Driveways, Signals, and Roundabouts: Oh My!

COMPASS
Educational Series
March 10, 2010

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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

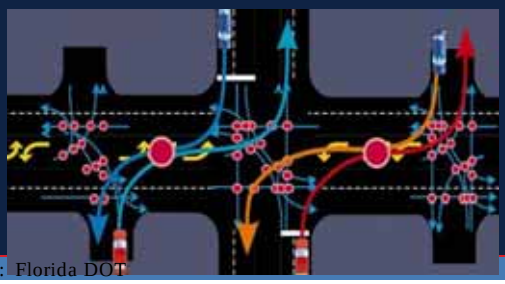
Goals

- 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.



7 Source: Florida DOT

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.

From AllState Insurance

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.

AASHTO Strategic Highway Safety Plan, December 2004

Idaho Fatal Rates Higher

Year		Fatalities	Total Vehicle Miles Traveled (Millions)	Fatalities Per 100 Million Vehicle Miles Traveled	Total Population	Fatalities Per 100,000 Population
2007	Idaho	252	15,782	1.60	1,496,145	16.84
	US	41,259	3,032,399	1.36	301,290,332	13.69
	Best State*			0.79		6.55
2008	Idaho	232	15,251	1.52	1,523,816	15.22
	US	37,261	2,973,509	1.25	304,059,724	12.25
	Best State*			0.67		5.59

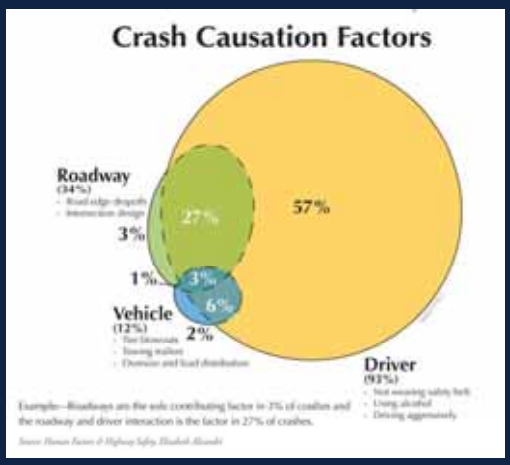
Per population: OR = 10.98 WA = 7.96 Utah = 10.05

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



Minnesota DOT

- 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

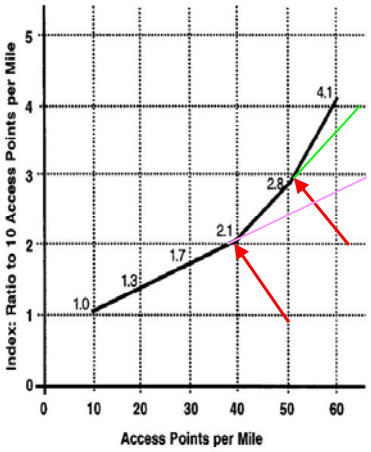
- Access Related crashes at driveways and intersections represent over **55** percent of all traffic crashes. 65% to 75% in urban areas
- More than 3.5 million access related crashes annually.
- Over 3,500 access related injuries each day.

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%

NCHRP 420



Source: Estimated from Various Sources

Figure 15. Composite accident rate indices.

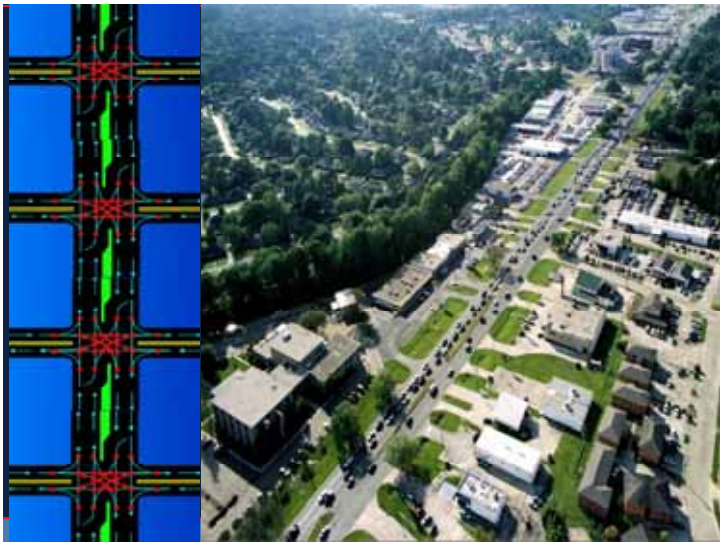
Every Access Point is Fundamentally a Safety Problem

