DESIGNING FOR PEDESTRIAN SAFETY

Module 1

Logistics

- Health and safety (emergency exits, procedures for evacuation, etc.)
- Please silence your cell phones/pagers
- Breaks (when, restrooms, snacks)
- Lunch arrangements
- Other site-specific issues

Self Introductions

☐ Please tell us:

☐ Your Name and Title

☐ Your employer

☐ What is your ONE pedestrian safety issue?

Instructods:

- Peter Eun
- Transportation Safety Engineer
- FHWA Resource Center Safety & Design TST
- peter.eun@dot.gov
- 360-753-9551

- Dan Nabors
- Senior Transportation Engineer
- VHB
- DNabors@vhb.com
- 703-847-3071 x 5235

This is a workshop: Expect to do some work!

- Ask questions and issues as you have them
- May be covered in course material or
- Will be placed on the "Park Bench" for later
- Exercises, questions, and discussions –
  YOU provide the answers!
- Field trip: Assess the situation, apply the principles, and make recommendations
- Identify and prioritize potential policies and procedures

Designing for Pedestrian Safety Workshop Outcomes

- At the end of this workshop, you will be able to:

- Describe the influence of planning factors: land use, street connectivity, access management, site design, and level of service.

- Describe how pedestrians should be considered and provided for during the planning, design, work zone, maintenance, and operations phases.

- Describe how human behavior affects the interaction between pedestrians and drivers

- Identify good practices and effective solutions to enhance pedestrian safety and accessibility.

Overview of Pedestrian Safety Problem

- Annually almost 4,500 pedestrians are killed in traffic crashes, representing about 12% of all traffic deaths.

- Nearly 70,000 pedestrians are injured each year

- Most crashes occur when the pedestrian crosses a road

- Most fatalities and serious injuries occur on roads designed with little attention for pedestrian safety.

- Pedestrians are less likely to be killed in walkable environments.

Pedestrian Fatalities by Year U.S. Data

Pedestrian Fatalities
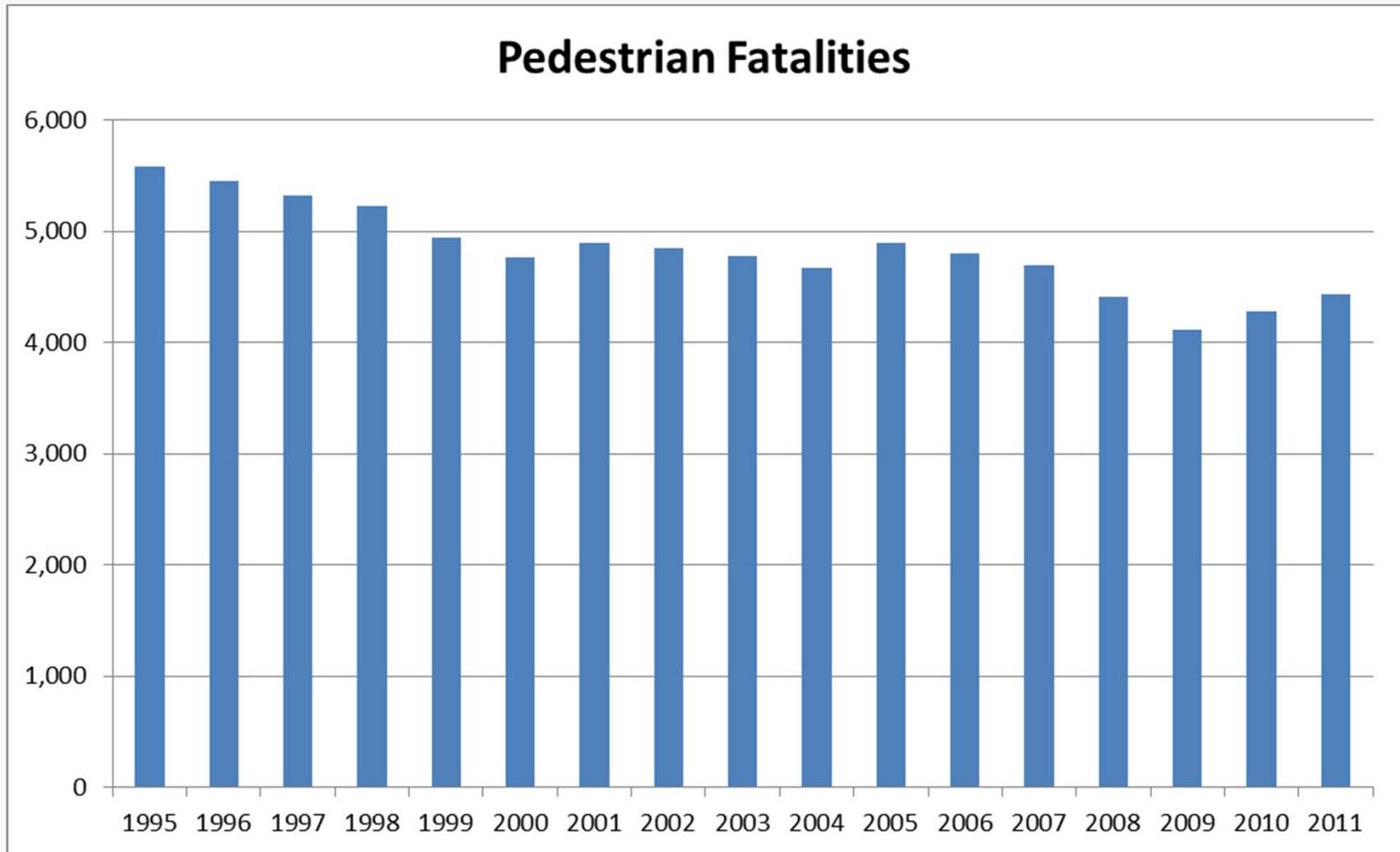
Pedestrian Injuries by Year U.S. Data
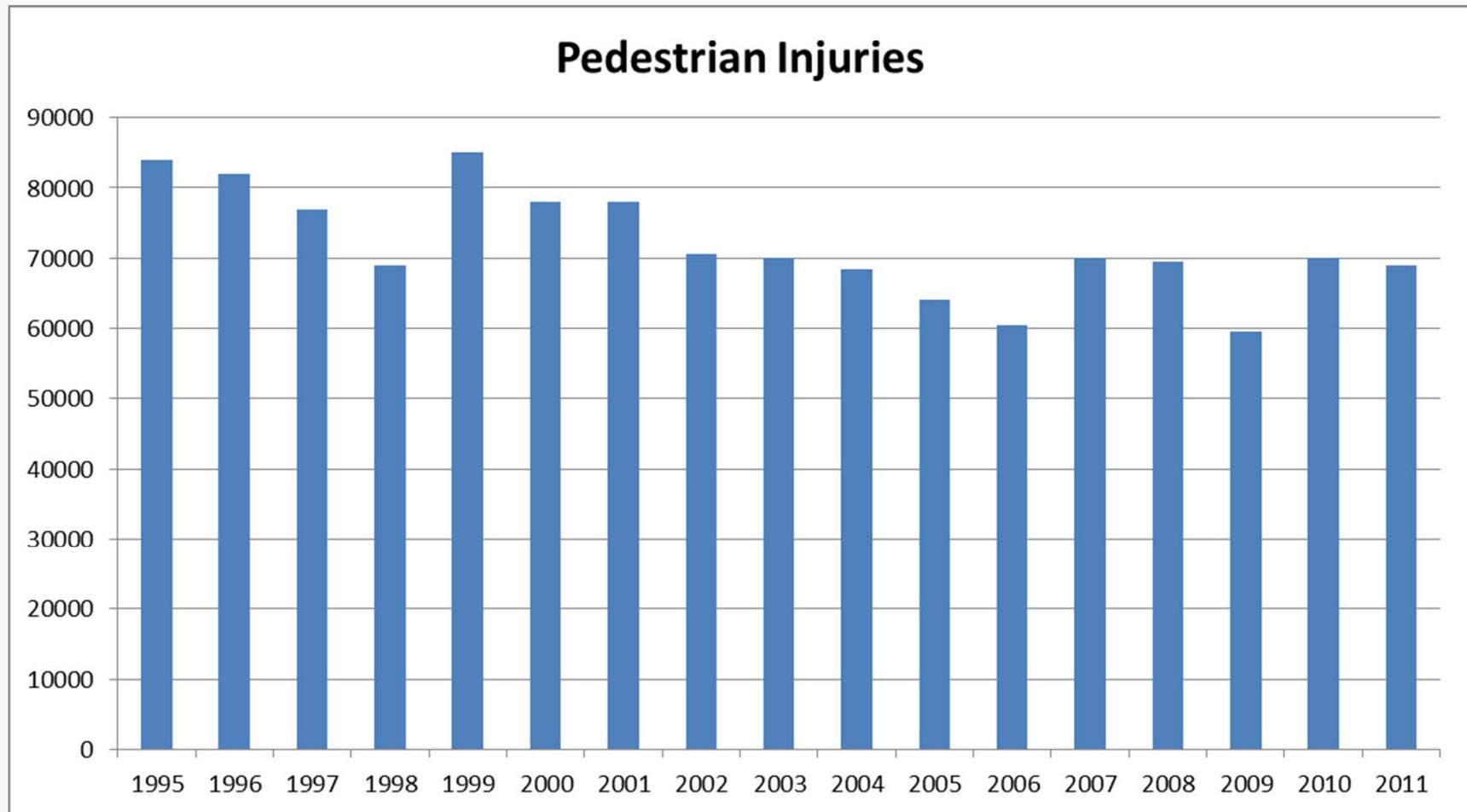
NY Pedestrian Fatalities

