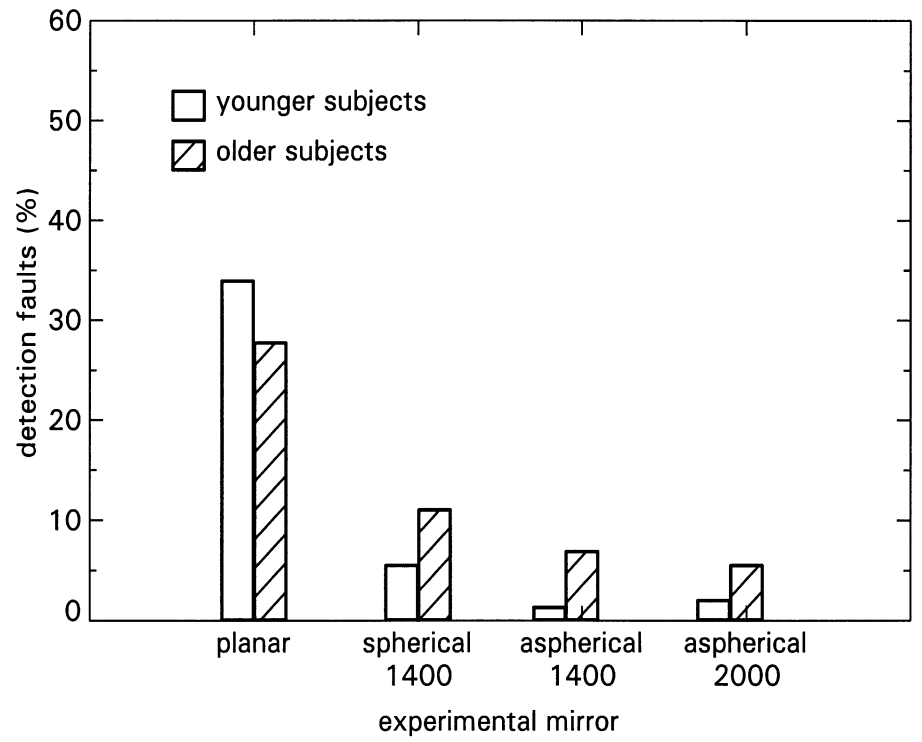
**Measured driver
detection of location of
approaching vehicle**



Smaller gaps for curved mirrors; no age effect

•Improved detection of adjacent vehicle with non-planar mirrors

•Older drivers made ‘better safe than sorry’ mistakes



Implications

- Misjudging gap may be overcome by slowing of approaching vehicle
- Detection errors for nearby vehicles have immediate crash consequences
- Convex mirrors, such as aspherics, may be helpful to older drivers

Advanced Vehicle Crash Warning Technologies

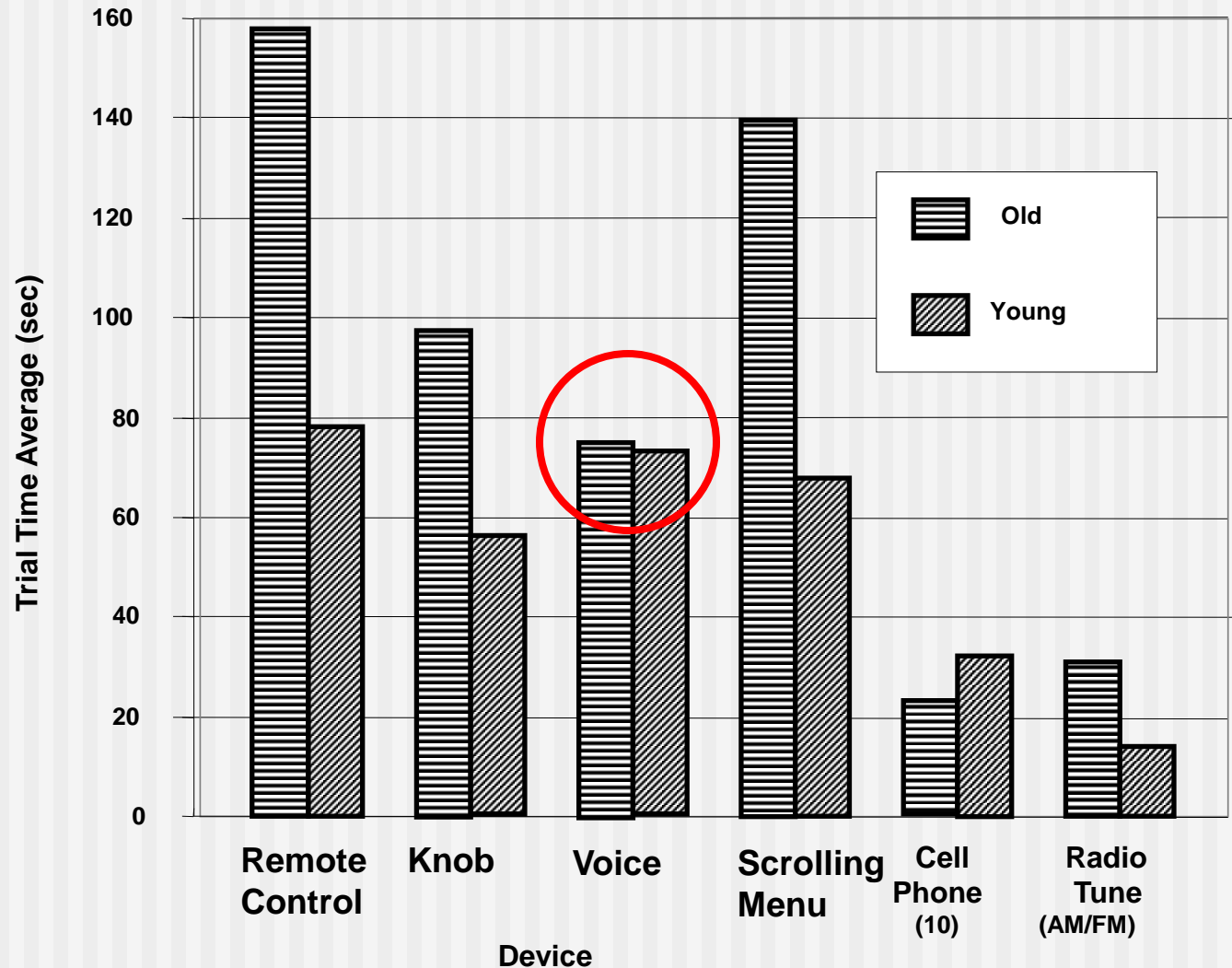
- **Forward Crash Warning**
- **Lane Change/Blind Spot Warning**
- **Rear Object Detection Systems**
- **Road Departure Warning**
- **Intersection Collision Warning**