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

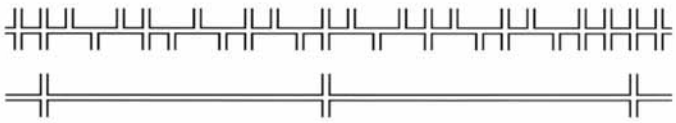
When access principles are applied to a specific Corridor

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

Fairview



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



For a Typical 3 Mile Section of 4 Lanes at 37,000 daily traffic	Top Highway	Bottom Highway
Number of Conflict points	1,641	324
Number of Crashes Expected in 5 years	2,435	680
Cost of Crashes in 5 years	$ 26.5 M	$ 7.5 M
Average Speed	25 MPH	44 MPH

3.5 vs 12.5 mvm

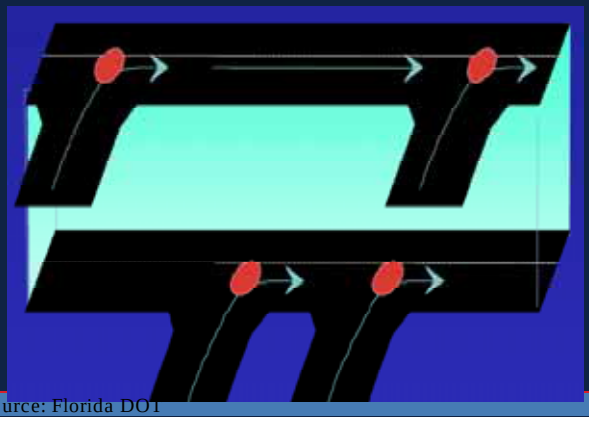
Goals of Access Management

- Separate Turning Vehicles from through traffic

Source: Florida DOT

Goals of Access Management

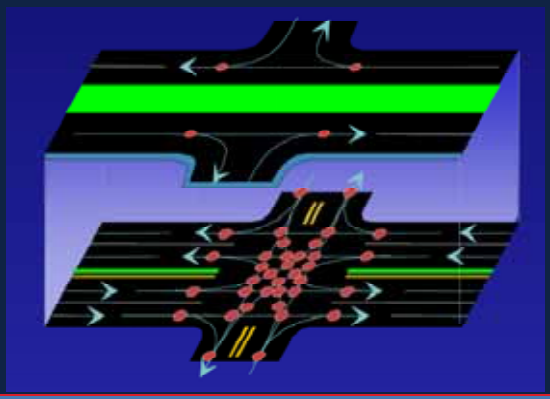
- Separate conflict points



Source: Florida DOT

Goals of Access Management

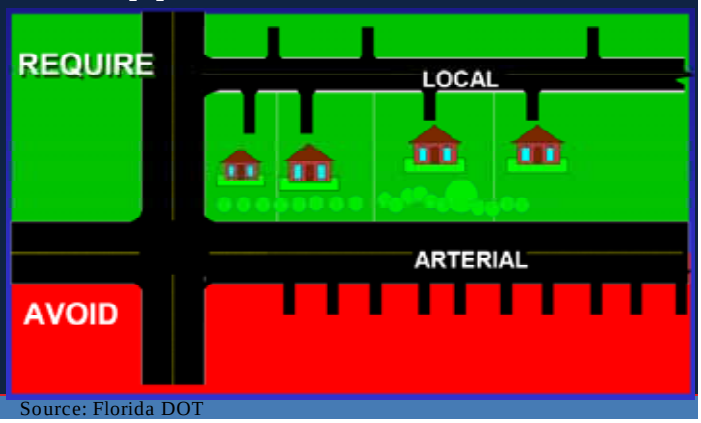
- Limit access conflicts