PED	2012	2011	2010	2009	2008	2007	2006	2010-12	2007-09
STATEWIDE	312	296	311	307	302	272	315	306	294
Putnam	2	3	1	4	0	1	0	2	2
Rockland	4	3	4	2	2	3	8	4	2
Westchester	11	7	5	9	11	7	9	8	9
Bronx	17	28	27	25	22	13	23	24	20
Brooklyn	41	46	39	44	52	53	43	42	50
Manhattan	32	30	29	35	38	35	46	30	36
Queens	37	36	43	47	34	26	34	39	36
Staten Island	8	3	11	7	5	8	10	7	7
Nassau	39	19	32	33	27	27	30	30	29
Suffolk	41	47	34	29	32	29	26	41	30
Total	232	222	225	235	223	202	229	226	222

NY Pedestrian Injuries

PED	2012	2011	2010	2009	2008	2007	2006	2010-12	2007-09
STATEWIDE	15607	15689	16090	15321	15317	15472	15369	15,795	15,370
Putnam	15	13	19	17	20	11	19	16	16
Rockland	152	138	158	159	127	119	132	149	135
Westchester	541	569	580	514	547	551	569	563	537
Bronx	1589	1403	1821	1703	1729	1726	1645	1,604	1,719
Brooklyn	3524	3572	3793	3519	3500	3397	3384	3,630	3,472
Manhattan	2964	2958	2709	2573	2938	3171	3290	2,877	2,894
Queens	2316	2334	2413	2364	2237	2240	2115	2,354	2,280
Staten Island	416	393	348	284	318	325	310	386	309
Nassau	996	981	1000	950	904	904	953	992	919
Suffolk	559	625	524	572	558	575	540	569	568
Total	13072	12986	13365	12655	12878	13019	12957	13,141	12,851

Agenda overview

- Planning factors: land use, street connectivity, access management, site design, and level of service
- Walking along the road: Effectiveness of sidewalks
- Street crossings: Human behavior, midblock crossings, crosswalks, medians, signals, over/under-crossings
- Pedestrian-friendly intersections: Geometry, radii, curb extensions, islands, crosswalks
- Signalized Intersections: Making them better for pedestrians
- Interchanges: Providing pedestrian safety and accessibility
- Roundabouts: Making them work for pedestrians
- Transit: Stop locations & pedestrian crossings
- Road diets: Making room for pedestrians
- Field Exercise: Apply what we have learned
- Policy Discussion – Optional based on time

Why is it important to accommodate pedestrian safety and accessibility?

Because we are all pedestrians

Why?

Because many people do not drive

Why?

Because other modes depend on walking

Why?

Because it's good for business – people walk into stores

Why?

Because pedestrians use and belong on streets and highways

Why?

Because walking is healthy exercise

Why?

Because it will make roads safer for all road users

Why?

□ Myth: Accommodating pedestrians increases liability

□ Fact: ignoring a problem increases liability

□ A good solution is to identify the problem and have a plan to address it.

"A Circuit Court civil jury … awarded $3.3 million to relatives of a woman killed by a motorist as she walked on a stretch of Pennsylvania Avenue that did not have a sidewalk or guard rails. The jury found the state of Maryland liable in the wrongful death lawsuit, and voted to award $2.5 million to Kayla Martin, the daughter of Kelay Smith, who was struck and killed by a motorist on Aug. 12, 2008."

--Washington Post; March 11, 2011

□ To reduce liability

Why?

AASHTO: "Because of the demands of vehicular traffic in congested areas, it is often extremely difficult to make adequate provisions for pedestrians. Yet this should be done, because pedestrians are the lifeblood of our urban areas…"

(2011 edition, AASHTO Green Book, page 2-78)

Why?

☐ USDOT Policy Statement on Bicycle & Pedestrian Accommodation (Announced March 15, 2010)

☐ Every transportation agency, including DOT, has the responsibility to improve conditions and opportunities for walking and bicycling and to integrate walking and bicycling into their transportation systems

It's also been Federal Policy since ISTEA (1991)

U.S. Transportation Secretary Anthony Foxx

Why?

☐ USDOT Policy Statement – Actions to integrate non-motorized modes into future projects:

☐ Consider walking and bicycling as equals with other transportation modes;

☐ Ensure convenient choices for people of all ages and abilities;

☐ Go beyond minimum design standards;

☐ Collect data on walking and biking trips;

☐ Set mode share targets for walking and bicycling

☐ Maintain sidewalks paths, including snow removal

☐ Improve non-motorized facilities during maintenance projects.

Resources
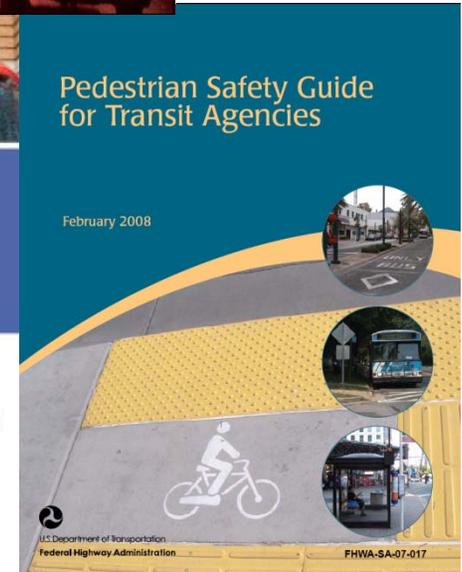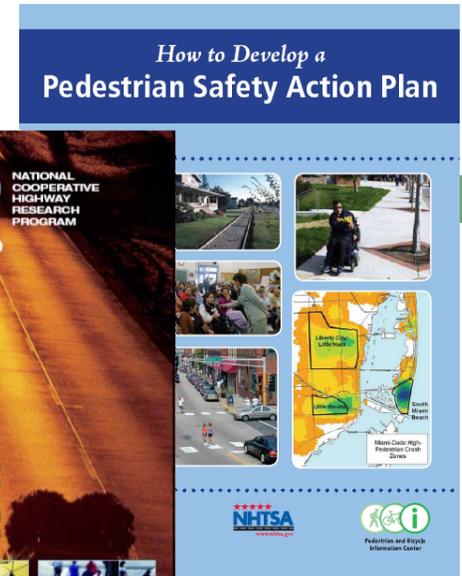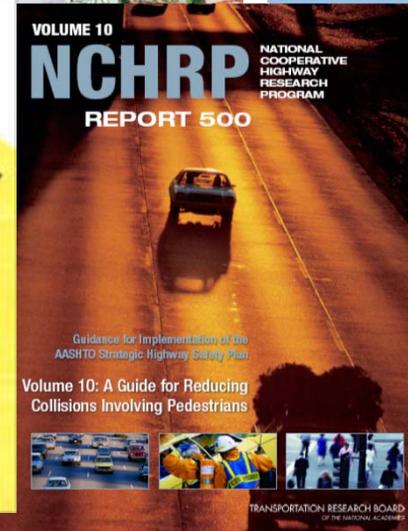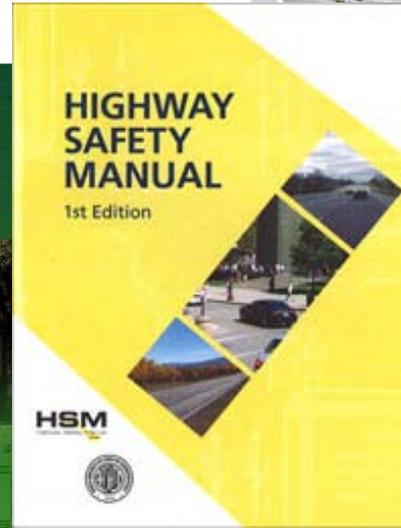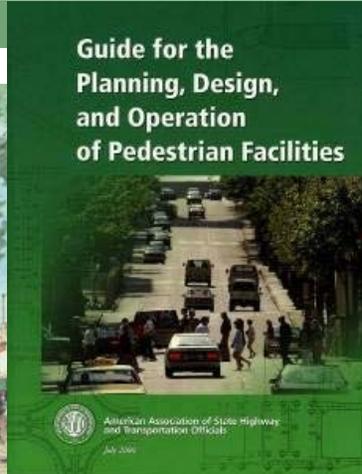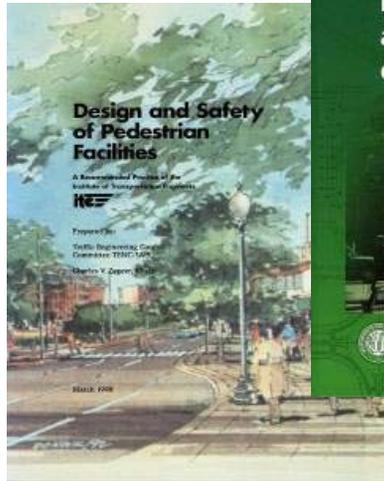
PBIC: www.walkinginfo.org