Advanced Information and Telematics Systems

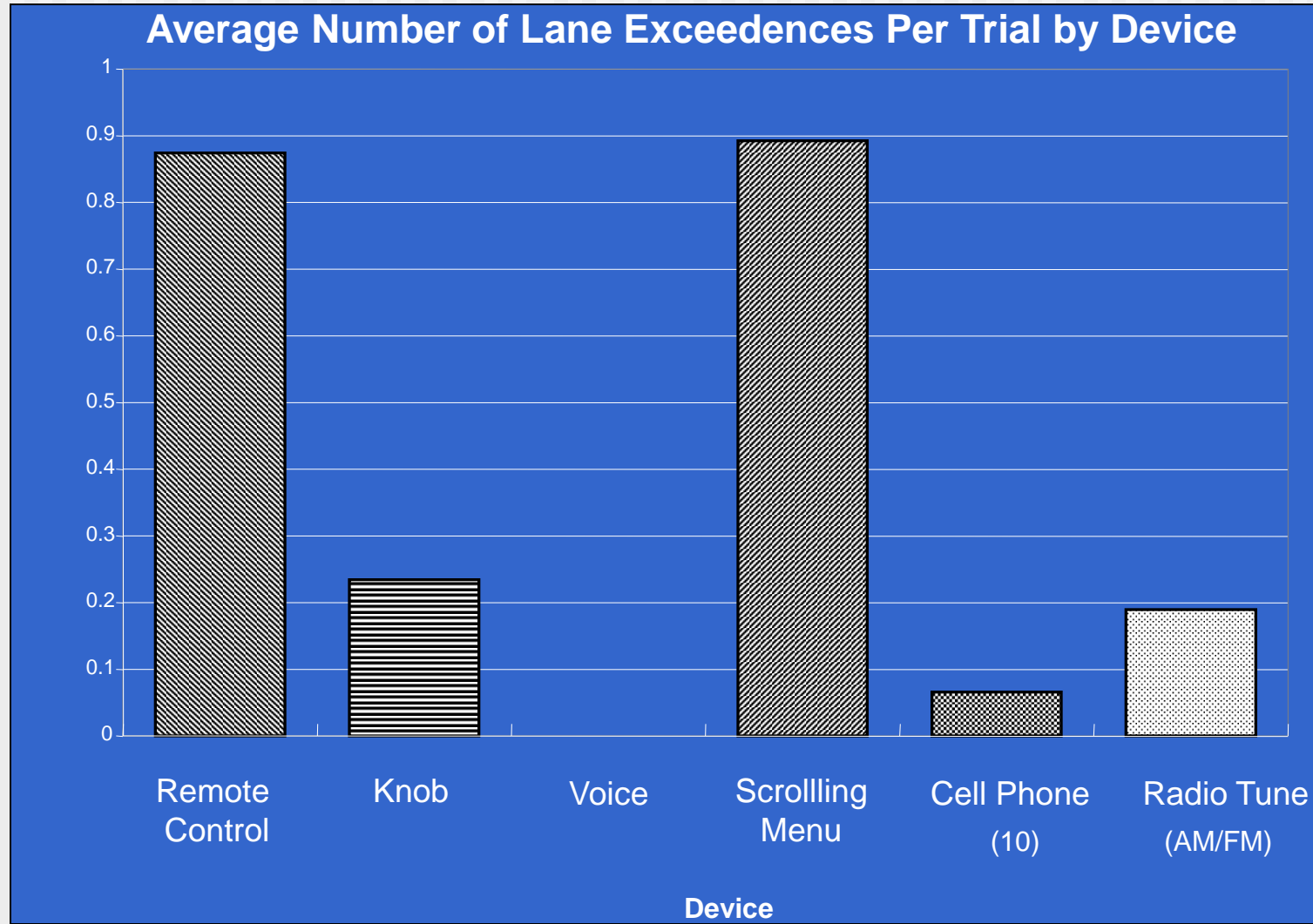
- **Navigation**
- **Email, Internet**
- **Audio/Video entertainment**
- **Head Up Displays**
- **Voice controlled information**

Vehicle Technologies: A good prescription or a bitter pill for older drivers?

Time to Complete Destination Entry While Driving on Test Track



Effects on lane keeping of entering destination in different types of navigation system designs



Voice system challenge: Hands free, not risk free

Enhancing senior driver safety with compatible vehicle design

- Design features compatible with capabilities of average, not superstar seniors
- Focus on aiding cognitive limitations, in addition to physical limitations
- Keep headlamps aimed and clean
- Test drive vehicle before buying
- Learn from early adopters of new technologies
- Make system reliable and understandable to drivers.

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dot.gov](mailto:mike.perel@nhtsa.dot.gov)**