Why Manage Access to the State Highway System

Division of Research and Innovation, Caltrans
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Parametrix

Problem Identification

- Traffic volumes continue to increase
- Congestion and travel delays
- Unacceptable crash rates & loss of life
- Roadway construction costs
- Social, economic, environmental impacts
- Maintenance costs
- Decreasing buying power

What is Access Management

- Managing each point of access.
- Driveways and intersections
- Goal – improved performance

Smoother traffic flow

Better travel times

Less delays at traffic signals

Less stressful drive

Fewer accidents

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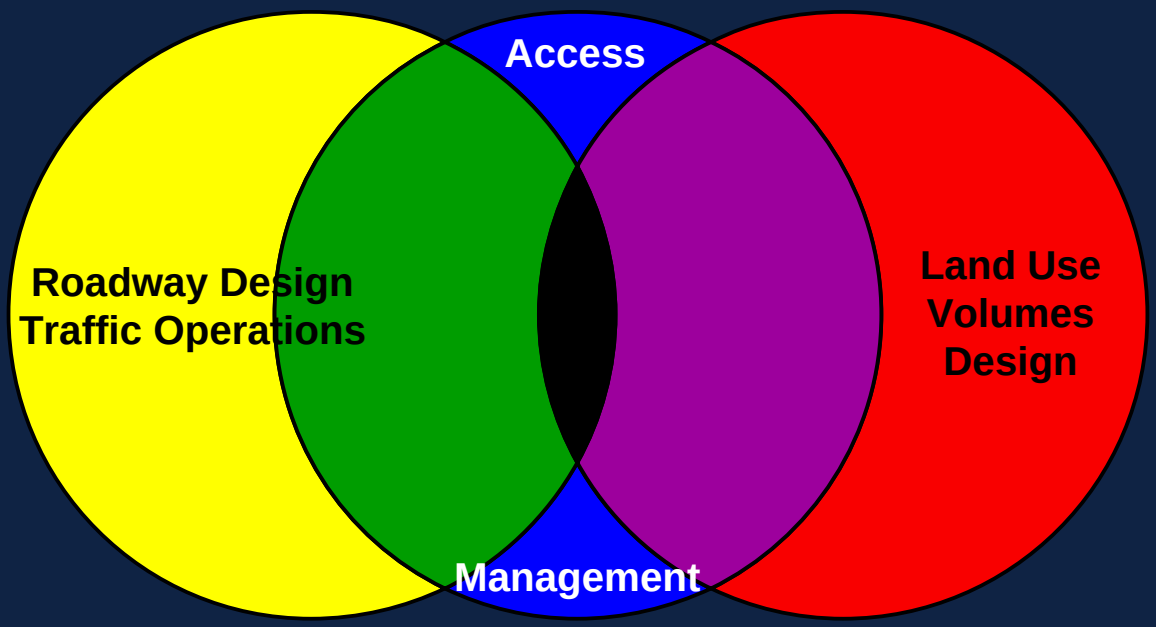

Source: Chris Huffman, KDOT

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Access Management Strategies Support:

- Congestion Management
  - Improves roadway performance
- Asset Management
  - Preserves functional integrity of existing roadway, reducing reconstruction needs
- Safety Management
  - Reduces crash rates significantly
- Mobility Goals
- Saves energy

Managing Congestion, Capacity and Mobility includes:

- Managing location and design of access to land development
- Uniform intersection spacing
- PARTNERSHIPS with land use authorities – is a TOP priority
- Ounce of prevention saves a pound of cure.

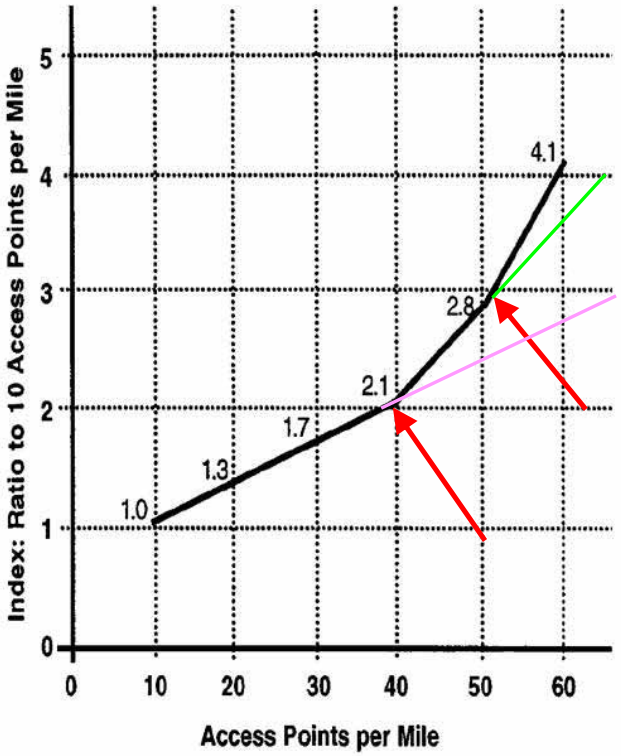
There is no such thing as a safe access.

As the number of access points per mile increase, so does the frequency of total highway collisions.

And the rate also increases

Each access = 4%

NCHRP 420



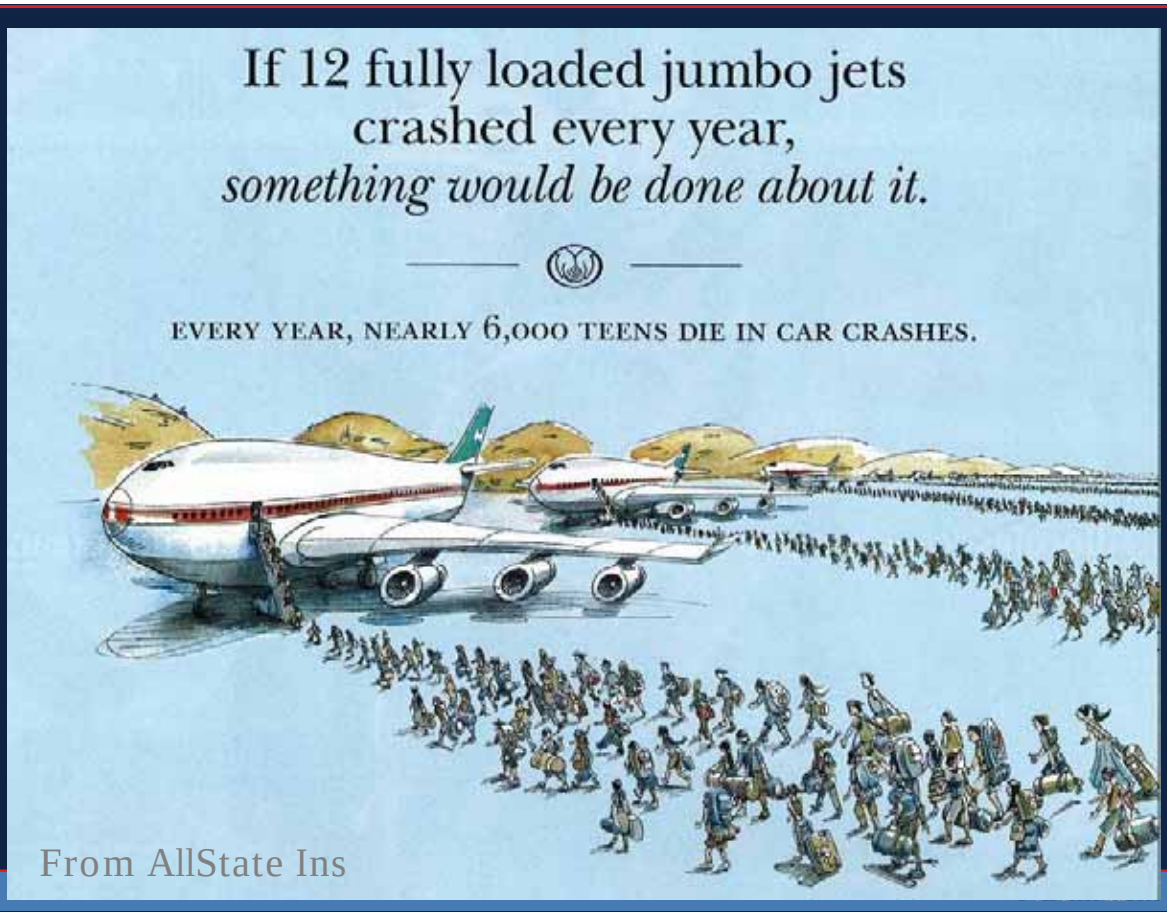
Source: Estimated from Various Sources

Figure 15. Composite accident rate indices.

Roadways are the Most Dangerous Public Facilities on the Face of the Earth

- In the US, over 830 people were killed each **week** in 2005
- 17,500 Crashes each **day**
- 7,400 Injuries each **day**

- Over $630 million dollars in losses daily
- The leading cause of death of children, 4-15 (45 per week)



From AllState Ins

California Recent Rates

- Since 1999, fatal rates are up
  - 1999 1.19 per 100 mvm (record low)
  - 2002 1.27, 4089 & 309,000 injuries
  - 2003 1.30 4215
  - 2004 1.25 4126
  - 2005 1.31 4329, 12 per day (+5%)
- Economic loss of over $20 billion annually in California
- About 250 children annually

Intersection Crash Statistics (nationally)

- 27.3 % of all reported crashes (in intersection)
- Almost 25% of all traffic fatalities
- Almost 50% of all traffic injuries

Access Related crashes, occurring at driveways and intersections represent over **55** percent of all traffic crashes.

