Access management – the most demanding application of human factors in highway, design, operations, control and planning
Definition of Access Management

“Access Management is the coordinated planning, regulation and design of access between roadways and land development. It encompasses a range of methods that promote the efficient and safe movement of people and goods by reducing (and controlling) conflicts on the roadway system and its interface with other modes of travel.”

Source: AMAG
Access Management Analysis Guidelines (AMAG)

- Published as a printed manual and also a CD
- Aimed at covering the “how” of access management in 27 chapters
- Topics covered include:
  - General Access Management Concepts
  - Access Management Program Development
  - Local Access Driveway Design
  - Corridor Design
  - Site Design
  - Turn Lane Design
  - And others
**Roadway Elements for Access Management**

- Three primary elements of the roadway:
  - The driver
  - The vehicle
  - The roadway
- Human element is most important for providing safe and effective highways
- Driver characteristics and behavior estimated to be causative factor in 90% of highway crashes

**Human Factors Affecting Access Management**

- Important human factors and characteristics:
  - Driver vision and object visibility
  - Cognitive limits, especially for elderly
  - Driver workload
  - Driver expectations and expectancy
  - Perception and reaction behavior
  - Analytical and decision-making ability
  - Psychological limitations
Human Factors Affecting Access Management (cont)

• Resulting design, operations and control measures:
  – Sight distance
  – Geometric design features
  – Control strategies
  – Expectancy issues

Focus of Human Factors for Sighting

• Access management recognizes need for:
  – Stopping sight distance
  – Decision sight distance
  – Intersection sight distance
  – Pavement sight distance

• Also focuses on:
  – What – object height
  – Where – location, e.g., driveway, curbs, markings
Sight Distances for Access Management

- Stopping Sight Distance must be provided for safety everywhere
- Decision Sight Distance has been adopted by AMM for access management design, operations and control due to:
  - Complexity of conditions
  - Numerous conflicts present
  - Mix of traffic
  - High volumes
  - Moderate to high speeds
  - Heavy workload

### Decision Sight Distance Design Guidelines

<table>
<thead>
<tr>
<th>Avoidance Maneuver</th>
<th>A Stop on Rural Road</th>
<th>B Stop on Urban Road</th>
<th>C Speed Path/Direction Change on Rural Road</th>
<th>D Speed Path/Direction Change on Suburban Road</th>
<th>E Speed Path/Direction Change on Urban Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (s)</td>
<td>3.0 s</td>
<td>9.1 s</td>
<td>10.2–11.2 s</td>
<td>12.1–12.9 s</td>
<td>14.0–14.5 s</td>
</tr>
</tbody>
</table>

\[
d = \text{PRT}(V) + \text{MT} (V^2)
\]

\[
d = \text{PRT}(V)
\]

Source: NCHRP #600, p. 5-8
What Does Decision Sight Distance Work For?

- Handles more complexity
  - Compensates for unlimited expectancy
- Decision sight distance PRTs

<table>
<thead>
<tr>
<th></th>
<th>Rural</th>
<th>Suburban</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>To a stop</td>
<td>3.0s</td>
<td>6.0s</td>
<td>9.1s</td>
</tr>
<tr>
<td>For speed, path or</td>
<td>10.2s to 11.2s</td>
<td>12.1s to 12.9s</td>
<td>14.0s to 14.5s</td>
</tr>
<tr>
<td>direction change</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5A. Decision Sight Distance (English Units)