Source: Florida DOT

Goals of Access Management

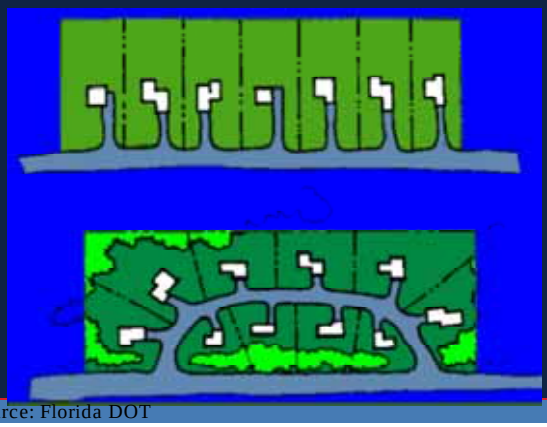
- Keep private access off arterials



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

Relative crash involvement rate ratios

in comparing speed differentials over 10 mph for arterial roads

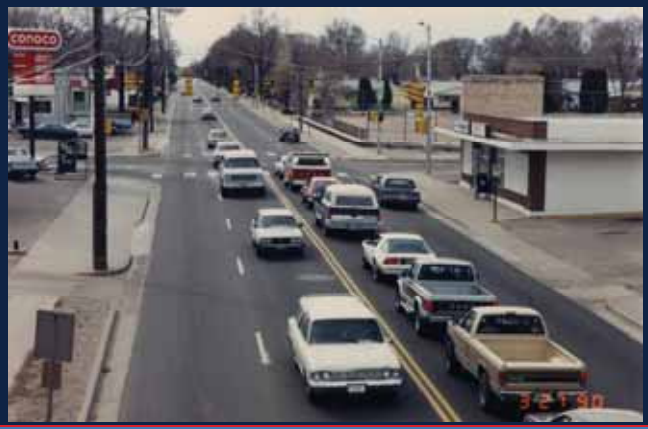
Solomon: 1964
Bureau of Public Roads
Accidents on Main Rural Highways related to speed

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.

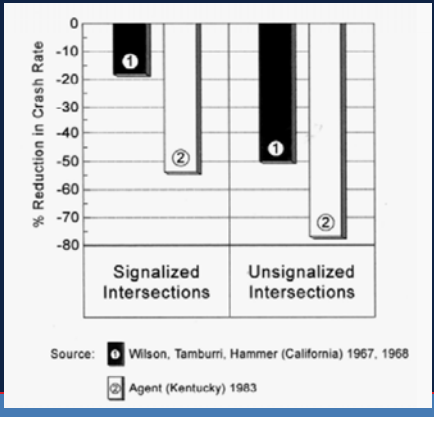
When turn lanes are too short, they impact flow and safety

No Right Turn lane reduces signal capacity, increases delay

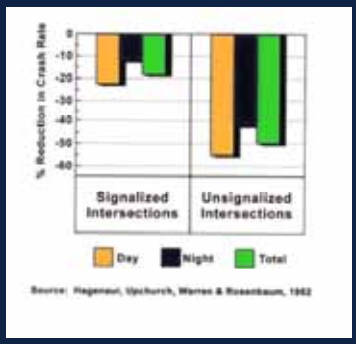
No left turn has greatest impact



How adding a left turn bay reduced the crash rate (Kentucky, California)



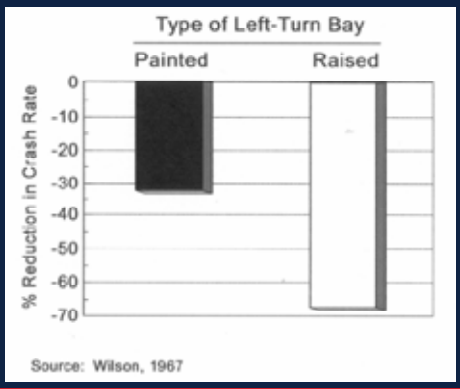
Adding left turn bays reduced the crash rate (Vancouver BC)



Vancouver, B.C.