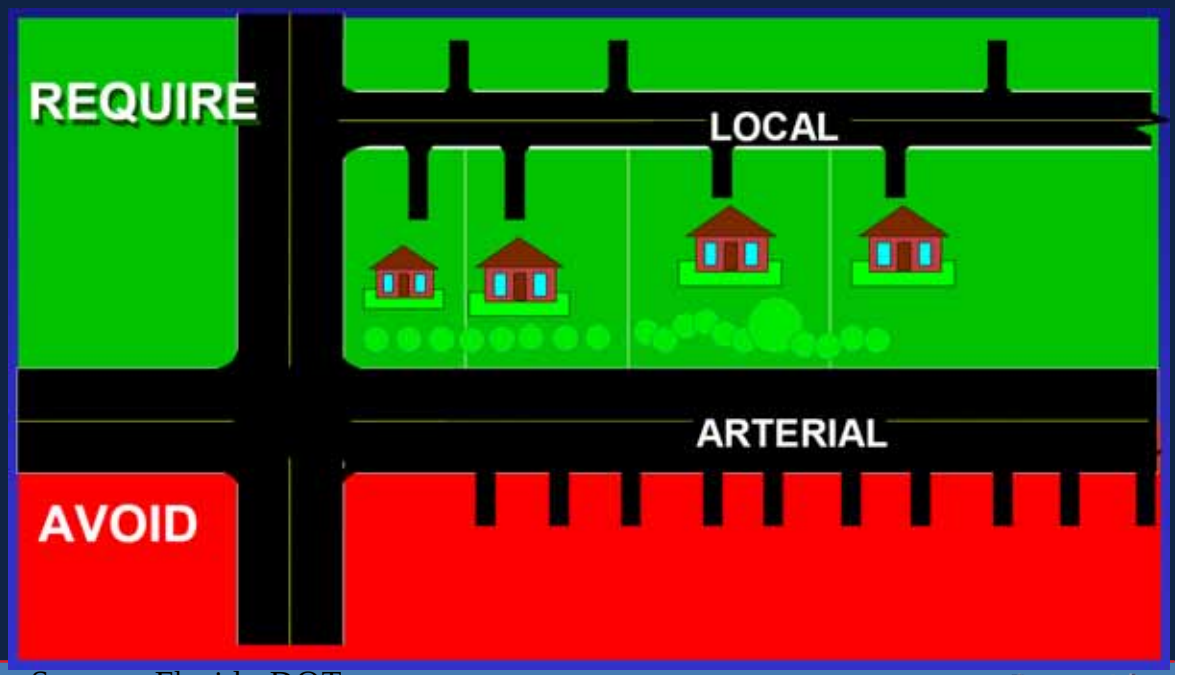
Over 40% in rural; 65% in urban areas

Every Access Point Creates Conflicts and is Fundamentally a Safety Problem

- Issuing a permit is a decision to diminish public safety and roadway function.
- It is one of the few daily agency decisions that is counter to the values, goals and objectives of a public agency.

Goals of Access Management

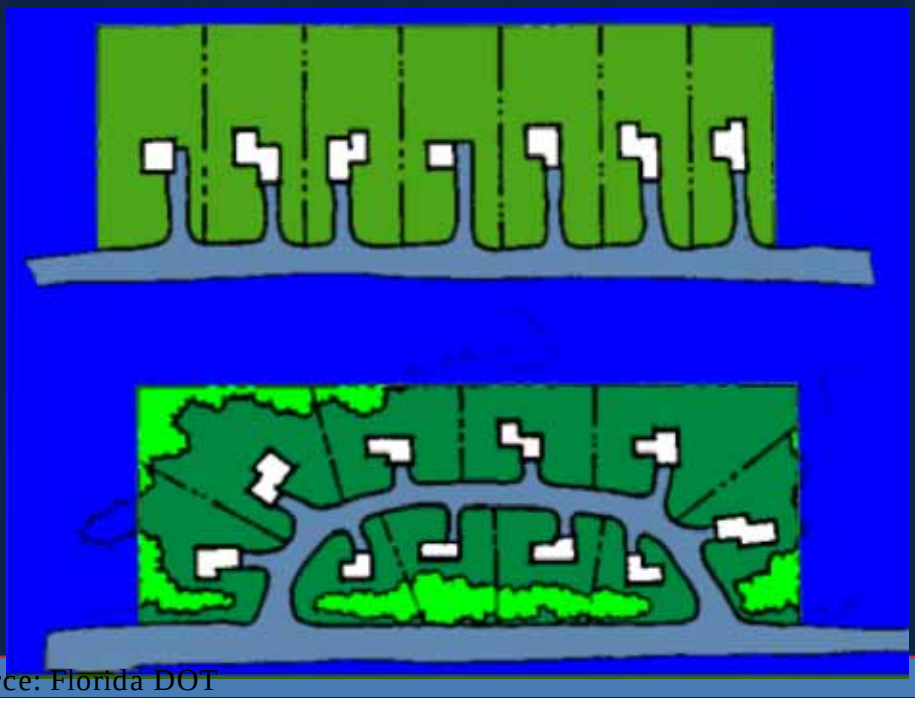
- Keep private access off state highways



Source: Florida DOT

Goals of Access Management

- Safer residential access



Source: Florida DOT

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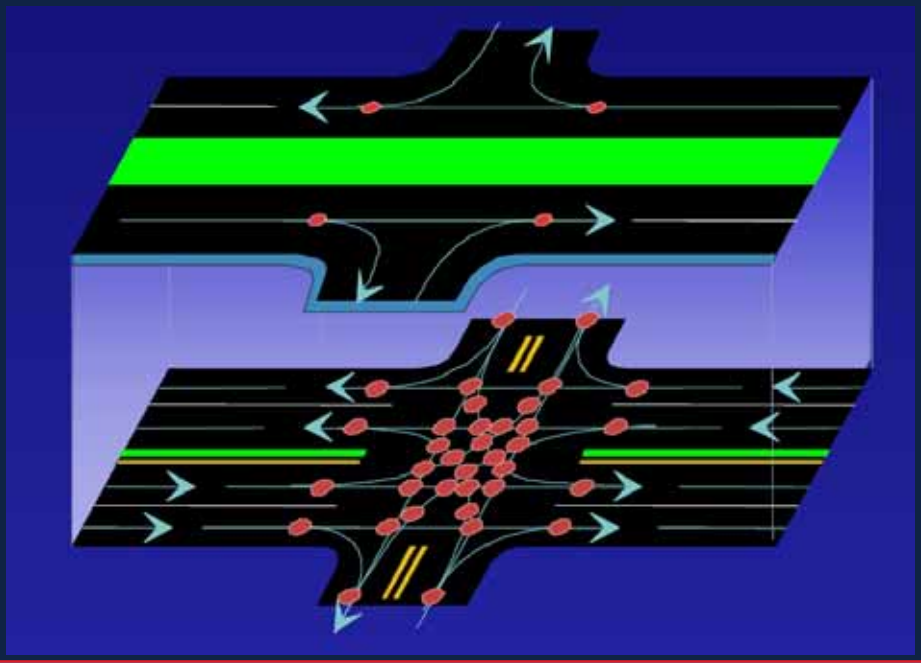
Goals of Access Management

- Limit access conflicts



Source: Florida DOT

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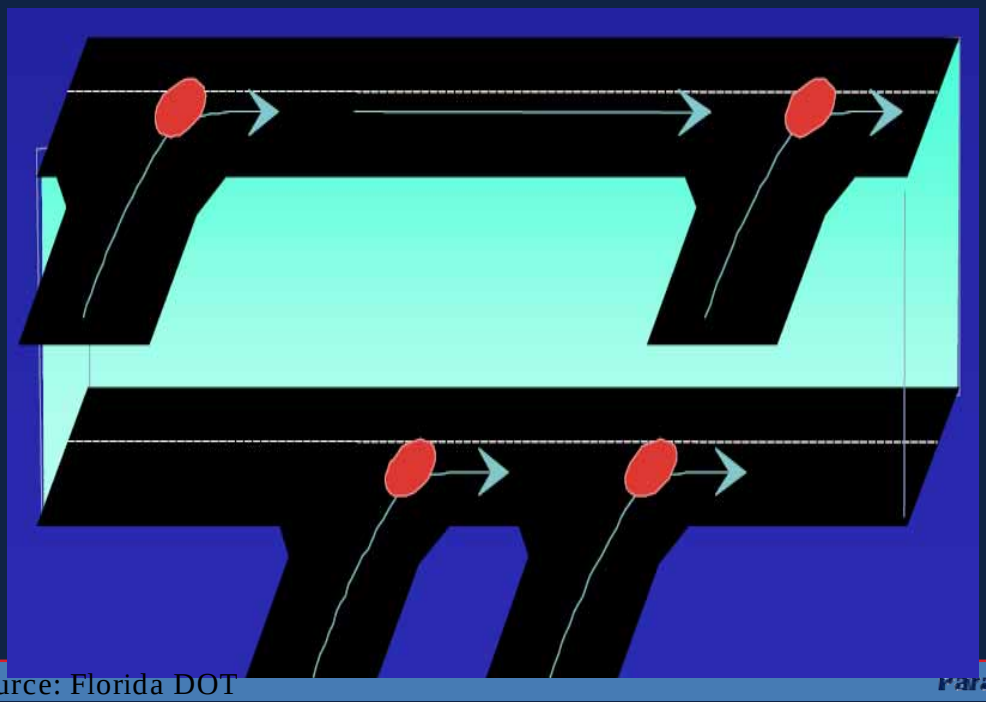
Goals of Access Management