<table>
<thead>
<tr>
<th>Design Speed (mph)</th>
<th>Decision Sight Distance for Avoidable Maneuver, (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>25</td>
<td>180</td>
</tr>
<tr>
<td>30</td>
<td>220</td>
</tr>
<tr>
<td>35</td>
<td>275</td>
</tr>
<tr>
<td>40</td>
<td>330</td>
</tr>
<tr>
<td>45</td>
<td>395</td>
</tr>
<tr>
<td>50</td>
<td>465</td>
</tr>
<tr>
<td>55</td>
<td>535</td>
</tr>
<tr>
<td>60</td>
<td>610</td>
</tr>
<tr>
<td>65</td>
<td>695</td>
</tr>
<tr>
<td>70</td>
<td>780</td>
</tr>
<tr>
<td>75</td>
<td>875</td>
</tr>
<tr>
<td>80</td>
<td>970</td>
</tr>
</tbody>
</table>
Other Sight Distances for Access Management

- Pavement Sight Distance must be provided to see:
  - Pavement markings
  - Curb and lane location
  - Driveway entrances and entering vehicles
- Intersection Sight Distance provides estimates of gaps for:
  - Vehicles entering at driveways and unsignalized intersections
  - Crossing at left-turning lanes

Access points and entering vehicles hard to “perceive”
Important Visual Stimuli for Access Management

• The complexity, numerous conflicts and high workload where access management is applied add to strain on drivers
• Drivers must shift their vision to keep track of:
  – Traffic conditions
  – Local activities
  – Traffic control features
  – Highway geometric design
  – Pedestrians and bicycles
• This requires them to focus on objects, then shift to other objects or conditions

Access management facilities require highest visual work load of any transportation application

Information and conflicts continually change
### Eye Movement

- Drivers cannot see all objects in visual field clearly
- So, they scan the visual field; typically fix their attention about:
  - 100-200 ft at 30 mph
  - 120-495 ft at 55 mph
- Then, shift vision from right to left

<table>
<thead>
<tr>
<th>Eye Movement Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift to new position</td>
</tr>
<tr>
<td>Fix or focus on object</td>
</tr>
</tbody>
</table>

*Information outside of “tunnel,” i.e., immediate surrounding vehicles and conflicts, can be missed*

### Review of Critical Human Factors for Access Management

- Must review some human factors to give perspective of their application to access management
Cone of Vision

- Recall, drivers lose ability to see objects clearly as angle from axis of focus increases
  - 3-5° cone – best vision
    - Can see details of shape, size, color, texture, etc.
  - 10° cone – clear vision
    - Critical traffic control devices are in this cone
  - 20° cone – satisfactory vision
    - Regulatory and warning traffic control devices must be in this cone
  - ~90° cone – peripheral vision
    - Of limited use with access management because of speed, volume, and complexity on arterials

* Tends toward “tunnel vision” on arterials due to complexity, conflicts and speed

---

Cone of Vision with Respect to Speed

- Lose peripheral vision as speed increases
- Outside of cone of vision, objects are blurred, unless the driver focuses on one object

* Contributes to tunnel vision; loses track of peds, bicycles and entering vehicles
Required Cognitive Information Processing

• Complexity with access management requires:
  – Drivers to employ static visual acuity, dynamic visual acuity, contrast sensitivity and peripheral field viewing
• Cognitive information processing integrates visual information

  * More analytical processing than any other; increasing the required PRT

Static Visual Acuity for Access Management

• The ability to see stationary details, such as;
  – Details in signs
  – Markings
  – Geometric features, curb cuts, driveways

  * More information than usual must be observed simultaneously; curb cuts, driveways, pavement markings, regulatory and warning signs, even guide signs

  ** Must resolve geometrics signing, controls and alignment into desired "path"
Numerous “static” items drivers must take account

Dynamic Visual Acuity

• The ability to resolve details of moving objects, such as;
  – Reading signs
  – Seeing driveways and entering vehicle
  – Observing pedestrians and crossings
  – Determining movement of other vehicles
  – Making left-turns through opposing traffic stream
  – Only thing not moving in the visual field is the hood ornament on the vehicle

* Extremely critical especially for left-turns. More vehicle paths to track
Contrast Sensitivity