Left-Turn Bays
- Increase Capacity 20% or more
- Decrease Crash Rates 25% to 50%

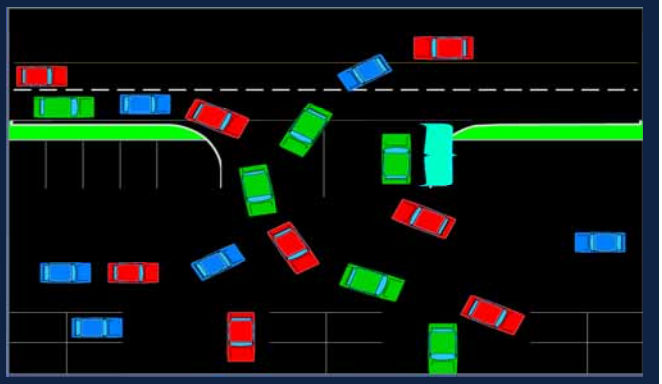
Adding painted left turn compared to raised left turn



New Boise subdivision without right-turn lane

Goal – Good Turn Lanes

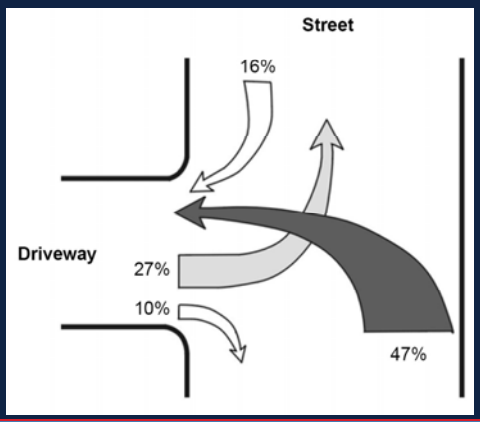
Lack of driveway throat



Source: Florida DOT

Using Medians to Improve Operation and Safety

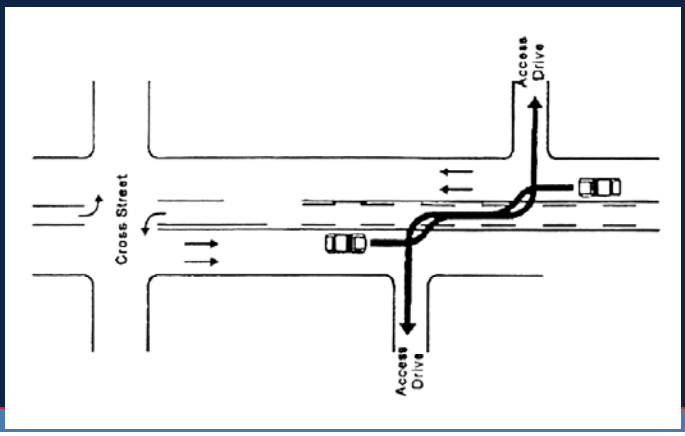
Left Turns Dominate Crash History



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 TWLTL

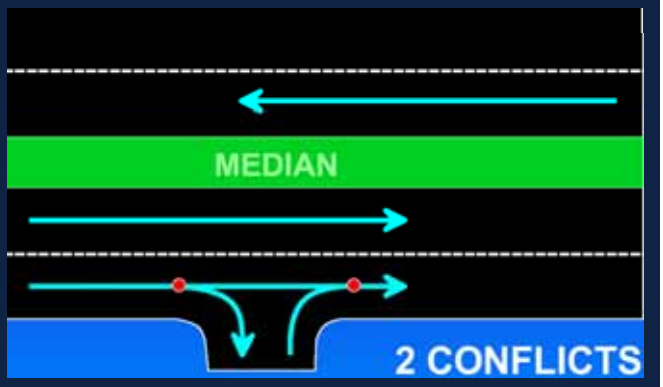


TWLTL has volume limits.

Median Types

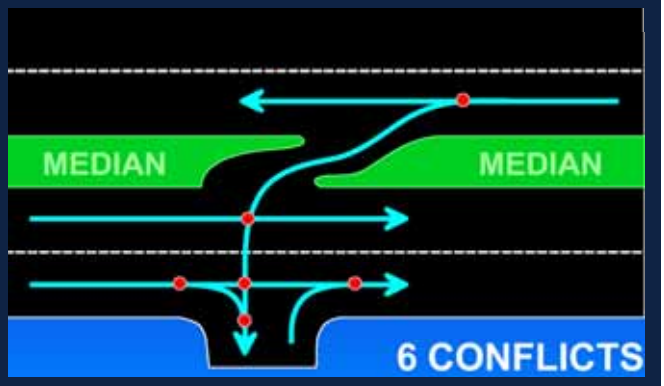
- Painted medians often need 'short' medians (for left turn bays)