- Separate conflict points



Source: Florida DOT

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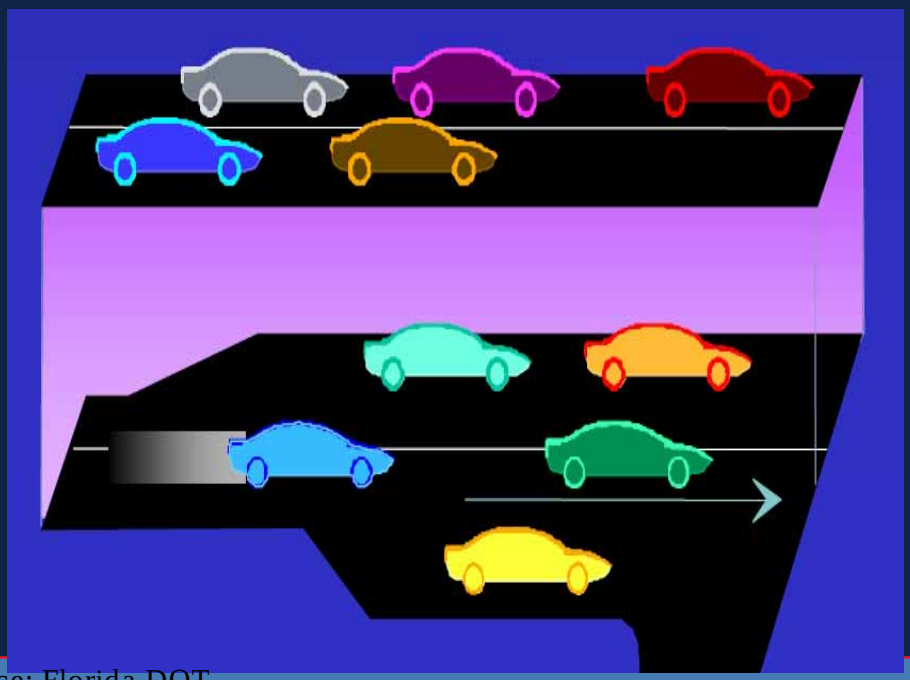
Goals of Access Management

- Separate Turning Vehicles from through traffic



Source: Florida DOT

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When access principles are applied to a specific Corridor

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

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Access Management Strategies Are Successful Applying Two Basic Principles

1. Reducing roadway conflicts

2. Reducing speed differential in the through travel lanes

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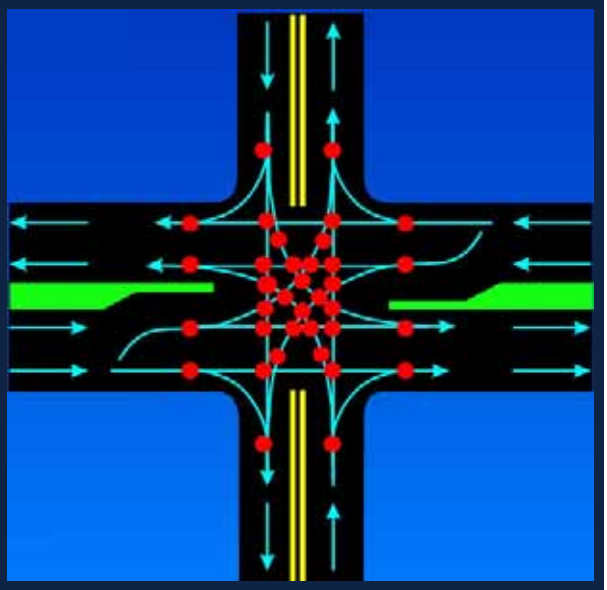
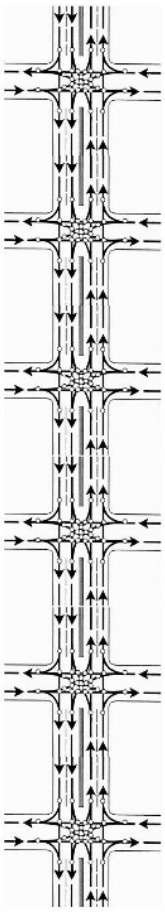
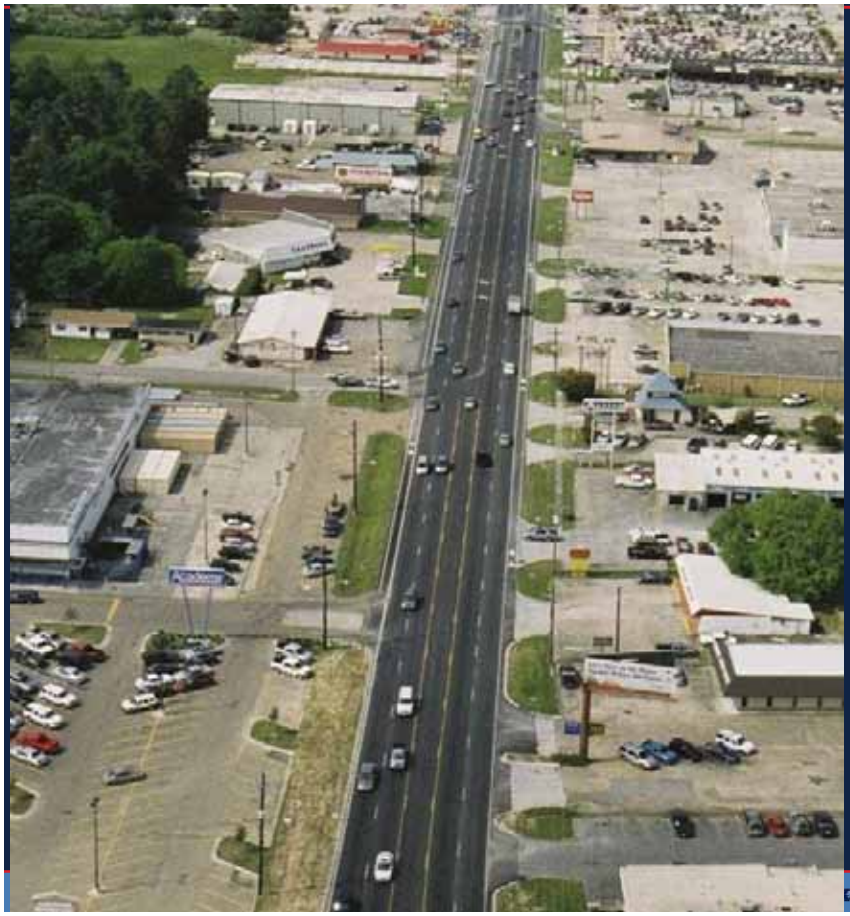
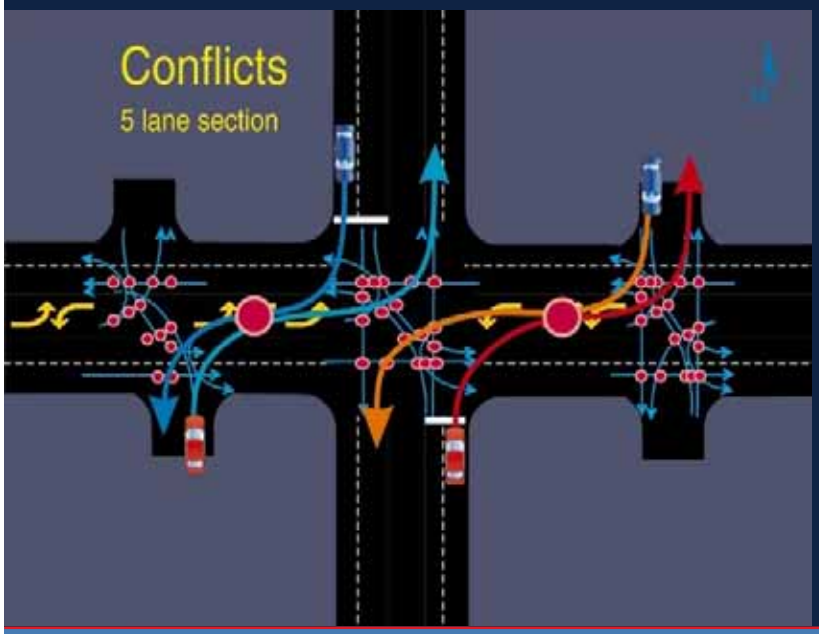
36 conflict points exist at a 4 leg intersection







Access management is – Conflict Management



- Reducing the Rate at which a motorist encounters conflicts, reduces the Rate of crashes.