- Ability to analyze contrast information, to see patterns in visual field
  - Hazard perception-reaction time increases significantly with loss in contrast sensitivity
  - Contrast sensitivity extremely important for night time driving
  - Older drivers have less contrast sensitivity than younger drivers
    - Requires higher levels of contrast
    - More time to adjust to conditions at dark

*Pedestrian crossings & driveways on arterials often have inadequate contrast. Mostly needed to see objects and conditions other than vehicles.*
**Glare Sensitivity**

- Level of brightness in visual field greater than illumination that driver’s eyes are accustomed
  - Reduces contrast sensitivity
  - Reduces static visual acuity
- Sources of glare include roadside illumination, traffic signals, on-coming headlights, sun positioning, and many others

* Sources of glare on arterials are difficult to control. Most is “discomfort glare”

**Depth Perception**

- The ability to determine distance to and relative depths of objects
  - Increasingly lost to elderly drivers, from hardening optic lens and weakened ocular muscle
  - Depth perception helps assess:
    - Speed of on-coming vehicles
    - Gaps between vehicles
    - Distance to roadside features, like driveways

* Critical ability for making left-turns and crossing through approaching traffic safely. Major problem for the elderly.*
Night Time Vision Impacts for Access Management

• All measures of vision deteriorate at lower levels of illumination
  – Lower levels of illumination are a major problem for elderly
  – Drivers over 75 need 32-times as much light as needed at 25

* Compounded by glare for elderly from illumination provided; mostly low beams for vehicles

Night Time Vision Impacts for Access Management (cont)

• Drivers see by silhouette and reverse silhouette at night
  – Silhouette - Seeing dark objects against a dark background of uniform brightness of pavement and surroundings
  – Reverse silhouette - bright objects against dark background, as illuminated with street lighting
• Brightness of pavement and surrounds provided by illumination to give uniformity, adequate brightness and no glare

* Difficulty seeing pedestrians and objects in roadway at night. Normal ability to be seen is expected by pedestrians. "I can see you - you can see me."
Eye Viewing Mechanism are Somewhat Different for Day and Night

- Uses different set of muscles
- Transition to day or transition to night takes time
- At twilight, objects seem farther away
  - Objects and background blend and blur

* Converts normal vision to near-sighted in dim light, often time when commute occurs

Source: H.W. Leibowitz, Pennsylvania State University, and D.A. Owens, MIT

Eyes Short Focus in Dark

- In dark, eyes relax with limited visual stimulations
  - Focus as little as 6-ft away
- More distant objects are somewhat blurred

* Complexity and detail with Access Managed Facilities adds to danger

Source: H.W. Leibowitz, Pennsylvania State University, and D.A. Owens, MIT


# Summary of Important Visual Functions

<table>
<thead>
<tr>
<th>Visual Function</th>
<th>Definition</th>
<th>Potential Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static Visual Acuity</td>
<td>Ability to see detail</td>
<td>Visual clutter along arterials</td>
</tr>
<tr>
<td>Dynamic Visual Acuity</td>
<td>Ability to see moving object detail</td>
<td>Assessing speeds and movement of other vehicles</td>
</tr>
<tr>
<td>Contrast Sensitivity</td>
<td>Ability to analyze contrast and see patterns</td>
<td>Hazard perception time increases with contrast loss</td>
</tr>
<tr>
<td>Glare Sensitivity</td>
<td>Level of brightness in visual field greater than ambient condition</td>
<td>Results in losses in static visual acuity and contrast sensitivity</td>
</tr>
<tr>
<td>Depth Perception</td>
<td>Ability to determine distance and relative object depth</td>
<td>Loss in depth perception impacts ability to assess speeds, gaps, and distance to objects</td>
</tr>
<tr>
<td>Night-time Vision</td>
<td>All vision measures are diminished with less illumination</td>
<td>Drivers must see in silhouette or reverse silhouette. Elderly in 70s need 32 times as much light as someone in their 20s</td>
</tr>
</tbody>
</table>