FHWA: safety.fhwa.dot.gov

NHTSA: nhtsa.dot.gov

ITE: www.ite.org

AASHTO/NCHRP: safety.transportation.org

Highway Safety Manual

- ☐ **Science-based technical approach for safety analysis**

- ☐ AASHTO HSM Website:
  - ❏ www.highwaysafetymanual.org
- ☐ FHWA HSM Website:
  - ❏ http://safety.fhwa.dot.gov/hsm/
- ☐ TRB Highway Safety Performance Committee Website:
  - ❏ www.safetyperformance.org
- ☐ FHWA RC HSM Webinar Series
  - ❏ http://www.highwaysafetymanual.org/Pages/FHWAResourceCenterHSMWebinarSeries.aspx
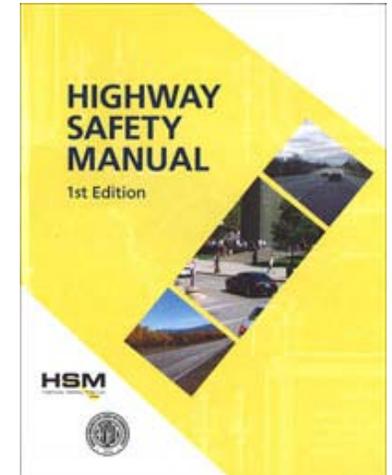
Calculating Reduction in Number of Crashes

Crash Modification Factor (CMF): factor used to compute the expected number of crashes after implementing a given countermeasure.

Crash Reduction Factor (CRF): % fewer crashes experienced on a road with a given countermeasure than on similar road without the countermeasure

Relationship between CMF and CRF:

CMF = 1 - (CRF/100)

CRF = 100*(1 – CMF)

CMF/CFR Clearinghouse: www.cmfclearinghouse.org

CMF - Important Concepts

☐ May apply to all crashes, or crash specific subsets (e.g., run-off-road, night, wet weather, multi-vehicle, etc.)

☐ Same treatment in different contexts or highway types may have different effects and different CMF values

Planning elements that affect pedestrian safety:

- Land Use

- Street Connectivity

- Access Management

- Site Design

- Level of Service

Land Use

Why do we have cities?

To minimize travel & maximize exchange (to be closer together)

How have we built our urban roadway system?

To facilitate travel over longer distances

Reducing travel demand is best achieved through _Land Use_ policies that bring destinations closer together

- The problem:

- Commercial activities concentrated in auto-dominated corridors.

- Segregated land uses

- Result: long travel distances, not conducive to walking

Potential solutions?
1. Allow small-scale retail in neighborhoods
2. Create neighborhood parks
3. Site school closer to residences & parks

School

Commercial

ZONING LEGEND

Commercial	
Industrial	
Residential	
Open Space	
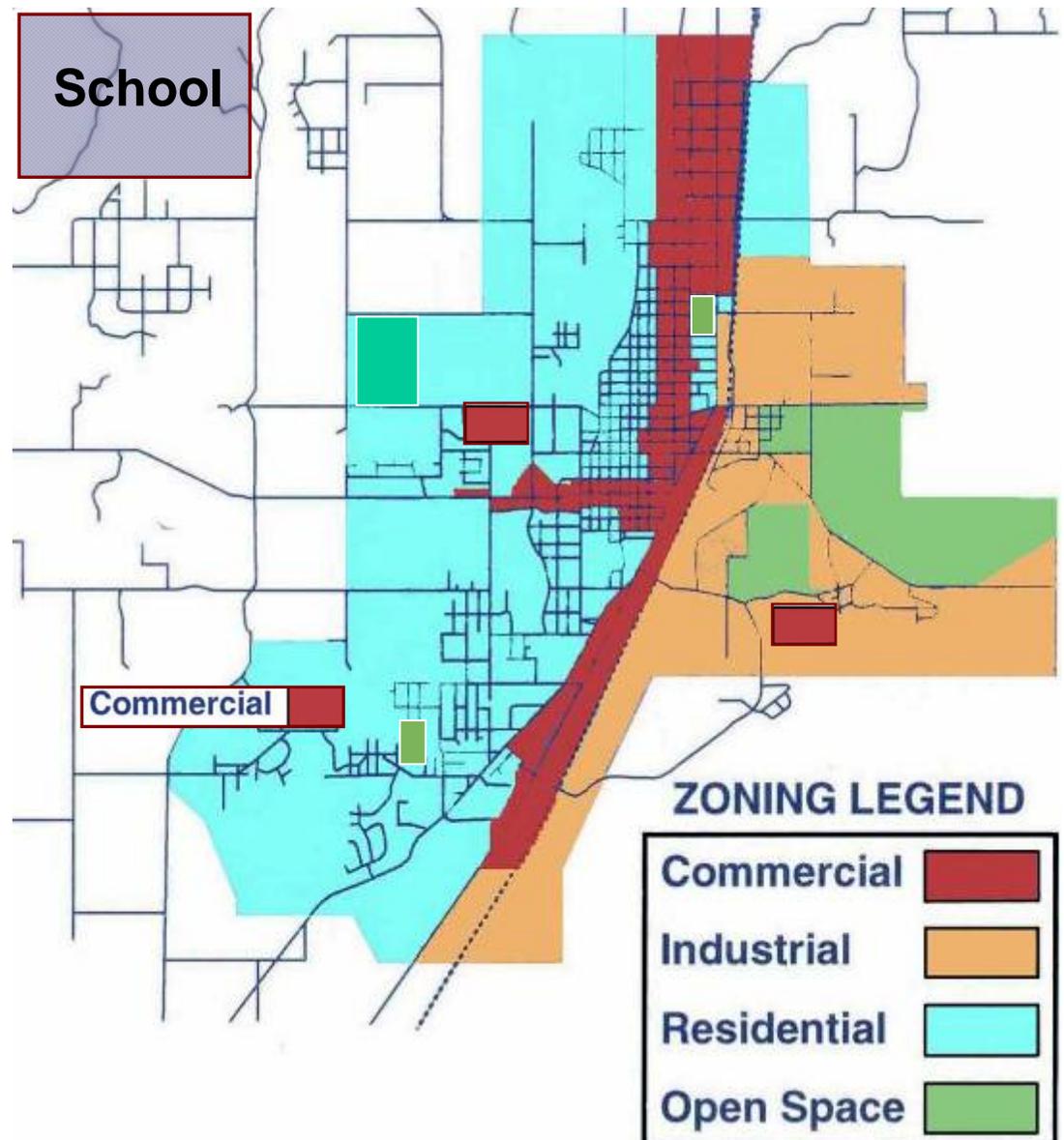
Madison WI