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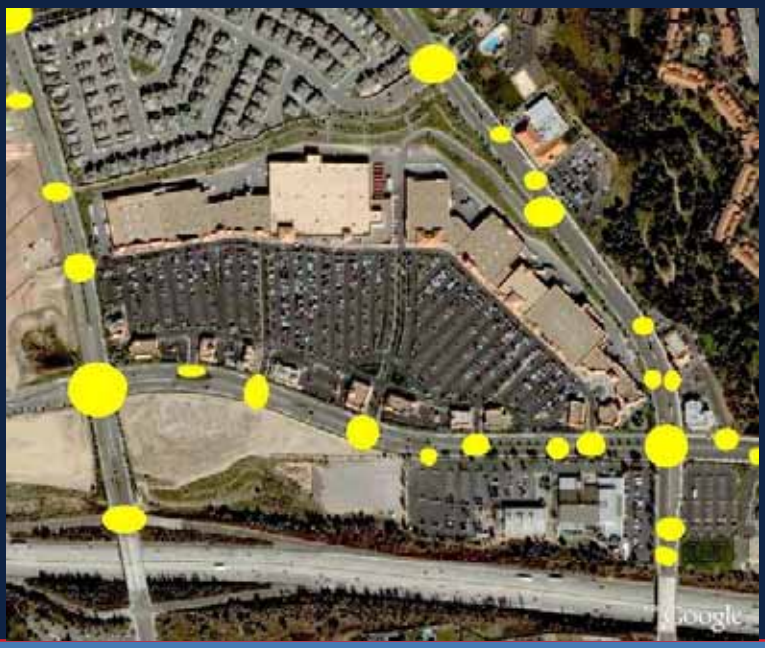
This new shopping center has created many new conflict points on the supporting street system

Access convenience for shoppers becomes conflict and delay for passerby's



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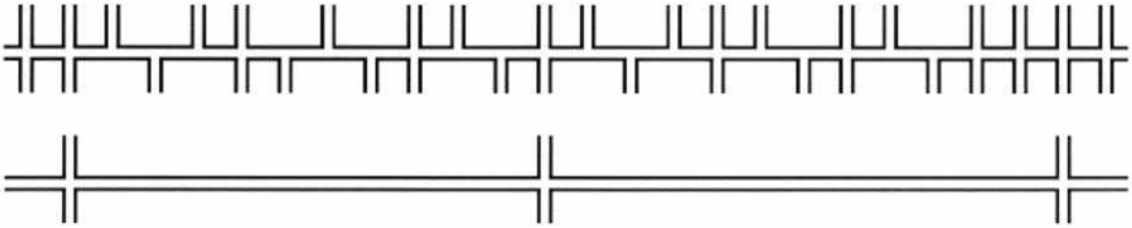
The Frequency of Access Determines a Long Term or Permanent Crash Rate



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

Widening this highway from 5 to 6 lanes, caused an increased in access related crashes.

Loading up an intersection the high generators can increase crashes 200 to 600% at this location. In this 1971 photo, LA Co was installing medians to restrict left turns.

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A shopping center with limit direct access and good on-site circulation is convenient and successful without numerous driveways

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Reducing Access Demands Onto State Highways is all about local street networks

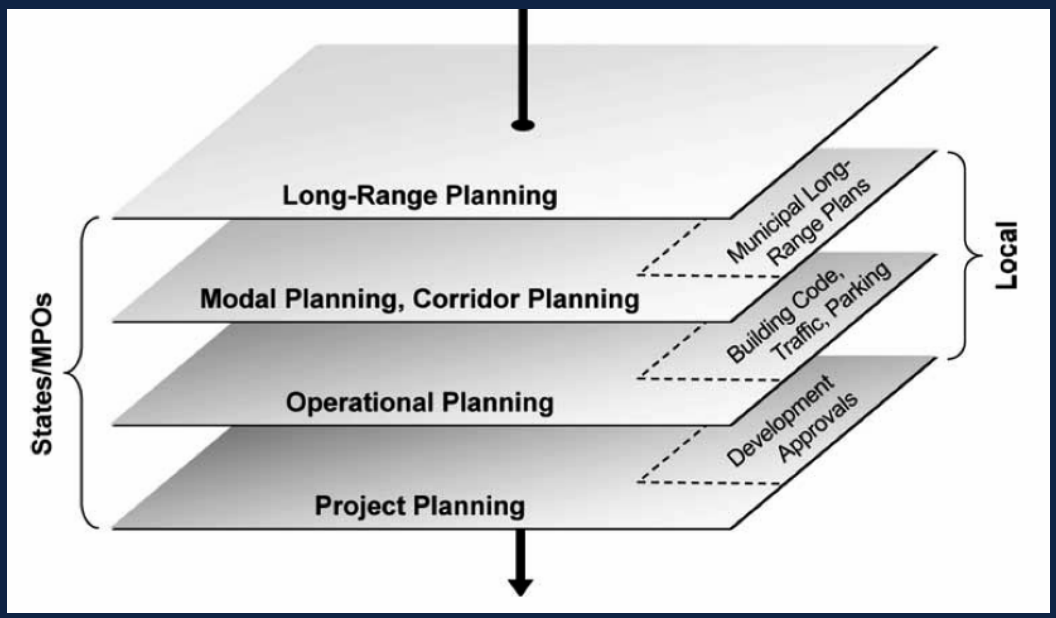
- Having a hierarchy,
  - major to local for circulation.
- Avoiding Strip commercial and residential frontage with direct state highway driveways.

This road lacks a supporting local network, therefore requiring

Land-use and Transportation Planning plays a strong role in determining long term community crash rates

- Local street layouts, local network
- Subdivision design
- Shopping center design and connections
- All determine state highway conflict frequency

Ideally, AM starts with long range planning



A Guidebook for Including Access Management In Transportation Planning. NCHRP 548

AASHTO on Hierarchy – a Trip

- Six stages: begin (unpark), access public system, collection, distribution, transition and main movement.
- Each of 6 stages has a specific design for its function (volume and speed)
- The failure to recognize the need for trip hierarchy is a prominent cause of highway obsolescence.

Why The Hierarchy?

- When each functional class is designed and operated for its specific use, both safety and desired performance is maximized.
- Separating the various travel purposes (long distance, short distance, shopping, commuting, neighborhoods) means more functional consistency in the travel stream of motorists.

No National Standards

- There are no national standards for most driveway design elements
- No warrants for right turn lanes
- No warrants for left turn lanes
- No standards for driveway width
- States & Municipalities use various standards and warrants based on old guides, old research and a lot of "judgement".

Signalized Intersection Spacing

Traffic signals produce and greatest amount of conflict, delay and workload

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Relative crash frequency

- 0.7 per year at rural unsignalized intersections
- 1.4 per year at urban unsignalized intersections
- 4.8 per year for rural signalized intersections
- 6.2 per year at urban signalized intersections

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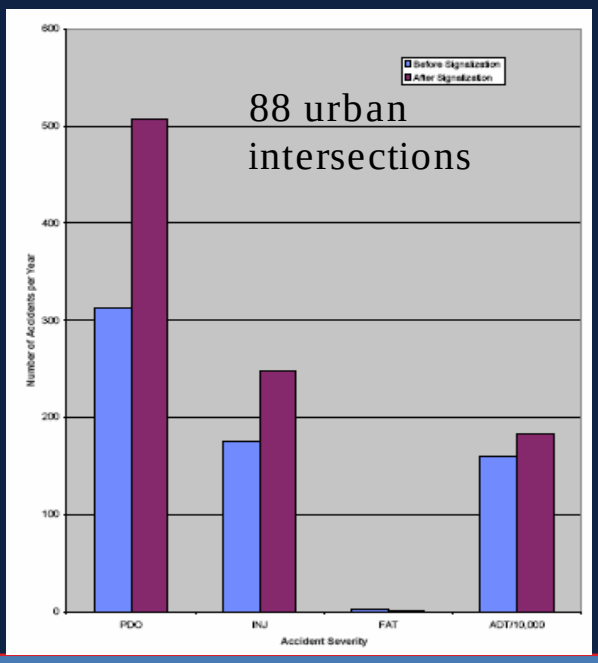
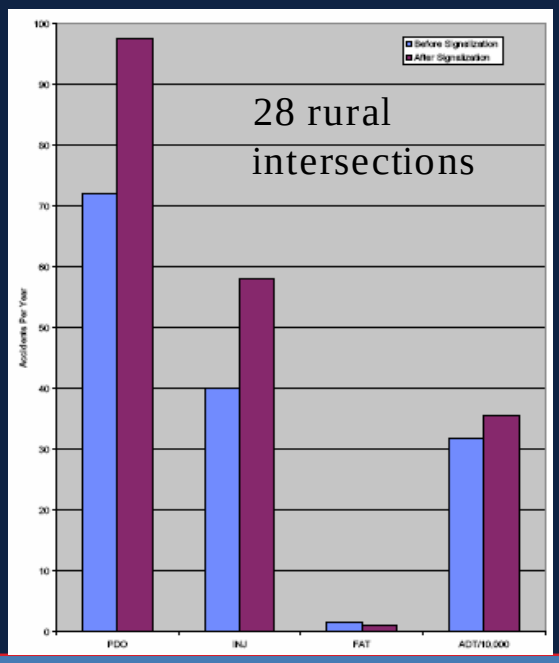
Signals Increase Accidents





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Relative crash frequency

- 1.4 per year at urban unsignalized intersections
- 6.2 per year at urban signalized intersections