- New LED based lighting efficient but not effective at higher speeds
- Solution to problems – street lighting at potential problem locations

## Review Perception-Reaction Times

- Design PRTs
  - Operation/control – 1.0 sec
  - Design – 2.5 sec
- Design for elderly driver – 3.0-5.0 sec
  - AASHTO recommendation to provide more analysis and decision time
- Research has shown
  - Alerted 85% PRT – 0.9 sec, use 1.0 sec
  - Surprise 85% PRT – 1.3 sec, use 1.5 sec
    - *Signal head around curve or hidden by trees or underpasses*

* Also problematic without signal coordination. Signal heads hidden by traffic, especially trucks and buses. Problem for the elderly.
Cognitive and Psychological Functions

- The mental/psychological tasks of safe driving on access managed arterials depend on:
  - Driver’s familiarity
  - Traffic conditions
  - Weather
- Important functions include:
  - Attention
  - Working memory capacity
  - Decision-making
  - Navigation
  - Expectancy

*Multitasking at the extreme

Perception-Reaction Times Considering Complexity and Driver State

- Research has shown complexity and driver’s state impact on perception-reaction times

<table>
<thead>
<tr>
<th>Driver’s State</th>
<th>Complexity</th>
<th>Perception-Reaction Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Volume Road</td>
<td>Alert</td>
<td>Low</td>
</tr>
<tr>
<td>Two-Lane Primary Rural Road</td>
<td>Fatigued</td>
<td>Moderate</td>
</tr>
<tr>
<td>Urban Arterial</td>
<td>Alert</td>
<td>High</td>
</tr>
<tr>
<td>Rural Freeway</td>
<td>Fatigued</td>
<td>Low</td>
</tr>
<tr>
<td>Urban Freeway</td>
<td>Fatigued</td>
<td>High</td>
</tr>
</tbody>
</table>

*Arterial requires “alert” driver; other research shows longer PRT’s
“Attention” on Access Managed Arterials

- Attention to driving task important to safe driving
  - 25-50% of crashes estimated are result of inattention
- Selective attention – selection of most critical information out of mass of information presented on arterials
  - Selection and appropriate use are basic to safe driving
  - Elderly takes longer to process and more difficulty selecting critical information
- Divided attention – taking information from more than one source, and performing more than one task, at once
  - Must steer, brake, select safe path, navigate, process traffic control information, etc., at same time

* Arterials with high volumes, high speeds, numerous conflicts, local land use activities, present greatest challenge

Perception-Response Time by Age and Day / Night Conditions for Arterials

<table>
<thead>
<tr>
<th>Age Groups</th>
<th>50th</th>
<th>85th</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day</td>
<td>Night</td>
</tr>
<tr>
<td>20 - 40</td>
<td>2.0</td>
<td>2.8</td>
</tr>
<tr>
<td>65 - 69</td>
<td>2.8</td>
<td>2.4</td>
</tr>
<tr>
<td>70+</td>
<td>3.4</td>
<td>2.8</td>
</tr>
</tbody>
</table>


* Observed PRT’s on arterials demonstrate complexity and difficulty

Source: AMAG, Ch. 23
**Age Distribution of Perception-Reaction Time Near Driveways – A Simulator Study**