Median eliminates all left turns and the related problems



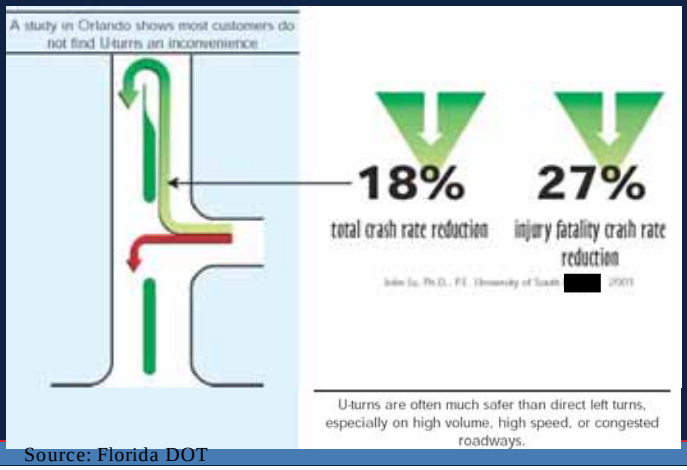
Source: Florida DOT

3/4 th opening / no left out



Source: Florida DOT

U-turns are safer



Source: Florida DOT

Full movement driveways increase bike and ped hazards

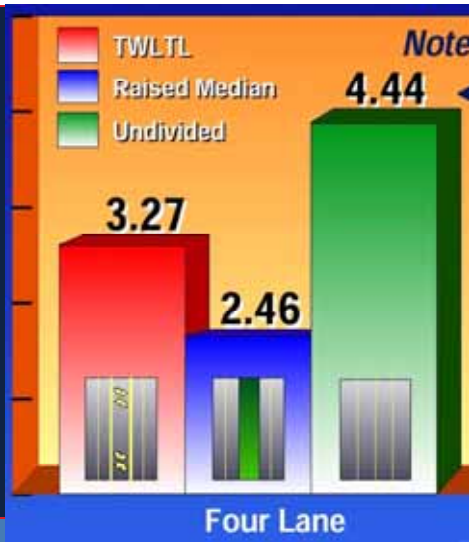
Source: Oregon DOT

Medians reduce bike and ped conflicts

Source: Oregon DOT

Decreasing crash rates by adding medians

Florida DOT



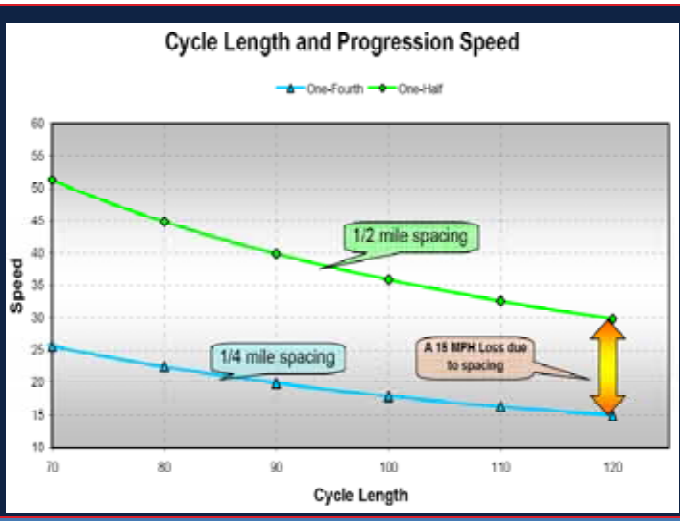
Memorial Drive, Atlanta; 35-55K ADT

Post Project – Memorial Drive

- **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.

