Driveways, Signals, and Roundabouts: Oh My!

Decreasing Budgets are Challenged by:
- Increasing traffic volumes
- Unacceptable accident rates & loss of life
- Increasing roadway construction costs
- Social, economic, environmental impacts
- Increasing maintenance costs

Why Access Mgmt Important Today?
- It supports sustainability
- It is cost effective
- It preserves the function of roadways
- It reduces accidents
- It improves capacity

What is Access Management
- Managing each point of access to a road.
- Driveways and intersections
- Interchanges and interchange crossroads

Goals
- Smoother traffic flow
- Better travel times
- Less stressful drive
- Fewer accidents

SAFETY is a big component of Access Management
In its simplest form, Access Management is Conflict Management
• If you reduce the rate and severity of conflicts the motorist encounters, you will reduce the crash rate, the injury rate and increase the smooth flow of traffic.

Roadways are the Most Dangerous Public Facilities on the Face of the Earth
• In the US, about 800 people are killed each week
• 16,000 Crashes each day
• 6,500 Injuries each day

• The leading cause of death of a child, age 3 to 14 is a traffic crash.
• 32 fatal week, >3,000 inj.

If two jumbo jets crashed weekly
Something would be done about it.

At the current U.S. crash rate, one child of every 90 born today will die violently in a motor vehicle crash. 70 out of every 100 will be injured at some point in their lives.

Idaho Fatal Rates Higher

<table>
<thead>
<tr>
<th>Year</th>
<th>Fatalities</th>
<th>Total Vehicle Miles Traveled (Millions)</th>
<th>Fatalities Per 100 Million Vehicle Miles Traveled</th>
<th>Total Population</th>
<th>Fatalities Per 100,000 Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>Idaho</td>
<td>252</td>
<td>1.60</td>
<td>1,866,145</td>
<td>16.84</td>
</tr>
<tr>
<td></td>
<td>US</td>
<td>41,259</td>
<td>1.26</td>
<td>301,200,332</td>
<td>13.69</td>
</tr>
<tr>
<td></td>
<td>Best State*</td>
<td>0.79</td>
<td>6.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>Idaho</td>
<td>232</td>
<td>1.52</td>
<td>1,521,816</td>
<td>15.22</td>
</tr>
<tr>
<td></td>
<td>US</td>
<td>37,261</td>
<td>1.25</td>
<td>301,630,724</td>
<td>12.25</td>
</tr>
<tr>
<td></td>
<td>Best State*</td>
<td>0.67</td>
<td>5.59</td>
<td></td>
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</tr>
</tbody>
</table>

Per population: OR = 10.98  WA = 7.96  Utah= 10.05

Fatal Rates, International Comparison
• UK, 6.1 per 100,000 population.
• Japan, 7.0 per 100,000
• Australia, 8.2 per 100,000
• US, 13.69 in 2007
Managing road design

- Do we design for the vehicle?
  - Size, stopping distance

- Or for the driver?
  - Reaction time, speeding, inattentiveness

If no human errors, there should only be 7% of the current crash history
human error contributes to the other 93%

- Idaho crashes would drop from 26,000 to 1,800
- Injuries drop from 13,000 to 900.
- This will not happen.

Driver Work-Load is a Rate

- Speed = increases work load rate
- Conflict frequency = increases work load rate
- High work load = higher crash rate

AM Strategy: Driver Work-Load can be modified by good planning and design

There is no such thing as a Safe Access.

As the number of access points per mile increase, so does the frequency of total highway collisions.
The crash rate also increases. Each access = 4%

Access Related crashes at driveways and intersections represent over 55 percent of all traffic crashes. 65% to 75% in urban areas
More than 3.5 million access related crashes annually.
Over 3,500 access related injuries each day.
Every Access Point is Fundamentally a Safety Problem

• Issuing an access permit is a decision to diminish public safety and roadway function.