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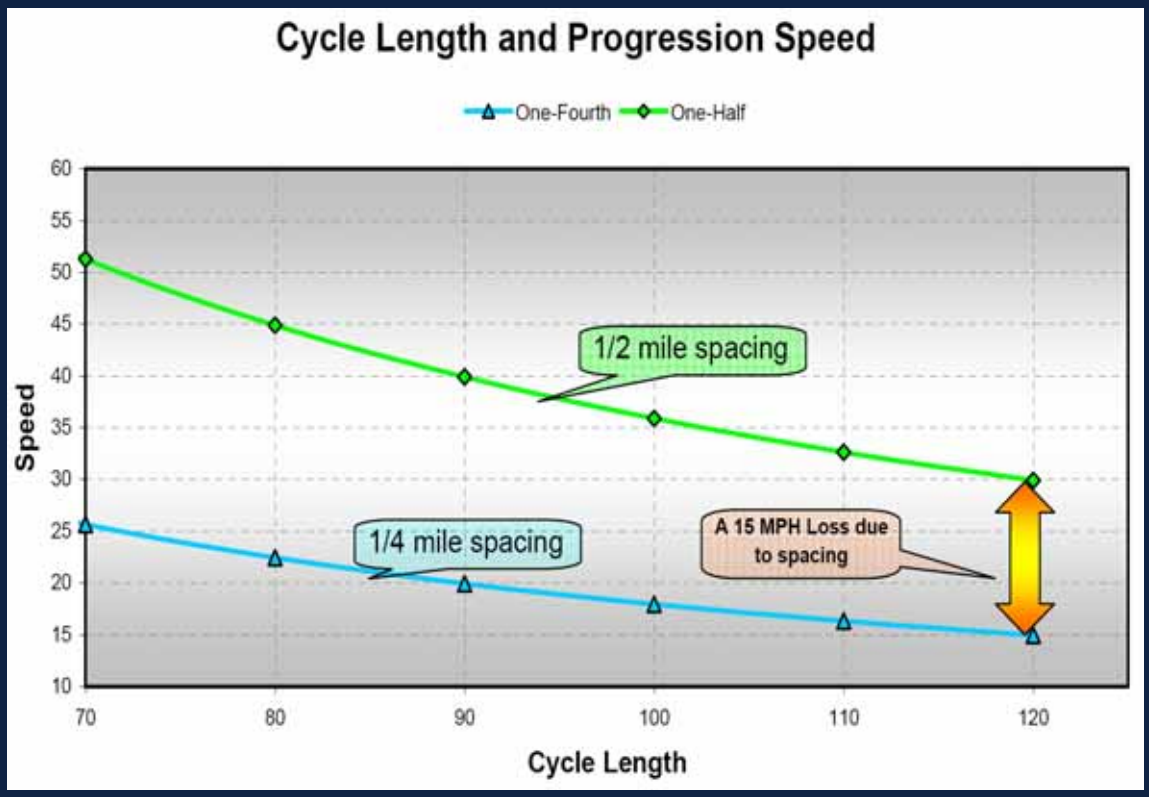
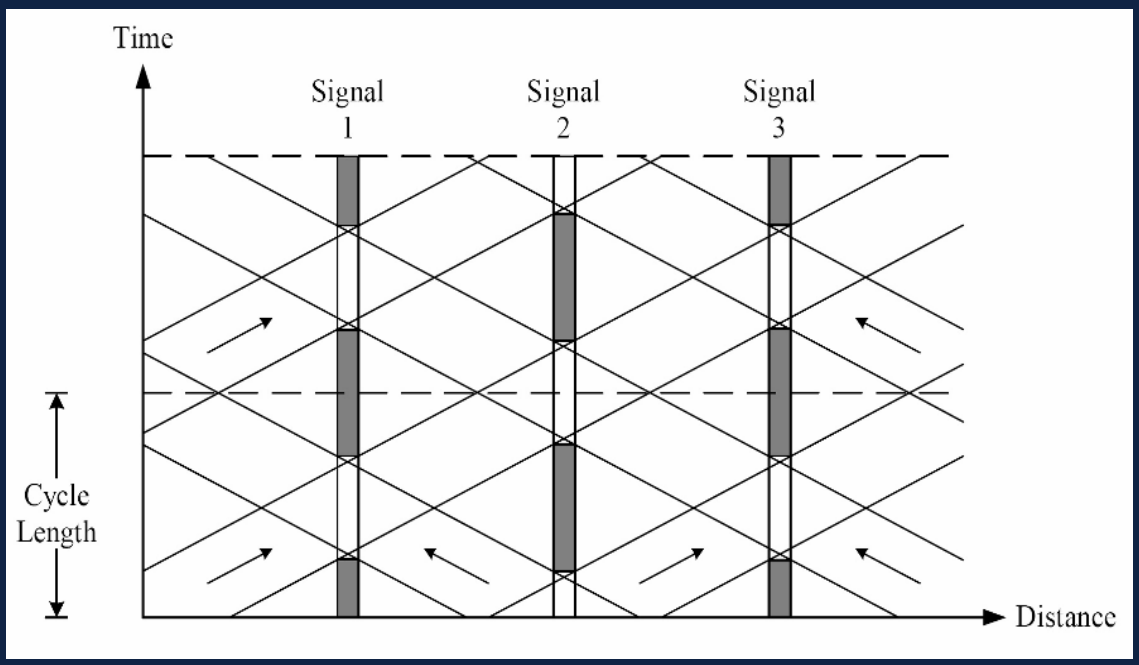
Why Signal Spacing is Important

- Short spacing reduces ability to maintain speed and capacity
- More signals per mile means more collisions per mile
- Short spacing may result in adjacent signal queues impacting each other



Time-Space Diagram, 2-Way traffic



1/2 or 1/4 mile signals ??

Estimated Savings in Travel time & Delay - 1/2 Vs. 1/4 Signals + Side Friction in 5 Miles

	Travel Speed MPH	Total Travel Time Veh-H/H	Total Delay Time Veh-H/H
Access Controlled Segment	22	542	275
Unrestricted Segment	13	942	675
Percent Change		- 42%	- 59%

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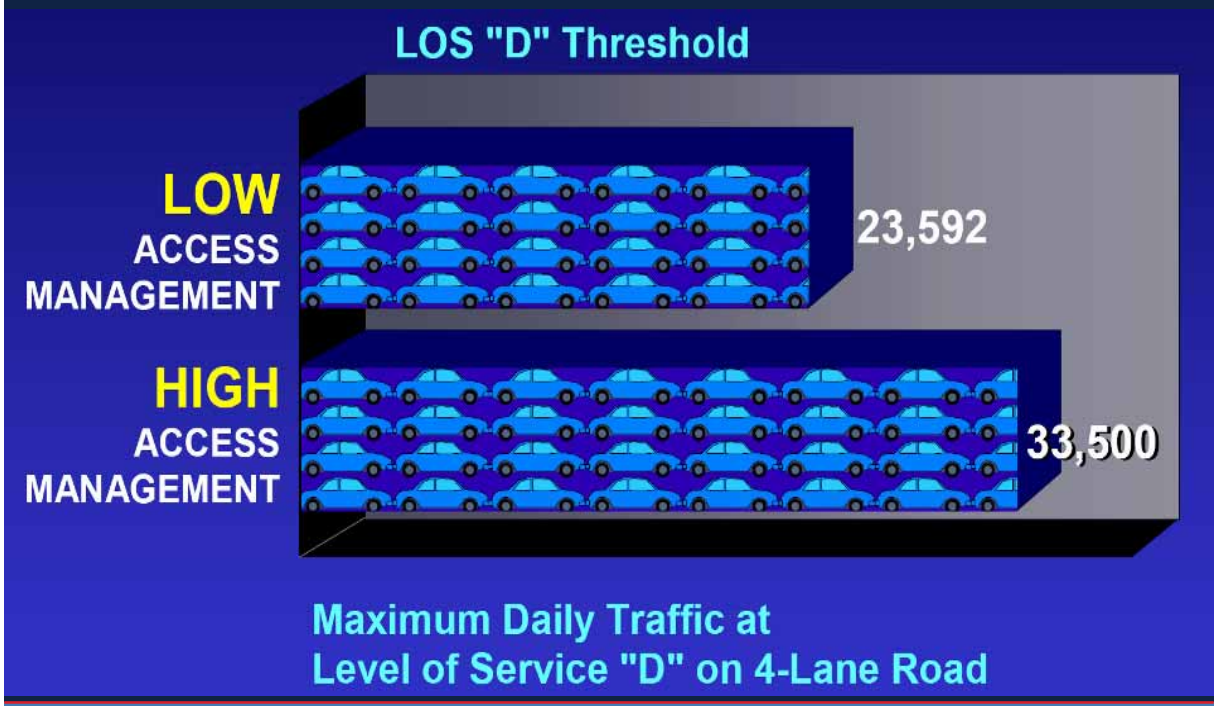
Capacity Benefits



Source: Florida DOT

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Have a Traffic Signal Plan

- Signals reduce capacity, mobility and increase crashes
- Yet, are a necessity
- Have a plan then minimizes their need and achieves good spacing
- At state level – adopt signal spacing standards

Is Access Management Bad for Business?