Traffic Signals and Spacing

Traffic signals produce and greatest amount of Conflict and Workload



Signals create rear-end conflicts

Access Management for Practitioners: Making Your Roadways Last Longer

Effects of minimum spacing requirements between signalized intersections

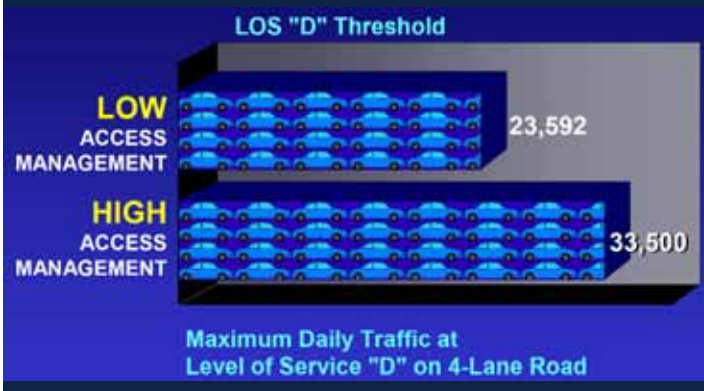
Signals per Mile	Accidents per Million Vehicle-Miles
< 2	2.6 - 3.8
2.01 - 4.00	3.9 - 8.2
4.01 - 6.00	4.8 - 8.7
> 6	6.0 - 9.5

from Gluck et al., NCHRP Report 420

Similar Capacity

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

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

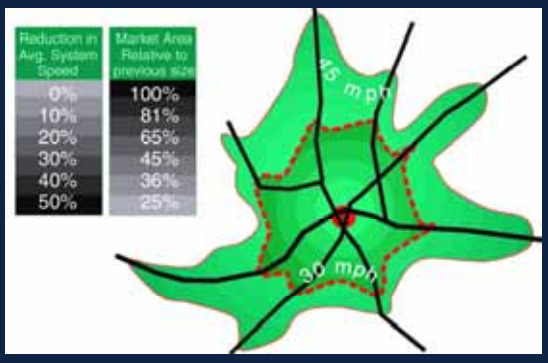
- Good jobs, good paychecks
- Local industries that export
- Freight mobility and reliability
- Labor mobility (access to jobs)
- Tourism

- 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.



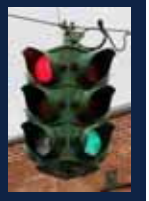
Assuming a 20 minute trip, dropping from average speed of 35 mph to 25 means over 50% reduction in market area.

Source: Florida DOT

Why Roundabouts

Why are they replacing traffic signals

Are Traffic Signals Obsolete?



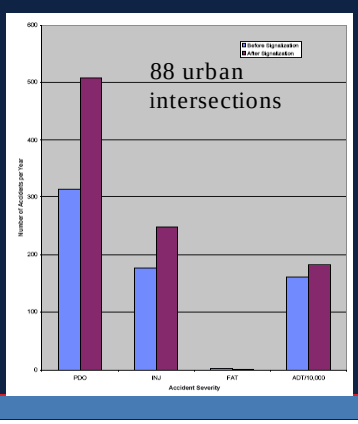
Without Exception, Traffic Signals are hazardous

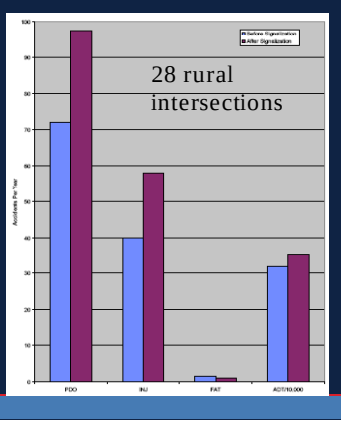
- They may be less hazardous than the current situation
- They are not a safety enhancement.
- They allow safer left turns

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

Signals Increase Accidents

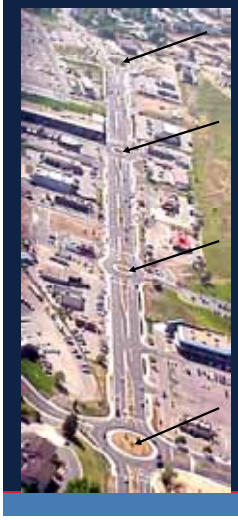




"Jeopardy" – What is IT?

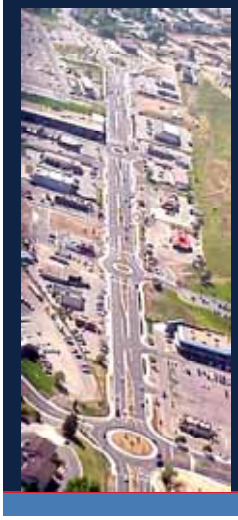
- It lowers the intersection crash rate by over 50%
- It lowers the intersection injury rate by 60 to 90%
- It lowers the fatal rate by 90% or more.