<table>
<thead>
<tr>
<th>Maneuver</th>
<th>PRT &lt; 65 (sec)</th>
<th>PRT ≥ 65 (sec)</th>
<th>85th Percentile &lt; 65 (sec)</th>
<th>85th Percentile ≥ 65 (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waiting Vehicle</td>
<td>3.2</td>
<td>3.1</td>
<td>4.5</td>
<td>3.9</td>
</tr>
<tr>
<td>Right-Turn Out</td>
<td>4.0</td>
<td>2.3</td>
<td>6.6</td>
<td>3.4</td>
</tr>
<tr>
<td>Right-Turn In</td>
<td>4.0</td>
<td>3.3</td>
<td>6.3</td>
<td>4.6</td>
</tr>
<tr>
<td>Left-Turn Out</td>
<td>2.1</td>
<td>1.4</td>
<td>2.9</td>
<td>2.2</td>
</tr>
<tr>
<td>Left-Turn In</td>
<td>2.2</td>
<td>1.8</td>
<td>2.9</td>
<td>2.2</td>
</tr>
<tr>
<td>Total all Maneuvers</td>
<td>2.9</td>
<td>2.2</td>
<td>4.4</td>
<td>3.3</td>
</tr>
<tr>
<td>Only Right-Turn Maneuvers</td>
<td>4.0</td>
<td>2.8</td>
<td>6.6</td>
<td>4.8</td>
</tr>
<tr>
<td>Only Left-Turn Maneuvers</td>
<td>2.1</td>
<td>1.6</td>
<td>2.9</td>
<td>2.2</td>
</tr>
</tbody>
</table>

*Nearly all 85% PRT’s exceed 2.5 sec*

**Working Memory Capacity**

- The mental cognitive ability to process new information while storing and analyzing known information
  - Working memory capacity – amount of information that a driver can receive and process at one time
  - Rule of thumb – estimated average workload of 7 items as typical working memory capacity
  - Working memory capacity for elderly is less

Source: AMAG, Ch. 23
Working Memory Capacity (cont)

- Response of drivers to significant increases volumes, congestion, signs, traffic control, speed difference, conflicts, etc., is to pay less attention to periphery or less important targets
- This is perceptual narrowing or “tunnel vision”
  - As volumes & speeds increase, visual field size is reduced
  - Less immediate targets, such as pedestrians & bicyclists, receive less attention

*Solution – strive for:
  - Simple designs – medians
  - Uniform speeds – coordinated signal timing
  - Fewer conflicts – fewer left-turns in controlled median openings
**Decision-Making**

- Application of rules and personal values to design geometrics and traffic control
  - More difficult as conditions become more complex, speeds increase, volumes increase, greater driveway density
  - Elderly require more decision time

*Solution*

- Simplify design, eliminate conflicts, use medians, reduce number of left-turns, implement coordinated signal timing

**Speed and Gap Analysis**

- Drivers and pedestrians have difficulty estimating approaching vehicle speeds and safe gaps in traffic
  - Elderly drivers have reduced ability to detect and analyze angular movement
  - Older drivers accept gaps for left-turns or crossing based on the “distance” length of gap, not “time” length
  - Analysis of crash data for intersections and midblock locations has shown 70% are left-turn related

*Solution*

- “Protected” left-turn phases at signalized intersections
- Control & eliminate left-turning movements with medians
- Do not allow full intersection movements midblock
Navigate or Wayfinding

• The ability to analyze location specific information and navigate to desire destination
  – Introduces speed variability when drivers read maps or look for street names

* Solution
  • Identify upcoming streets with street name signs midblock

Mid-block upcoming street signs
Driver Expectancy

• Driver expectations arise from cognitive analysis of roadway features, layout, environmental information and traffic control
  – Drivers expect a particular operation or physical situation based on formal and informal information presented
    • Formal information – traffic control devices, geometric design features, layout of roadway
    • Informal information – roadside features and land use features, such as, fences, brush lines, information signs
  – Expectations develop based on experience, training and habit

Expectancy Issues

• A variety of situations can create expectancy problems
  – Drivers use misleading informal information
  – Formal information is not proper or gives confusing mixed messages
Potential Expectancy Problem
Right-Turn Lane with Multiple Entering Driveways
Potential Expectancy Problem
Right-Turn Lane is not Separated from Through Lane

Potential Expectancy Problem
Separated Bike Lane is lost at Intersection or Driveway
Expectancy Solutions

• Much greater potential for expectancy problems with access management
  – Very complex conditions for geometrics, access points (driveways), traffic volumes, speeds
  – Potential solutions:
    • Simplify designs
    • Limit conflicts
    • Control speeds
    • Attempt to control speed variations