- **NO**
- Access Management
  - Improves local and regional mobility
  - Preserves travel time, reliability
  - Preserves capacity, LOS

Business Interests Include

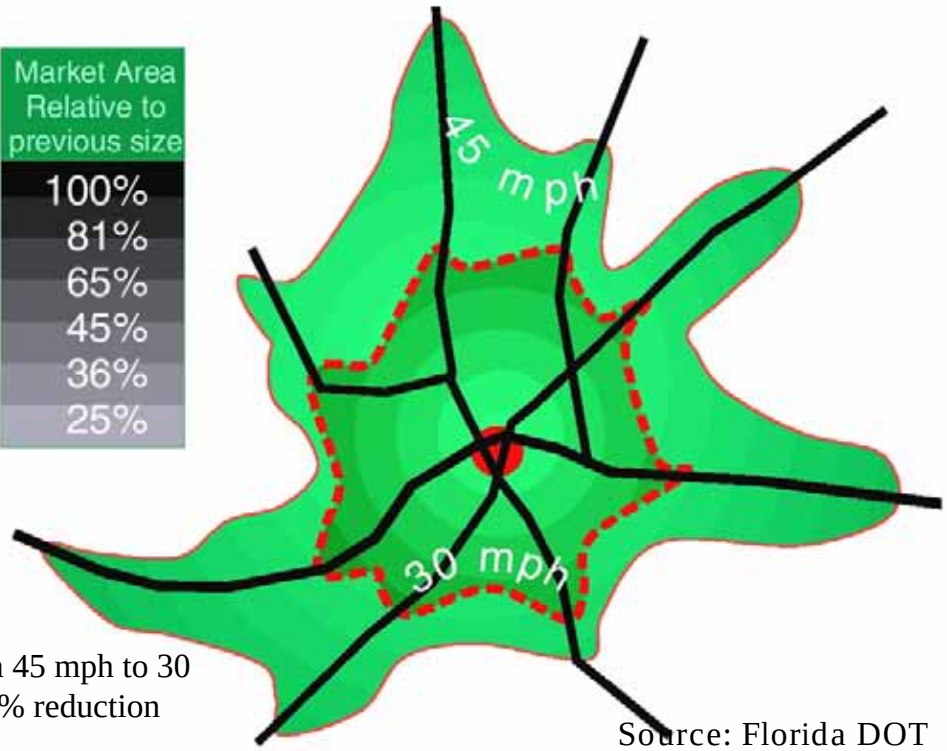
- Industry
  - Materials, labor, distribution
  - Agriculture, materials, farm to market
- Corporate.
  - Labor, services, travel, efficiency
- Services
  - Travel to clients, or clients to offices
- Freight, Distribution
- Agricultural (farm to market)

Retail – access demands are complex

- Retail depends on wallets – the fatter the better, not driveways.
- Customer base (households and income level in market area)
- Conflict of interest - local gov't is the regulator as well as the beneficiary of the collected retail taxes.
- <u>Retail should demand access management</u>
- Travel time determines customer base

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

Reduction in Avg. System Speed	Market Area Relative to previous size
0%	100%
10%	81%
20%	65%
30%	45%
40%	36%
50%	25%



Dropping from 45 mph to 30 means over 45% reduction

Source: Florida DOT

Most retail businesses see no loss in business due to access management improvements.

- Kansas; Except in extreme cases, no impact to businesses were noted
- Texas
  - Business owners reported no change in pass-by traffic
  - Most negative impacts were during construction
  - Perceptions before installation were more pessimistic than after
  - 93% of business owners saw no loss of customers
  - Property values stayed the same or increased

Kristine Williams, AICP, *Economic Impacts of Access Management*, 2000

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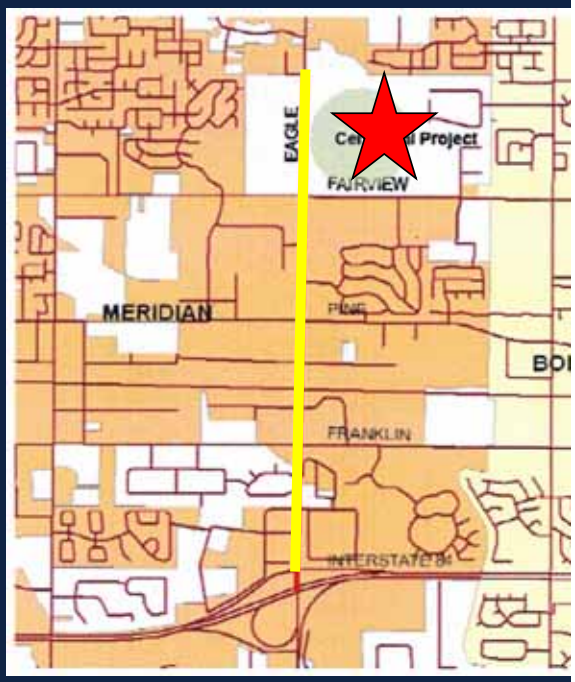
- The City of Meridian requests an amendment to 2030 Regional Long-Range Transportation Plan
- A two-mile project, widening to three through lanes in each direction from Interstate ramps to ½ mile north of Fairview Avenue.
- The cost is estimated at $15 million, which would be funded by a developer if their shopping center project is approved.



Regional Economy and Growth is

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

- Retail sales are a product of employment not driveways

FHWA, Office of Operations, Washington, DC
www.ops.fhwa.dot.go v/access_management
8/2006 FHWA-HOP-06-107 EDL 14294

SAFE ACCESS IS GOOD FOR BUSINESS

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Access Control - Early 1900s

- 1902 - New Jersey established "speedways" for horses and light vehicles - intersections required county approval. (5 mph was average speed)
- 1914 - New York began establishing "parkways" in urban areas.
- The Bronx river Parkway had adjacent park buffer strips to prevent strip development.

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1955 Report to President Eisenhower, “A Ten Year National Highway Program” regarding access controls

- “ . .experience shows that the facility becomes prematurely obsolete due to developments crowding against the roadway which make if unfit for the purposes for which it was designed.
- “Control of access to the degree required by traffic conditions is essential to the protection of life and property.
- “It is also essential to preserve the capacity of the highway.
- “So far as the investment of funds in major roads is concerned, provisions for control of access to the extent required by traffic is fundamental."

The Other 98.7 % in 1950s - 1990s

- Little or no access control on 4 M Miles
  - nada - zip - none
- Limited permitting for basic issues
  - design, drainage, backing
- No strong exercise of police powers to control the location or number of driveways and public intersections.
- No effort in land development and planning policies to reduce access frequency

Legal Issues in California

US Supreme Court Decision on Access

- In 1907 the US Supreme court deemed access control was a property rights issue controlled by the sovereign power of the states not the federal government.
  - Sauer v. City of New York 206 US 536 (1907)

Taking of Property

. . . nor shall private property
be taken for public use,
without just compensation.

U.S. Const. amend. V

. What is protected is a
right to use property

What is Property?

- Is there a constitutionally protected property interest in a driveway (which is not on the property)?
- Should there be compensation if the restricted interests (medians, street and driveway restrictions, traffic volumes) are not part of the landowner's title?

California Case law. Access cases—Eminent domain/inverse condemnation

- People v. Ricciardi (1943) 23 Cal. 2d 390, 399; People v. Russell (1957) 48 Cal. 2d 189. [rerouting traffic is a police power, not a compensable taking]
- People v. Sayig (1951) 101 Cal. App. 2d 890. [circuity of travel not necessarily compensable]
- People v. Ayon (1960) 54 Cal. 2d 217.
- Brumer v. Los Angeles County Transportation Authority (1995) 36 Cal. App. 4th 1738.
- Breidert v. Southern Pacific Co. (1964) 61 Cal. 2d 659 [need a substantial impairment of access; court first determines whether impairment is substantial];
- San Diego Metropolitan Transit Dev. Board v. Price Co. 37 Cal. App. 4th 154. [need extensive evidence of the effect of access impairment]
- Blumenstein v. City of Long Beach (1956) 143 Cal. App. 2d 264.
- People v. Romano (1971) 18 Cal. App. 3d 63.

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Vehicles turning across sidewalks must wait for pedestrians. A right turn decel lane would have improved safety and eliminated delay for vehicles following.

Left turns create high speed differential and avoidance behavior, significantly increasing crash potential.

Relative Accident Potential on At-Grade State Highways

- **Speed Differential -10 -20 -30 -35**

- **Relative Accident**
- **Potential 1 3.3 23 90**
  - A vehicle traveling 35 mph slower that other traffic is 90 times more likely to become involved in an accident that a vehicle traveling only 10 mph slower
  - V.G Stover and F. J Koepke, Transportation and Land Development, ITE 1987

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Suggested turning volume warrants for turn lanes

Access Category	Left-turn Decel		Right-turn Decel Lane	
	At/Above 45 MPH	Below 45 MPH	At/Above 45 MPH	Below 45 MPH
MR	10 AADT	10 AADT	5 VPH	10 VPH
UA	10 VPH	10 VPH	10 VPH	10 VPH
UB	10 VPH	15 VPH	15 VPH	15 VPH
UC	10 VPH	25 VPH	15 VPH	25 VPH
RA	10 VPH	10 VPH	10 VPH	10 VPH
RB	10 VPH	15 VPH	10 VPH	15 VPH
SF	10 VPH	25 VPH	15 VPH	25 VPH

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Turn lanes also need sufficient length to reduce departure speed differential on the mainline.