When access principles are applied to a specific Corridor

• Crashes reduced by 30 to 60 percent
• Capacity increased by 20 to 40 percent

Goals of Access Management

• Separate Turning Vehicles from through traffic

If a roadway program or project can reduce the crash rate from 12.5 to 3.5 per MVM

<table>
<thead>
<tr>
<th></th>
<th>Top Highway</th>
<th>Bottom Highway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Conflict points</td>
<td>1,641</td>
<td>324</td>
</tr>
<tr>
<td>Number of Crashes Expected in 5 years</td>
<td>2,435</td>
<td>680</td>
</tr>
<tr>
<td>Cost of Crashes in 5 years</td>
<td>$ 26.5 M</td>
<td>$ 7.5 M</td>
</tr>
<tr>
<td>Average Speed</td>
<td>25 MPH</td>
<td>44 MPH</td>
</tr>
</tbody>
</table>

Source: Florida DOT
Goals of Access Management

• Limit access conflicts

Source: Florida DOT

Goals of Access Management

• Keep private access off arterials

Source: Florida DOT

Goals of Access Management

• Safer residential access

Source: Florida DOT

New Flag lots in Virginia

TURN LANES

• Are critical for both capacity and public safety

Driveways impact flow and conflict
Busy Intersections without turn lanes impact Flow and Safety

Speed differential is a conflict

When turn lanes are too short, they impact flow and safety

Relative crash involvement rate ratios in comparing speed differentials over 10 mph for arterial roads

Relative Crash Involvement Rate Ratios

<table>
<thead>
<tr>
<th>Speed Differential</th>
<th>Crash Involvement Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>3.3</td>
</tr>
<tr>
<td>30</td>
<td>23</td>
</tr>
<tr>
<td>36</td>
<td>90</td>
</tr>
</tbody>
</table>

If the car following is going 45, and the car turning is at 15, it is 23 times more likely that a crash will occur than if the car turning was going 35.

No Right Turn lane reduces signal capacity, increases delay

No left turn has greatest impact
Adding left turn bays reduced the crash rate (Vancouver BC)

Adding painted left turn compared to raised left turn

New Boise subdivision without right-turn lane

Goal – Good Turn Lanes

Lack of driveway throat
Using Medians to Improve Operation and Safety

Raised or Painted Median?
• Generally, >25,000 daily means higher collision rate if a painted median.
• Painted medians are cheaper
• Paint does not control left turns
• Painted medians do not allow signs
• Raised medians have lower crash rates

Overlapping Left-Turn Movements on TW LTL

TW LTL has volume limits.
Median Types

- Painted medians often need ‘short’ medians (for left turn bays)

Median eliminates all left turns and the related problems

3/4 th opening / no left out

3/4 th opening / no left out

U-turns are safer

18% total crash rate reduction
27% injury fatality crash rate reduction

U-turns are often much safer than direct left turns, especially on high volume, high speed, or congested roadways.

Full movement driveways increase bike and ped hazards

Source: Florida DOT

Source: Oregon DOT
Medians reduce bike and ped conflicts

Memorial Drive, Atlanta; 35-55K ADT

- 37% drop in Total Accident Rate
- 48% drop in Injury Rate
- 59% drop in Mid-block Injury Rate
- 40% drop in Intersection Injury Rate
- Project has saved at least 15 lives and has prevented thousands of accidents since completion.

Post Project – Memorial Drive

Traffic Signals and Spacing
Traffic signals produce and greatest amount of Conflict and Workload

Signals create rear-end conflicts

Similar Capacity
- 4 lane divided roadway with 1/2 mile signal spacing
- 6 lane divided roadway with 1/4 mile signal spacing

Effects of minimum spacing requirements between signalized intersections

<table>
<thead>
<tr>
<th>Signals per Mile</th>
<th>Accidents per Million Vehicle-Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2</td>
<td>2.6 - 3.8</td>
</tr>
<tr>
<td>2.01 - 4.00</td>
<td>3.9 - 8.2</td>
</tr>
<tr>
<td>4.01 - 6.00</td>
<td>4.8 - 8.7</td>
</tr>
<tr>
<td>&gt; 6</td>
<td>6.0 - 9.5</td>
</tr>
</tbody>
</table>

from Gluck et al., NCHRP Report 420

Capacity Benefits

Source: Florida DOT
Business Benefits

- Commercial businesses depend on efficient transportation services.
- Retail market areas are determined in part by travel time.
- Manufacturing, Industry, services, and offices are best served when there is safe and efficient roadways available for employees and goods.