Conflicts

• Primary objective of Access Management is to control or eliminate conflicts
Conflicts for Access Management

- Traffic conflicts occur where vehicle paths cross

Conflicts for Access Management

Queuing

Weaving

Peds

Bikes
**Conflicts at a Full Intersection**

Total vehicular conflicts at a full intersection

**Conflicts with Pedestrians at Intersections**

Pedestrian-Vehicular Conflicts
Non-Traversable Median Reduces Conflict Points to a Minimum

Vehicular Conflicts

<table>
<thead>
<tr>
<th>Vehicular Conflict Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Crossing-Thru</td>
</tr>
<tr>
<td>0 Crossing-Turn</td>
</tr>
<tr>
<td>Δ 2 Diverge</td>
</tr>
<tr>
<td>2 Merge</td>
</tr>
<tr>
<td><strong>4 Total</strong></td>
</tr>
</tbody>
</table>

Non-Traversable Median Reduces Conflict Points to a Minimum & Provides Pedestrian Refuge

Pedestrian-Vehicular Conflicts

<table>
<thead>
<tr>
<th>Pedestrian Conflict Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 Turning</td>
</tr>
<tr>
<td>Δ 4 Crossing</td>
</tr>
<tr>
<td><strong>12 Total</strong></td>
</tr>
</tbody>
</table>
Conflicts for Left-Turn Ingress from One Direction Only

Vehicular Conflict Points
- 1 Crossing
- 3 Diverge
- 3 Merge
7 Total

Conflicts for Left-Turn Egress from One Approach Only

Vehicular Conflict Points
- 0 Crossing-Thru
- 1 Crossing-Turn
- 3 Diverge
- 3 Merge
7 Total

Vehicular Conflict Points
- 0 Crossing-Thru
- 1 Crossing-Turn
- 2 Diverge
- 1 Merge
4 Total
Conflicts for Left-Turn Ingress from Both Directions

Controlling Speeds on Arterials

- Conflicting expectancy issues for drivers can be improved on arterials by:
  - Controlling speeds
  - Limiting speed variability

* Methods to achieve these are:
  - Posting reasonable speed limits
  - Enforcement
  - Coordinated signal timing
Signalized Intersection Spacing for Progression

* Provides more uniform speeds and operations

Source: AMAG

Signalized Intersection Timing on One-Way Streets

Signal Timing for Progression on One-Way Streets

Source: AMAG
Signalized Intersection
Optimal Timing on Two-Way Streets

Optimal signal timing for progression can be achieved with equal block lengths.

Time space diagram for ½ mile spacing with 120 sec cycle

Recommended Practice for Human Factors in Access Management

• Stopping sight distance (SSD) should only be used to assess safety of an individual vehicle operating on roadway
  – SSD is distance required to stop from speed to one clearly discernible object in roadway
  – SSD should be provided to all driveways where entering vehicles are the hazard. Object height could range from 2-ft to 3.5-ft, depending on conditions
  – SSD may be adapted when conditions warrant to longer PRTs
    • Some have suggested 5-sec for elderly PRT

Source: AMAG
Recommended Practice for Human Factors in Access Management (cont)

- Decision sight distance (DSD) is adopted for most sight distance decisions in access management because:
  - Higher volumes
  - Moderate to high speeds
  - Numerous conflicts
  - Complexity of environment
  - Mix of familiarity of drivers
  - Impact of roadside conditions
  - Presence of peds and bikes
  - Longer perception-reaction and decision times required

- "DSD to a stop" would typically be applicable to:
  - Two-lane two-way facilities, or
  - Three-lane facilities with a two-way left-turn lane in the middle
  - May be used in suburban areas

- "DSD for a speed path or direction change" would be applicable for multilane facilities