Options for Deceleration Lane Length, includes taper

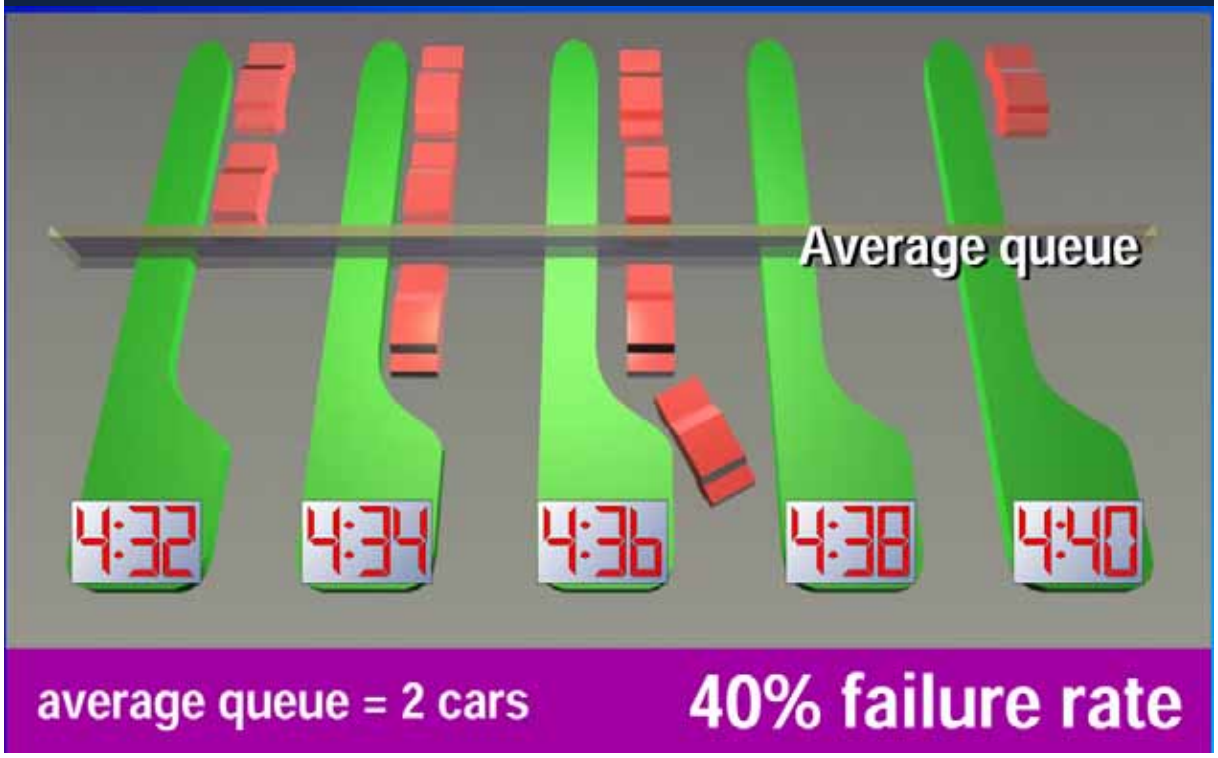
Speed in MPH	35	45	55	65
Deceleration Length, Ft.	215	345	510	710

10 mph speed differential
For normal state highway

Speed in MPH	35	45	55	65
Deceleration Length, Ft.	350	630	810	1060

Zero mph speed differential
For major state highway, expressway

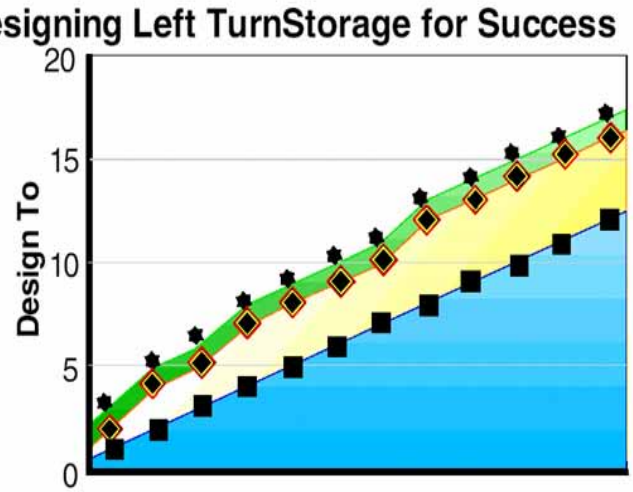
Why Designing for Average Queue will cause some failures



What a difference more storage can make

Remember:

you need almost twice the average queue for storage length



Average Demand Per Cycle	1	2	3	4	5	6	7	8	9	10	11	12
30-40% Failure ■	1	2	3	4	5	6	7	8	9	10	11	12
10% Failure ◆	2	4	5	7	8	9	10	12	13	14	15	16
5% Failure ✸	3	5	6	8	9	10	11	13	14	15	16	17

Source: Use of Poission Aproxmation

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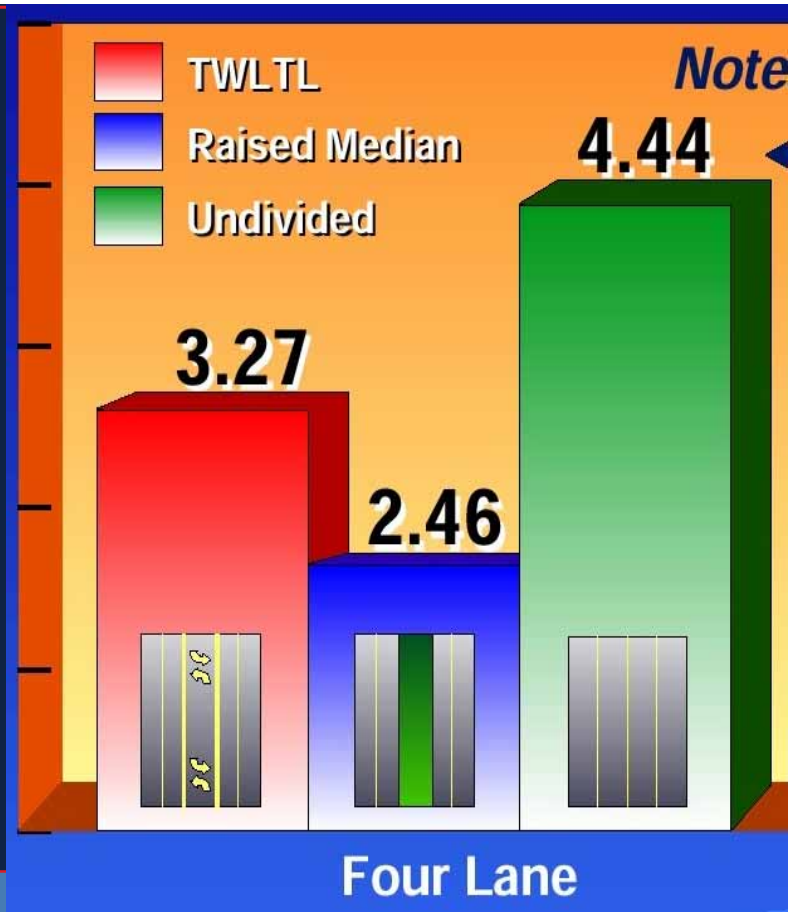
Decreasing crash rates by adding medians