Regional Economy and Growth is

- Good jobs, good paychecks
- Local industries that export
- Freight mobility and reliability
- Labor mobility (access to jobs)
- Tourism

- Retail sales are a product of employment not driveways

Employment is #1 economic need

Industrial Businesses are Very Important

Business Market Area Shrinks as Arterial Speed is reduced by congestion and more traffic signals.

Assuming a 20 minute trip, dropping from average speed of 35 mph to 25 means over 50% reduction in market area.

Source: Florida DOT
**Why Roundabouts**

Why are they replacing traffic signals

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**Without Exception, Traffic Signals are hazardous**

- They may be less hazardous than the current situation
- They are not a safety enhancement.
- They allow safer left turns

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**Relative crash frequency**

- **RURAL intersections**
  - 0.7 per year unsignalized
  - 4.8 per year if signalized
- **URBAN intersections**
  - 1.4 per year unsignalized
  - 6.2 per year if signalized

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**Signals Increase Accidents**

- 88 urban intersections
- 28 rural intersections

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**“Jeopardy” – What is IT?**

- It lowers the intersection crash rate by over 50%
- It lowers the intersection injury rate by 60 to 90%
- It lowers the fatal rate by 90% or more.
The Modern Roundabout
As A Signal Alternative

Roundabouts replaces traffic signals in Golden and Avon CO

Avon, Colorado

Crash reductions - Golden CO (3 years before & after)
• Commercial strip, 4 + TW LTL
• 60% drop in Crashes (mvm)
• 94% drop in injuries
  • Only 1 vehicular injury crash in 3 years (previous 3 years were 31)
  • No Pedestrian crashes

La Jolla before

La Jolla - After, with 5 RBTs
• Bend Oregon, pop 65,000 has 23 single lane roundabouts
• Carmel Indiana, Pop 70,000, has over 50 roundabouts
• Colorado Spgs CO pop 450k has 44+ roundabouts
• Over 220 in Colorado

NYSDOT - “Signal Policy”
• “When the analysis shows that a roundabout is feasible, it should be considered the Department’s preferred alternative due to the proven substantial safety benefits and other operational benefits.”
Many states are replacing isolated rural signals with roundabouts

Increased Traffic Capacity

- Will typically outperform a traffic signal in terms of delays and queues

Average Delay for Roundabout

Provides new alternatives (Kansas)
Hi-speed rural in Lafayette, Louisiana
Ten more urban ones in design

Wisconsin, arterial junction
(Mark Johnson MTJ Engineering)

Access Control and Roundabouts
• Roundabouts with non-traversable medians between – the best AM solution.
• Low conflict
• Low delays
• Low expense

Access Management Planning
• A plan for a specific segment
• Joint effort to set function and purpose
• Determine performance measures
  • Safety, capacity, efficiency
• Level of allowable private access
• Locations of public intersections
• Final joint agreement for all access permitting.

US 20/26 Preservation Study
What will SH 44 look like after 20 years of growth?

Draft network to support employment, residential, and airport growth

Fairview, W of Orchard, widening, more capacity and managed access.

Source: Parametrix
Draft Concept for a Portion of Fairview

Source: Parametric

Federal Highway Administration
Office of Operations Washington, DC
www.ops.fhwa.dot.gov/access_management

CD with report and movie is available:
Neil Spiller at FHWA
Neil.Spiller@dot.gov

COMPASS has prepared a good toolkit for everyone’s use

Access Management Toolkit
Prepared by Community Planning Association of Southwest Idaho

CD with report and movie is available:
Neil Spiller at FHWA
Neil.Spiller@dot.gov

Movie from the Insurance Institute for Highway Safety

Questions
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US 20/26 from I-84 to Eagle Road (15 mi)
• Crash History (January 1999 - July 2005)
  • Total Crashes: 500
  • Fatal Crashes: 8
  • Injury Crashes: 230
  • Access Related Crashes: 338 (67%)
  • 73% of Injury Crashes were Access Related
  • 62% of Fatal Crashes were Access Related
Site Design and Access Control

Why is On-Site Sight Distance Important?

- Safety of vehicles leaving driveway
- Slows traffic exiting driveway
- Can cause delays for exiting traffic and on-site stacking problems
- Safety of pedestrians and bicyclists

TRB National Roundabout Conference
Next: May 2011, Carmel Indiana

For Previous conference materials go to
www.teachamerica.com/roundabouts
/ra_conference.htm
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