Neo-traditional development: destinations are close to residential areas

Street Connectivity

Connected Streets

Lollipop pattern

<- 1 mile square ->   School

Market

<- 1 mile square ->   School

Market

3 left turns!
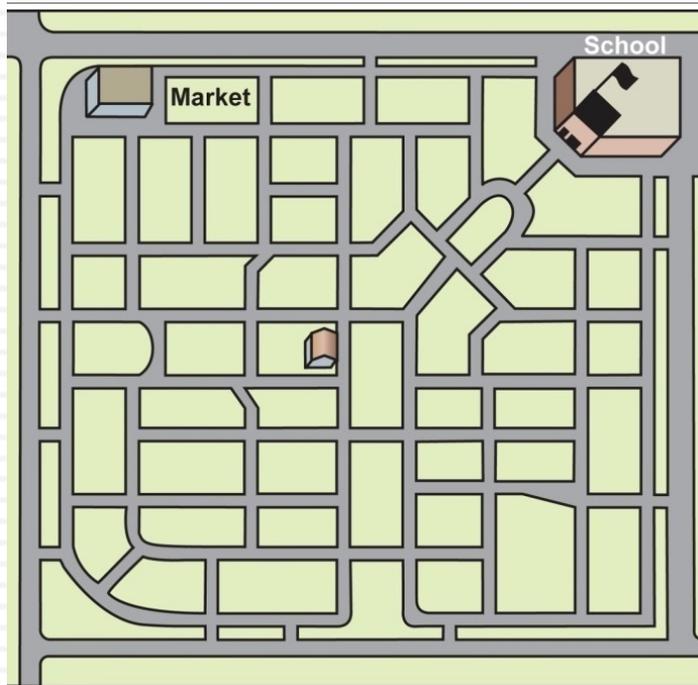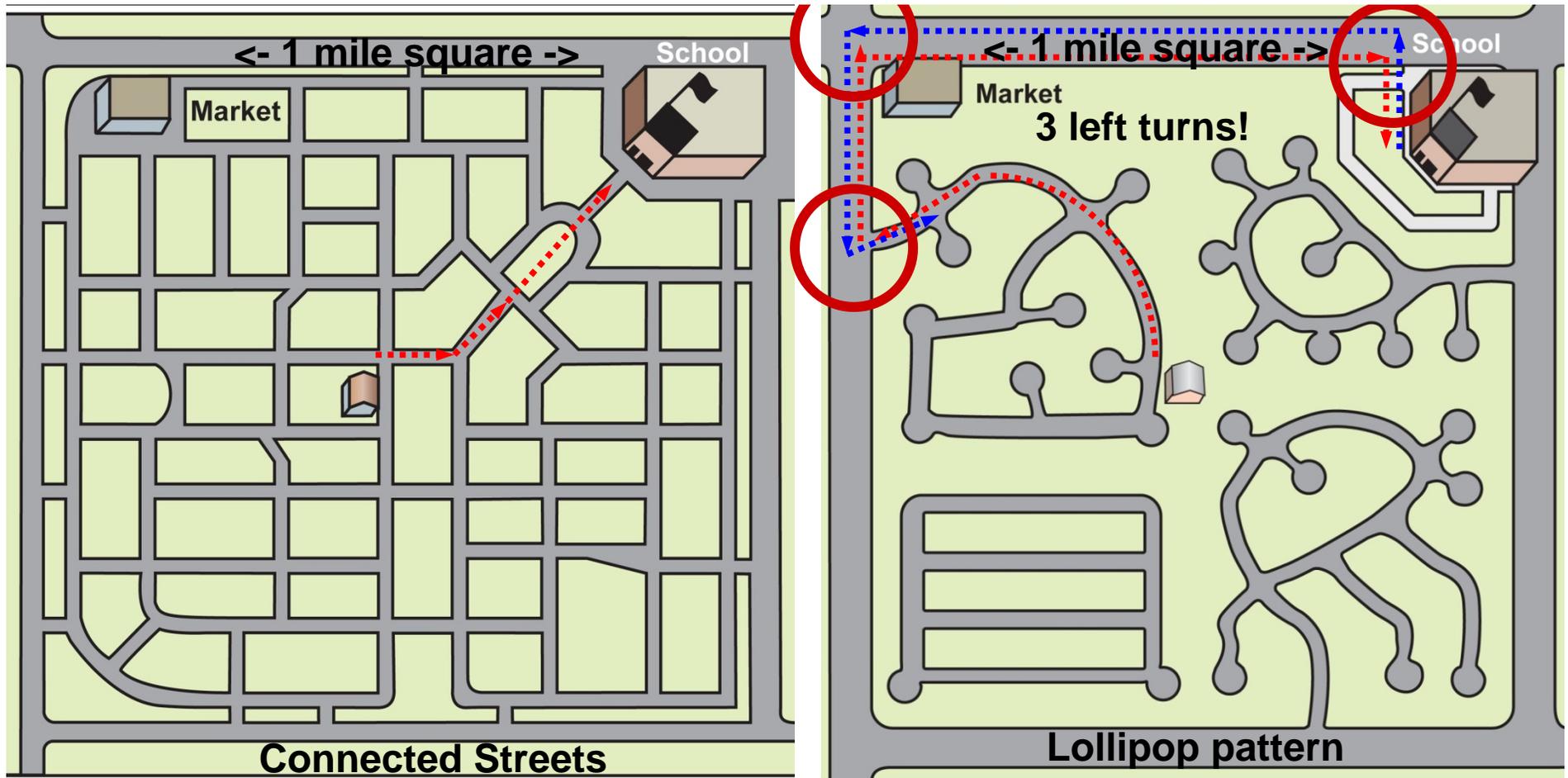
- ☐ Connectivity creates a walkable street system by:

- ☐ Reducing walking distances;

- ☐ Offering more route choices on quiet local streets;

- ☐ Dispersing traffic – reducing reliance on arterials for all trips

You live here, your child wants to visit a friend who lives not far away; how do you get there?

Cul-de-sac patterns increase walking distances & increase reliance on arterials

<- 1 mile square ->

School

Market

Lollipop pattern
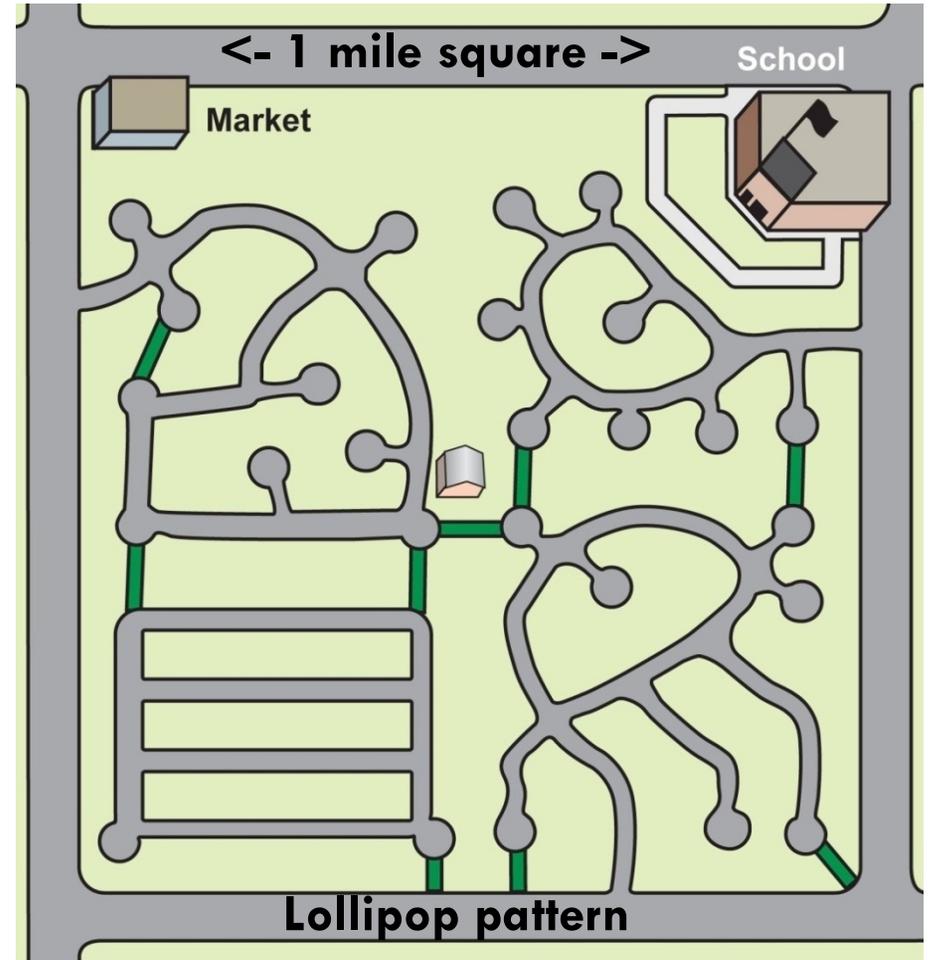
Can you increase connectivity with paths, greenways?

- ☐ Reduces walking distances: YES
- ☐ Offers more route choices: YES
- ☐ Disperses traffic: NO
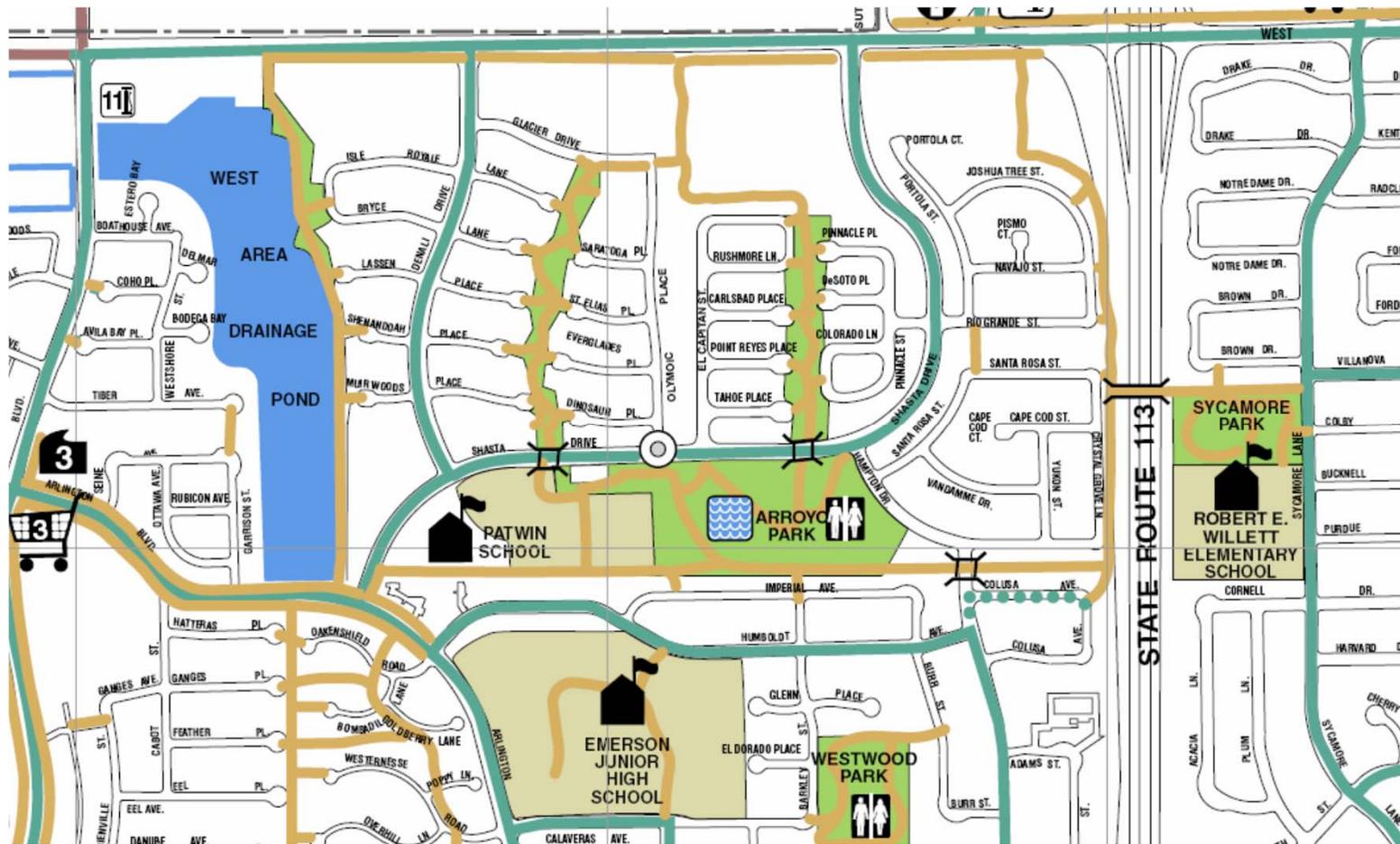
☐ Dedicate R.O.W. to link cul-de-sacs with linear parks