Source: AMAG
**Recommended Practice for Human Factors in Access Management (cont)**

- A preview sight distance should be employed where minor changes in geometrics, control or access are introduced
  - Typical preview time – 5 sec
  - Preview time for complex, high speed conditions – 7 sec

*These exceed most of the simulated PRT’s for various maneuvers*

Source: AMAG

---

**Recommended Practice for Human Factors in Access Management (cont)**

- Standard eye height and object heights are as:

<table>
<thead>
<tr>
<th>Height Type</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye height</td>
<td>3.5-ft</td>
</tr>
<tr>
<td>Object height (SSD AASHTO)</td>
<td>2.0-ft</td>
</tr>
<tr>
<td>Object height (SSD desirable)</td>
<td>0.5-ft</td>
</tr>
<tr>
<td>Object height (PSD &amp; ISD)</td>
<td>3.5-ft</td>
</tr>
</tbody>
</table>

- Object heights representing relevant conditions should be used:
  - Curb cuts – 0.5-ft
  - Driveways and turn lanes – 0.0-ft
  - Queued vehicle tail lights – 2.0-ft
  - Pavement markings – 0.0-ft
  - Signs – 5.0 ft, no pedestrians; 7.0 ft, urban

- Truck eye height established by AASHTO at 8.0-ft should be used as required

Source: AMAG
Recommended Practice for Human Factors in Access Management (cont)

- Concept of “positive guidance” should be implemented on arterials for access management
  - High driver workload results from:
    - Numerous conflicts
    - High speeds
    - Visual clutter from roadside activities
  - “Positive guidance” assures safety with information presented with:
    - Uniformity
    - Consistency
    - Unambiguously
    - Adequate conspicuity
    - Paced and placed as needed
    - Primacy for operations, regulatory and warning
Driver parked at gore “now what”? No arrow or signing

Important object heights; not just 2-ft
Clear indication “DO NOT ENTER” left turn ingress lane

Conflicting vehicles from left-turn ingress
Recommended Practice for Human Factors in Access Management (cont)

• Clear indication of critical access management sites should be made
  – Geometric features and traffic control locations for access management should be signed and/or marked, such as;
    • Major driveways
    • Pedestrian crossings
    • Median openings
  – Pavement arrow markings should be used to designate lane assignment on multilane driveways and turn lanes
  – Directional median openings should be signed and marked with lane arrows at their entrance or exit
  – Lane lines and arrows should always be provided for turn lanes

Source: AMAG

Well laid out access management site
Recommended Practice for Human Factors in Access Management (cont)

• Interchanges have the extreme conditions experienced on arterials:
  – Traffic volumes
  – Conflict level
  – Mixture of local and through traffic
  – Various vehicle sizes
  – Wide range of familiarity
  – Interchange ramp location and design
• Drivers are in transition from (or to) high speed controlled access driving to reduced speeds with significant access
• Decision sight distance for suburban or urban conditions should be used
  – Conditions are not “rural” even in rural areas

Source: AMAG

Access Management near Interchanges

• Areas near Interchange are often unique and different
  – Volumes can be high
  – Conflicts different and numerous
  – Speeds variable
  – Unfamiliar drivers/vehicles
    • Example: Displaced Left Turn Interchange
  – Left turn on-ramp traffic is displaced, crosses over to right of oncoming traffic (opposite to normal traffic orientation)
Recommended Practice for Human Factors in Access Management (cont)

• Medians have proven their worth as a valuable access management strategy for improved operations and safety
  – Medians reduce conflicts by nearly half and can eliminate severe conflicts, i.e., left-turning movements
    • Two-way left-turn lane reduces severity of left-turns marginally, but don’t eliminate them
  – Medians reduce visual field by half, eliminating all oncoming roadway area
    • Added curb on left introduces hazard that must be well designed
  – Presence of median allows driveway spacing to be reduced by half by eliminating left-turn operations and visual blocks

Source: AMAG