The Modern Roundabout As A Signal Alternative



Roundabouts replaces traffic signals in Golden and Avon CO

Avon, Colorado

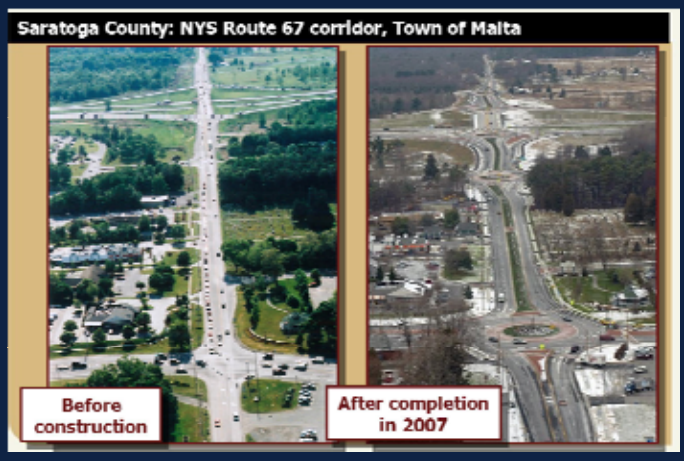


Crash reductions - Golden CO (3 years before & after)

- Commercial strip, 4 + TWLTL
- 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



Source: NYS DOT

Travel time statistics for the Route 67 corridor following opening of the 5th roundabout

Note: All measurements taken in the eastbound direction at approximately 5:00 PM

NYS Route 67 Corridor, Town of Malta
Travel Time Statistics - Before and After Roundabout Construction

		Before June 7, 2005	After Oct. 5, 2006	After June 19, 2007
Begin	State Farm Rd	0	0	0
Arrive	I-87 Southbound Ramps	0:40	0:27	0:29
Leave	I-87 Southbound Ramps	2:22	0:30	0:31
Arrive	I-87 Northbound Ramps	2:40	0:52	0:48
Leave	I-87 Northbound Ramps	2:40	0:53	0:50
Arrive	Malta Commons	2:56	1:14	1:07
Leave	Malta Commons	3:08	1:16	1:09
Arrive	US 9 Intersection	5:58	1:49	1:44
Leave	US 9 Intersection	6:23	1:57	2:00
Total Time Through Corridor		6:23	1:57	2:00

70% Reduction in Travel Time thru Corridor after Roundabouts

Signal corridor speed <10 mph

Roundabout corridor speed >30 mph

34

Source: NYS DOT

- 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

NEW YORK STATE
Department Of Transportation

- 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."

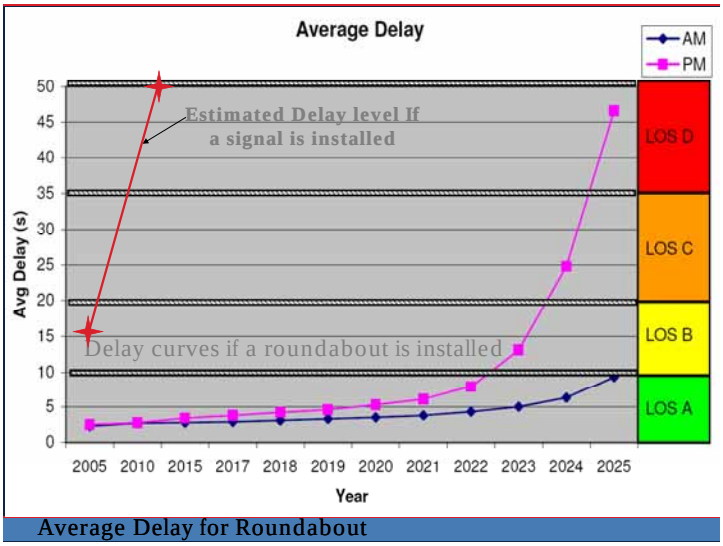
Commercial Area

Dual RBT in Commercial Area

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)