☐ Land Use & Connectivity: Schools next to parks.

High Connectivity
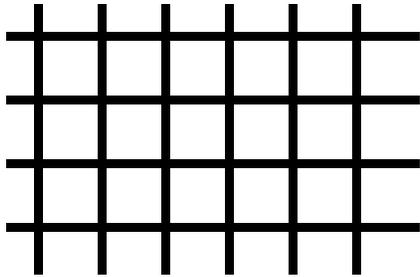
Moderate Connectivity
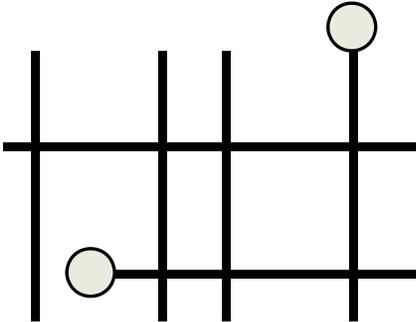
Low Connectivity
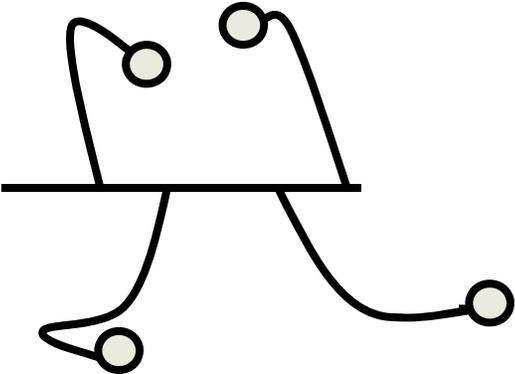
Travel Lanes Required
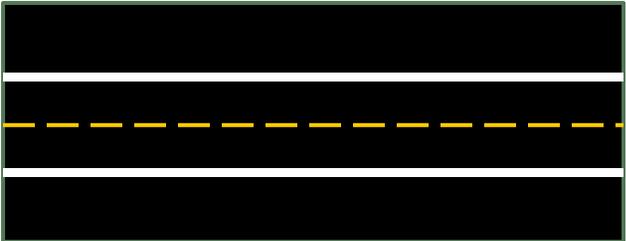
Lack of connectivity => overly wide streets

Lack of connectivity => few but large intersections

Access Management

Every driveway is a potential conflict

- Drivers and pedestrians must make choices:

- Walk in front or in back? Pull forward or back up?

Access Management => fewer conflicts at driveways
## 2 techniques: (1) median (no left turns) (2) consolidate driveways
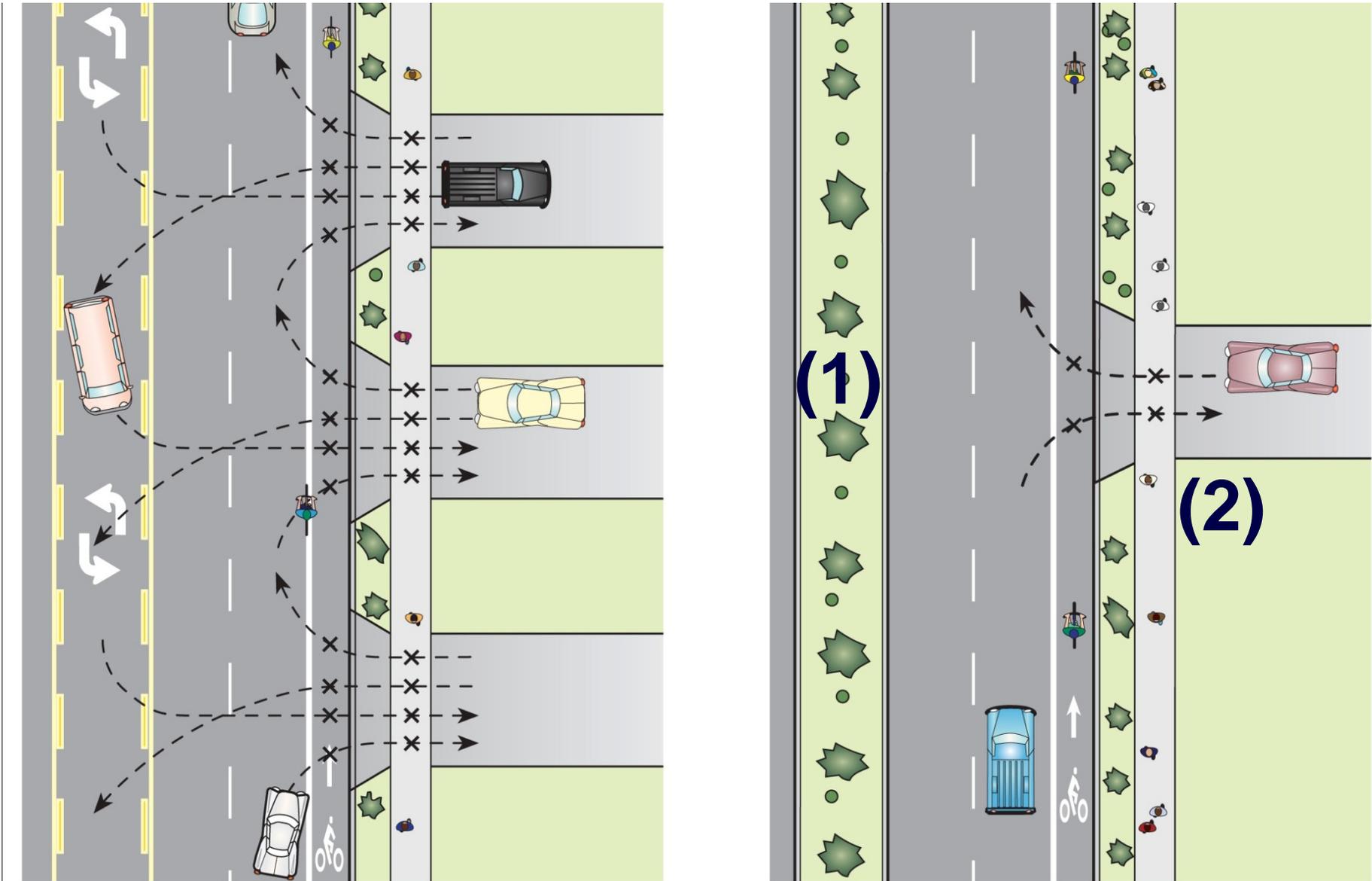
Which has greater crash reduction factor:
(1) Median (no left turns) or
(2) consolidate driveways?