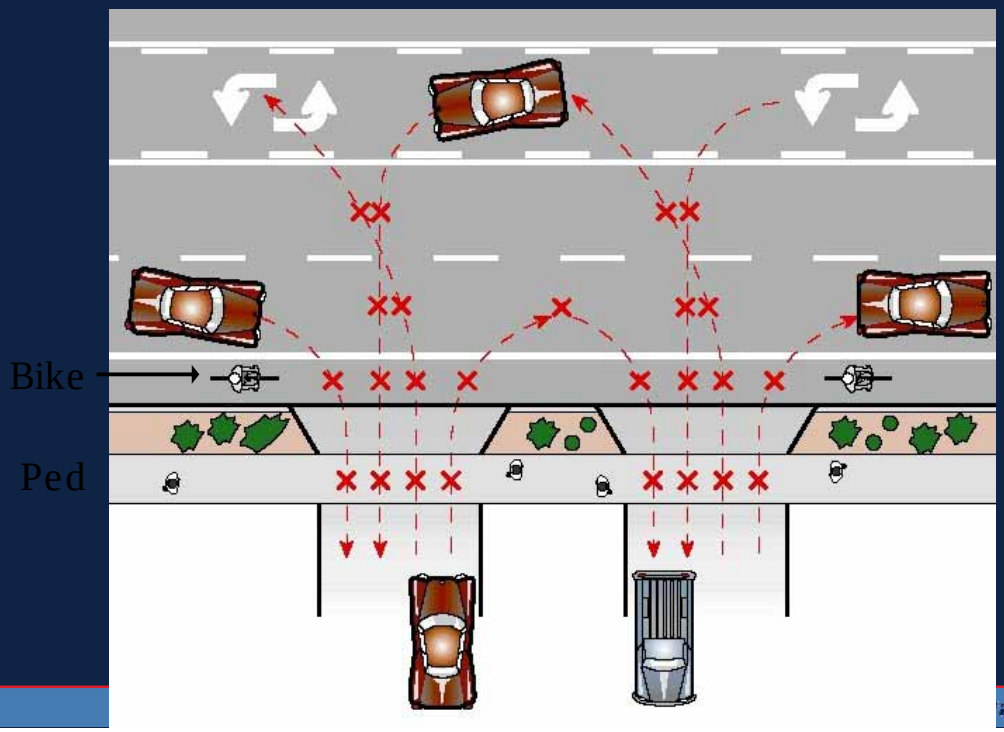
Florida DOT



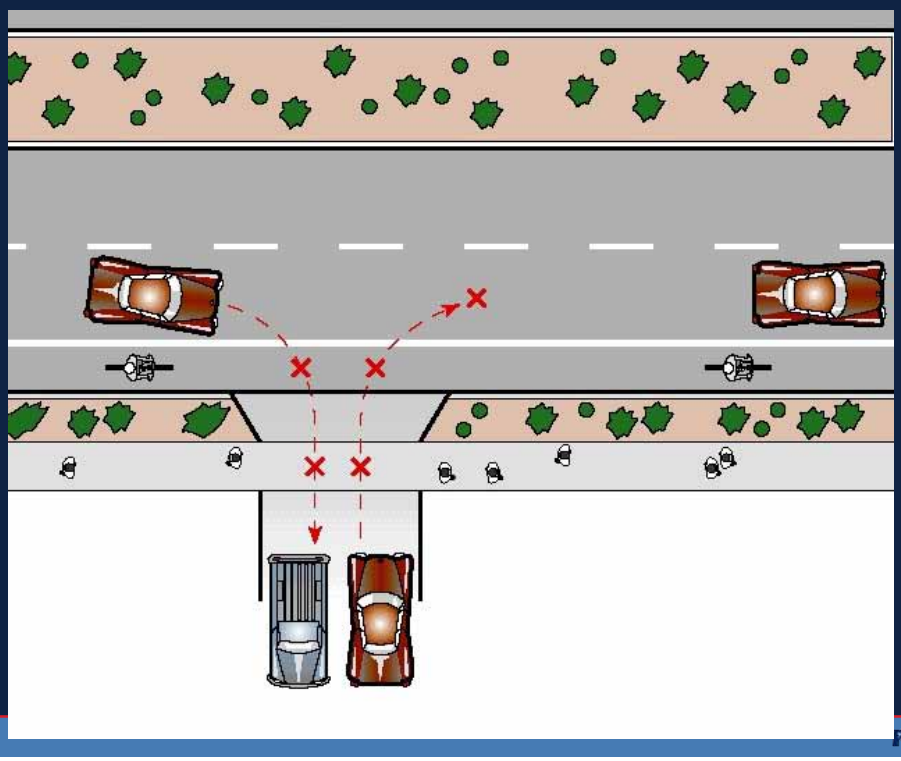
TWLTL has volume limits

Frequent driveways result in poor use of median lanes

Full movement driveways increase bike and ped hazards



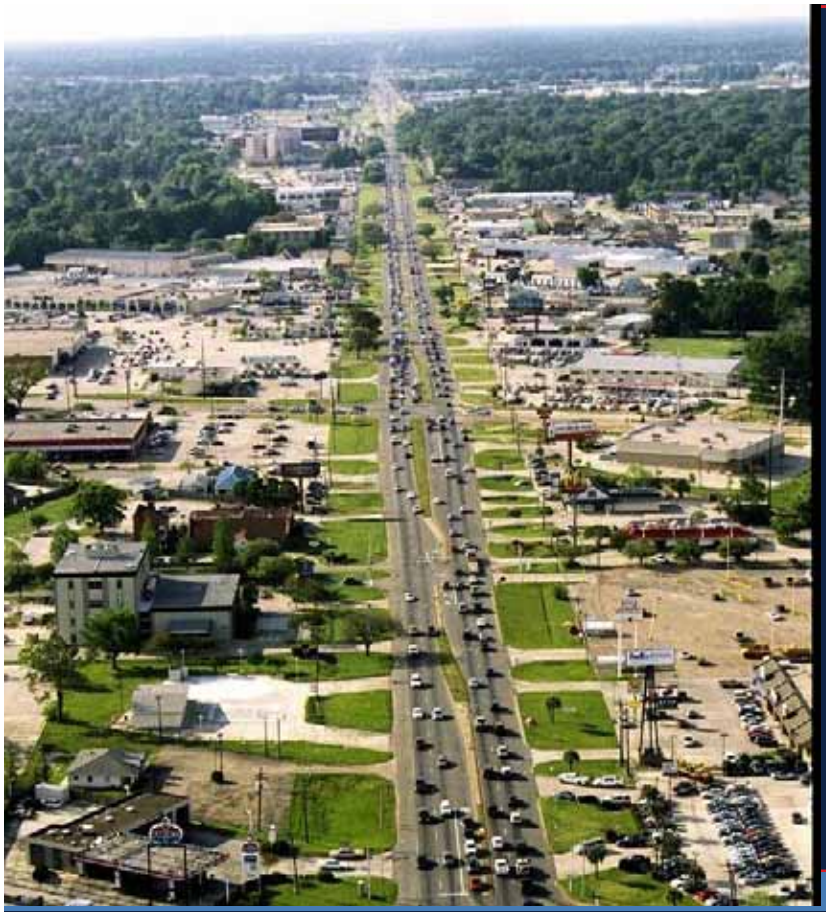
Medians reduce bike and ped conflicts



There is no Right to a left

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

- Was commercial strip, 4 signals and TWLTL
- 4 RBTs and raised median
- 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



Lacking local circulation network, how would this corridor look and work with solid median and roundabout intersections to handle u-turns?

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Access Management Program and Policy

- Have a permitting program
- Have standards that implement the key principals effectively
- Have the standards FIT the roadside land use
- Education, training, agency cooperation.
- Multi-discipline expertise.

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Safety and Long Range Planning

- Call for an access program with teeth.
- Fund and implement a program
- Program that achieves municipal buy-in
- Accountability and performance audits
- Hot spots – access related
- Standards that address Safety, not just LOS and AASHTO minimums.
- Fund projects with Access plans to protect the public investment

Most Access Programs have Two major elements:

- Access Standards
- and Access Categories.

The true heart of an access management program is the access category system

Arizona State Highway (Draft) Access Management Categories

FW (freeway)	
MR (major regional)	
RA (rural principal)	UA (urban principal)
RB (rural secondary)	UB (urban mixed)
	UC (urban secondary)
SF (service and frontage roads)	

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Access Classification System

- Establishes an access decision hierarchy that is aligned with the adopted transportation plan.
- Ensure that each access decision is consistent with meeting the functional purpose of the roadway.
- Access category is the functional guidance on day to day access decisions impacting the performance of the roadway.

Access Category Assignments

- Made at the highest level.
- Adopted as regulation
- Developed in cooperation with local government and regional planning agencies

ACCESS DECISIONS
Access Permitting Process
Permits Issued
Local Land Use Reviews
Access Management Plan Participation
Unit Reporting and Management
Local Agency Coordination
Traffic Impact Analysis Reports
Driveway Access Construction
Access Related Roadway Construction
Arizona Highway Projects
Roadway Design Driveway and Intersection Decisions
Project Related Access Closures
Access Management Plans
Right of Way Acquisition and Access Control
Project Related Access Closures
Access Management Plans
Interchange Design and Access Management of Approaches
Access Controls for Freeways
Planning
Move AZ
Budget Planning
Air Quality Benefits of AM
Data and Information
Right of Way Activities
Appraisal of Access Changes for Compensation Value
Acquisition Agent Guidance
Access Reductions by Acquisition
Access Change Damage Claims
Condemnation Proceedings Involving Access Issues and Damages
Local Agencies
Land Use Plans
Zoning Ordinances and Development
Subdivision and Exceptions
Traffic Impact Reports
Adopted Comprehensive Plans
Annexation and Growth Boundaries
Transportation Board
Access Policies
Budget Allocations
Capital Investment Strategies
Safety and Mobility Policies
ADOT Organizational Structure
ADOT Construction Practices
Adherence to Design and Driveway Decisions
Quality Assurance for Driveway Construction
Materials and Specifications for Private Access
Traffic & Safety Programs
Identification of High Crash Rates Related to Access
Identification of Access Related Congestion
Crash Histories and Reporting Requirements
Access Related Safety Project Funding

Arizona Access Management Program
Work Flow Diagram
Project Start-Up
Project Management Plan
Outreach Plan
Stakeholder Interviews
Legal Review
Establish Technical Advisory Committee
Conduct State-of-the-Practice Review
Nationally
State of Arizona
Define Program Vision, Goals & Objectives
Key Milestone #1
Review By:
TAC
Stakeholders (Workshops)
Transportation Board
Develop Program Framework
Policies
Procedures
Define Classification System
Develop System Data Sets
Establish Classifications
Identify Standards by Class
Key Milestone #2
Review By:
TAC
Stakeholders (Workshops)
Transportation Board
Program Implementation Strategies & Procedures
Administrative Structure
Role of Manual
Training
Outreach/ Program Information
Draft-Final Report
Key Milestone #3
Review By:
TAC
Stakeholders (Workshops)
Transportation Board
Final Report
Parametrix

Access Management

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Questions