Photo from Michigan DOT

Access Control and Roundabouts

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

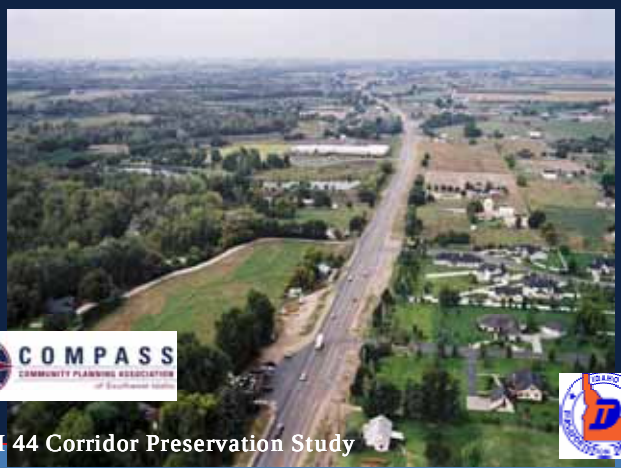
Arizona DOT

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?

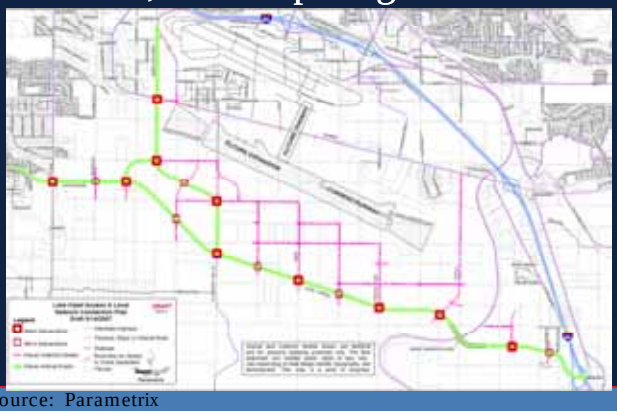


COMPASS
COMMUNITY PLANNING ASSOCIATION of Southwest Idaho

SH 44 Corridor Preservation Study

Source: Parametrix

Draft network to support employment, residential, and airport growth



Source: Parametrix

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

Fairview

Source: Parametrix

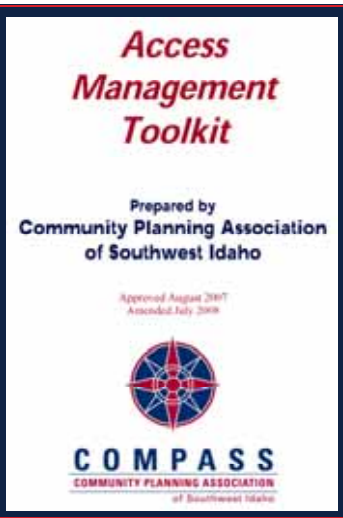
Draft Concept for a Portion of Fairview

Source: Parametrix

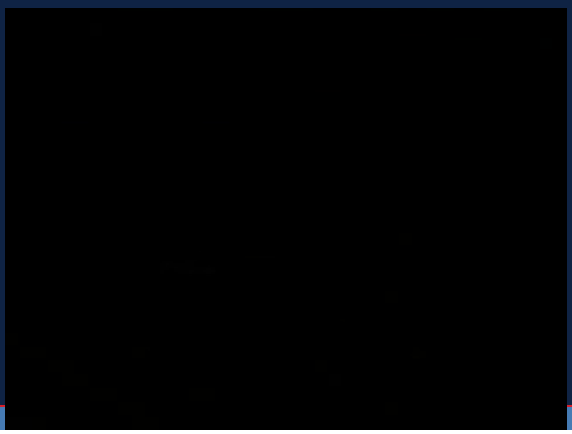
Federal Highway Administration
Office of Operations Washington, DC
www.ops.fhwa.dot.gov/access_management

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



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

Florida DOT

TRB National Roundabout Conference

Next: May 2011, Carmel Indiana

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

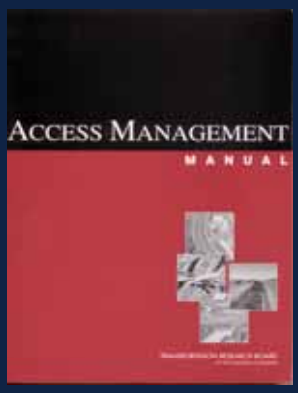
Why is On-Site Sight Distance Important?

- 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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