(1)

(2)
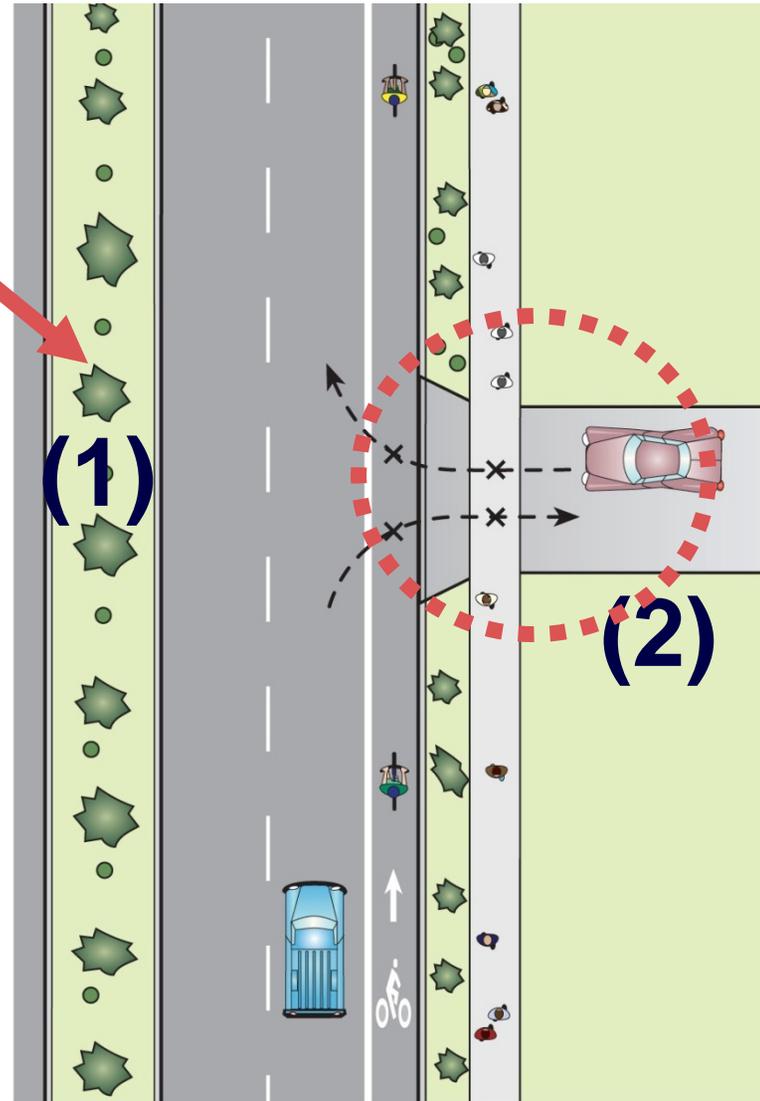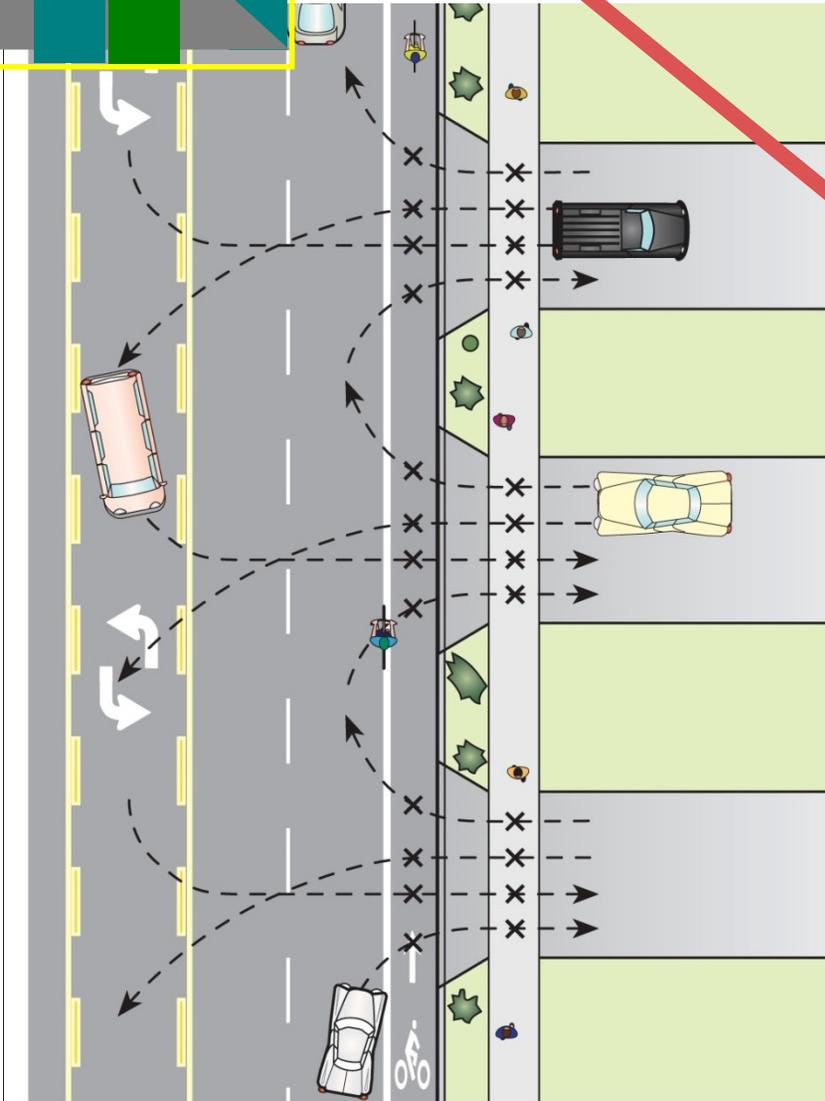
Driveways can be closed for safety

Severing public streets not a desirable access management technique

Non-traversable barrier

Possible bicyclist and pedestrian movement
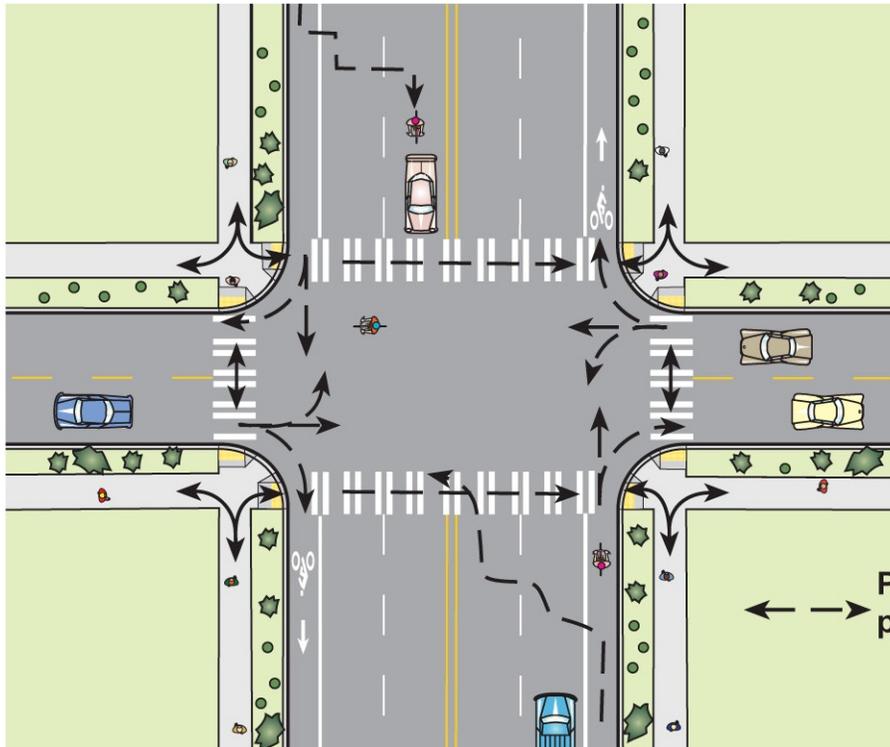
Available crossings and movements before access control
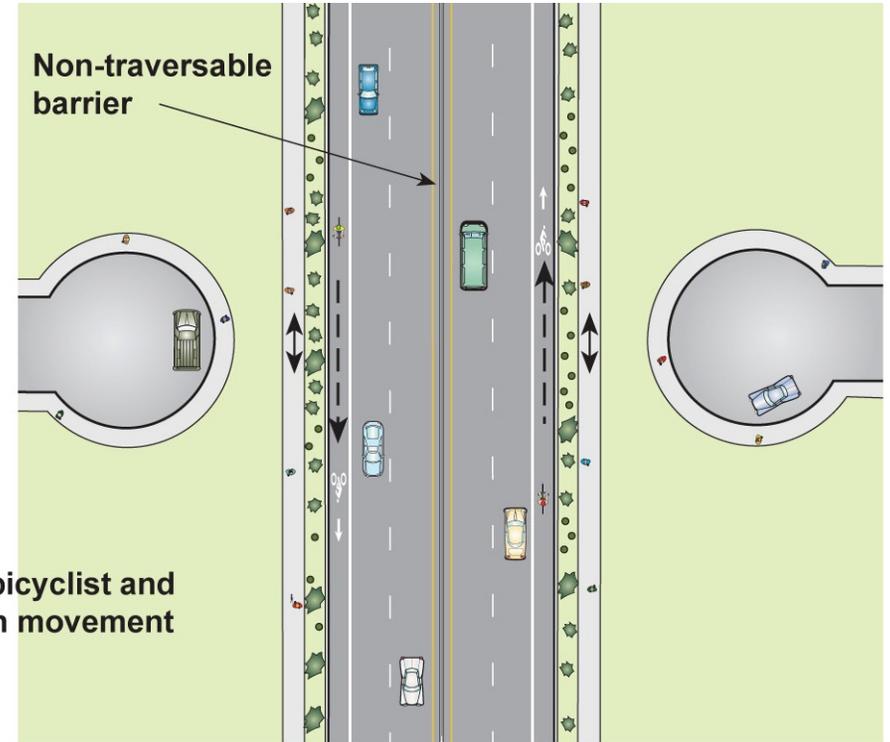
Available crossings and movements after access control

This limits people's ability to walk or bicycle
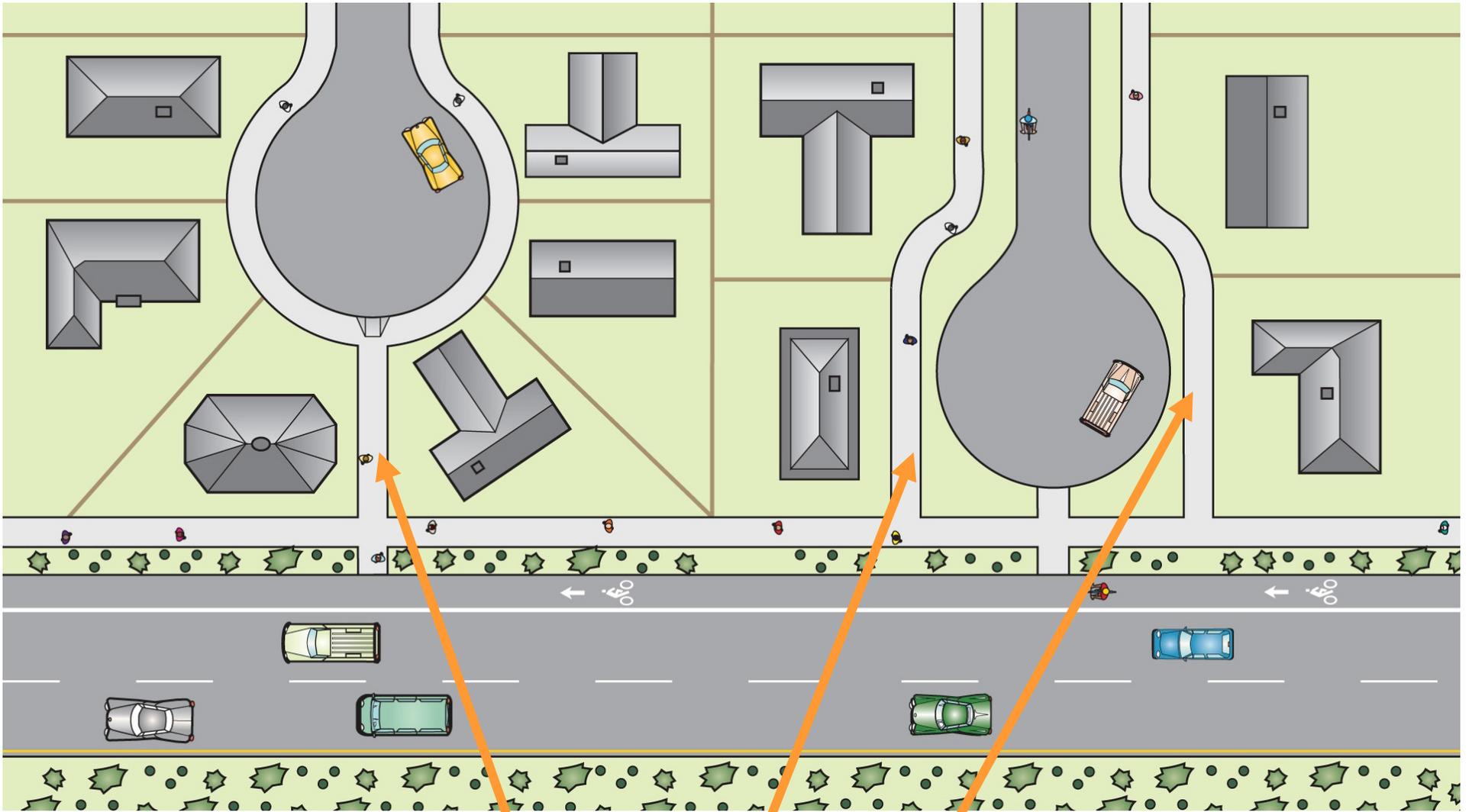
**Connecting severed streets reestablishes walking routes**
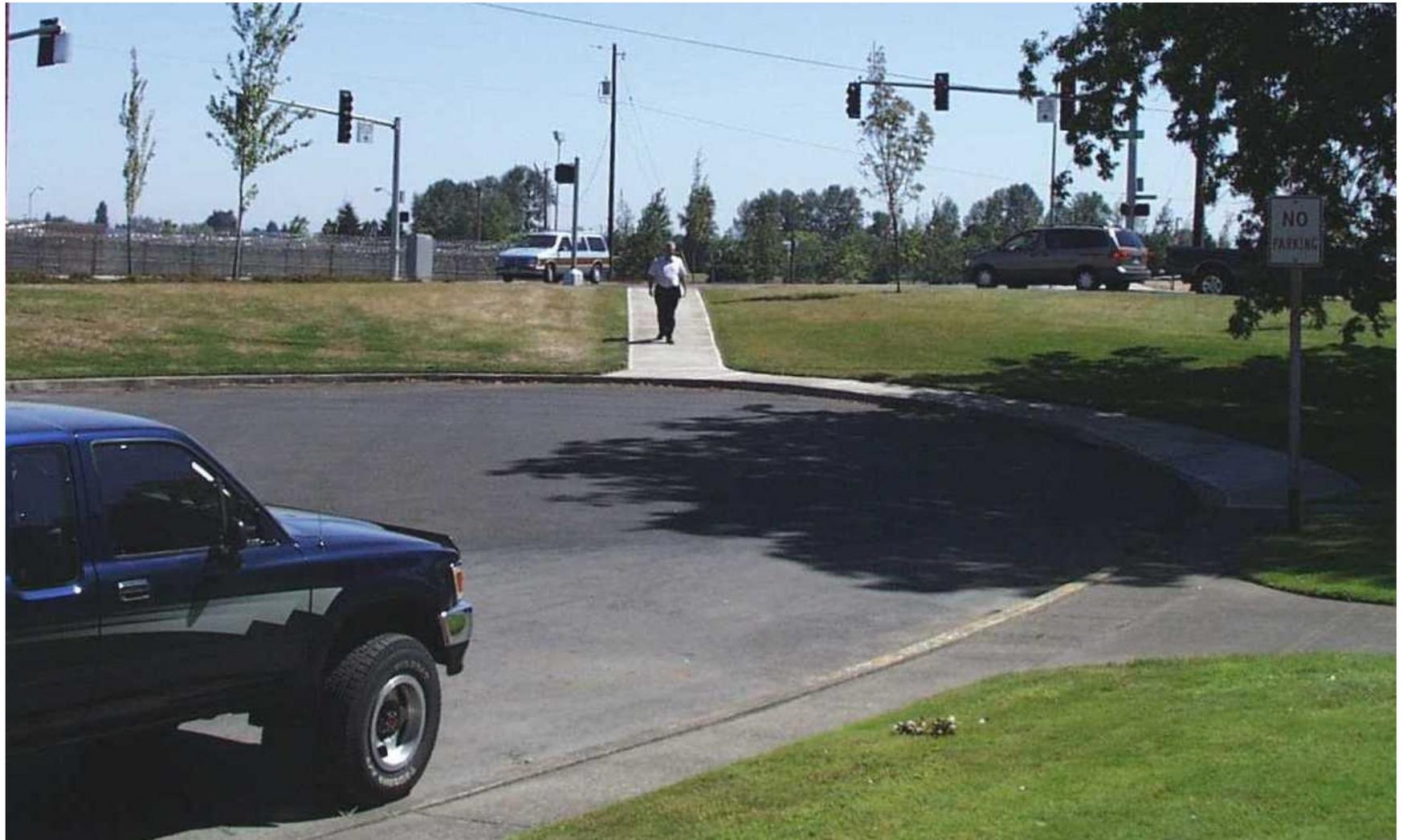
Severed street can be reconnected for pedestrians

1-50 Site Design

Bringing Buildings closer to the Street

- Creates a street where drivers know to expect pedestrians
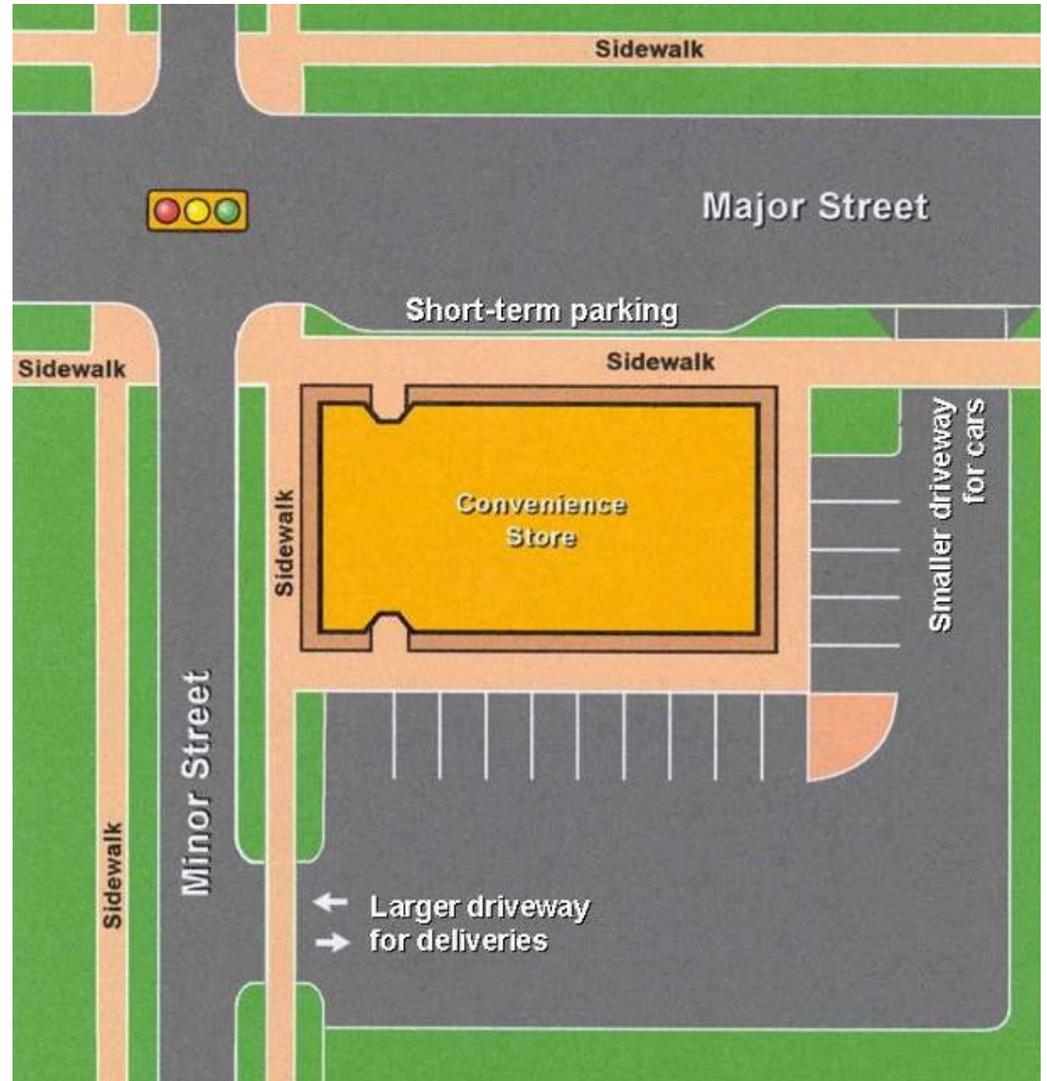
Parking between sidewalk and building is not pedestrian-friendly

Doylestown PA

# Building at back of walk: pedestrian-oriented design

*Designing for Pedestrian Safety - Introduction*

- Fast food typically favors drive-thru over walk-ins
- Pedestrians must cross drive-thru lane

Alternative design: Direct pedestrian access is provided with no vehicular conflicts

Parking and drive through are still provided

Designing for Pedestrian Safety - Introduction

Cars enter back here

☐ Even a gas station / convenience store can be built with pedestrian friendly design, at back of walk

Accessible Parking Space

Store

Landscape Bulbout

"Ped Way"

Sidewalk

Wheaton IL
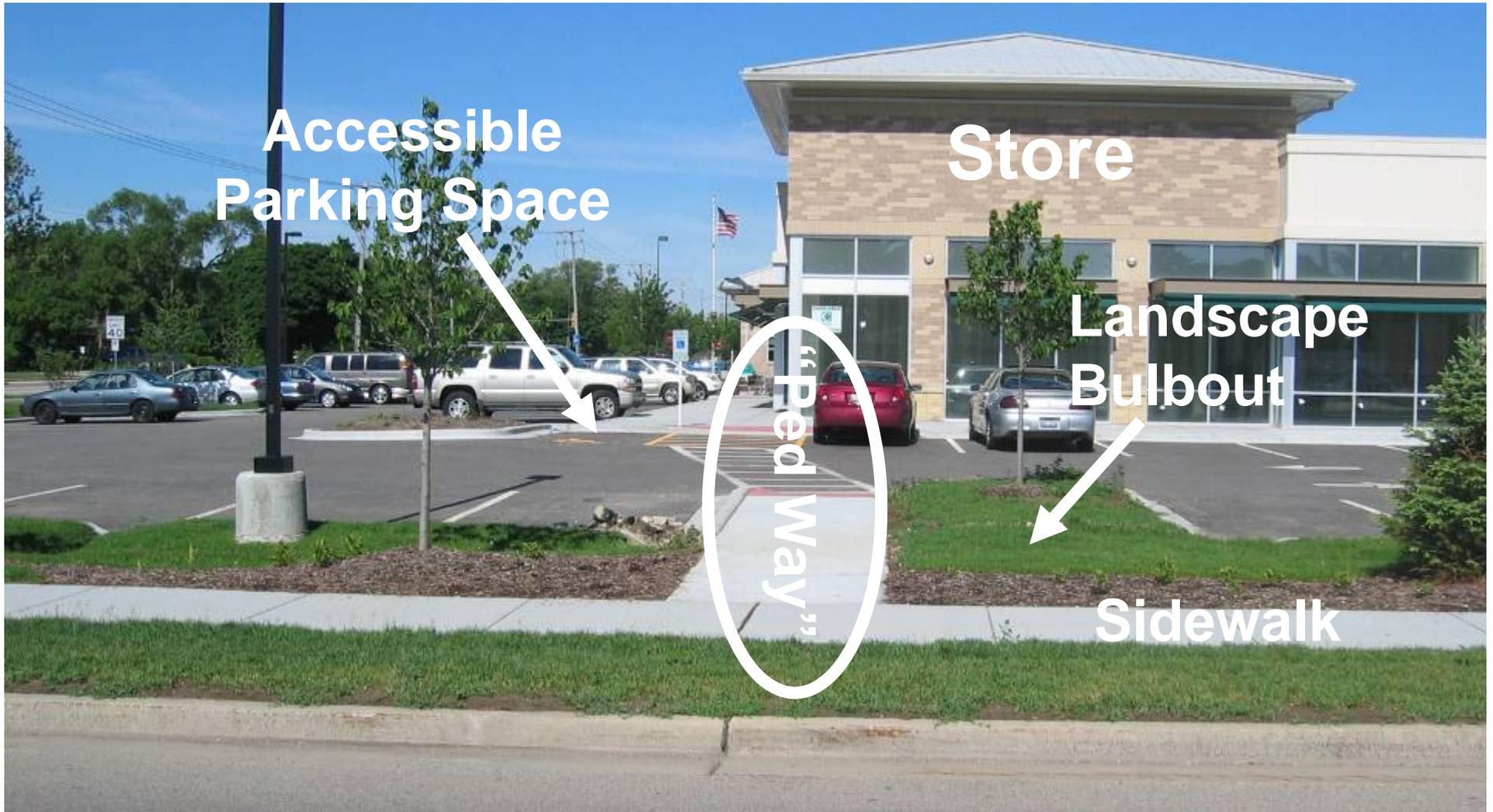
Pedway retrofitted from sidewalk to building through parking

☐ Same principles apply to large-scale developments:

☐ Direct, safe & convenient access is provided

So desperate for parking, they cut down tree!

Poor Design: Drivers use sidewalk for backing

Designing for Pedestrian Safety - Introduction

Do your local ordinances support pedestrian-oriented planning and design?

☐ These goals are achieved by local ordinances, which must be enforced.

☐ They are beyond the scope of road designers, yet contribute greatly to the safety, comfort and aesthetics of the walking experience

•

1-62   Rethinking The Role of Urban Streets

Portland, OR

- A "complete street" accommodates many uses and provides for all purposes of a street:
  - Mobility (all modes)
  - Access to destinations
  - Thriving businesses
  - Beauty

Transforming a street

Narrow lanes; add bike lanes, median, trees, texture

Bring in buildings that face the street

# More buildings: Infill

The street now has life and is safer for pedestrians

Level of Service

The impact of LOS standards on street design and pedestrian safety

☐ HCM 2000 says LOS = A; little traffic, no impediments

☐ Result: very wide roads that reduce pedestrian safety

- HCM 2000: ped LOS = A; few people walking
- New HCM 2010: worse ped LOS due to poor quality

- HCM 2000: ped LOS = F; too many peds!
- New HCM 2010: considers quality and density for peds

HCM 2010 Approach

Interactions

□ **Multimodal evaluation for urban streets**

▪ Emphasizes combined evaluation of auto, bike, and transit modes
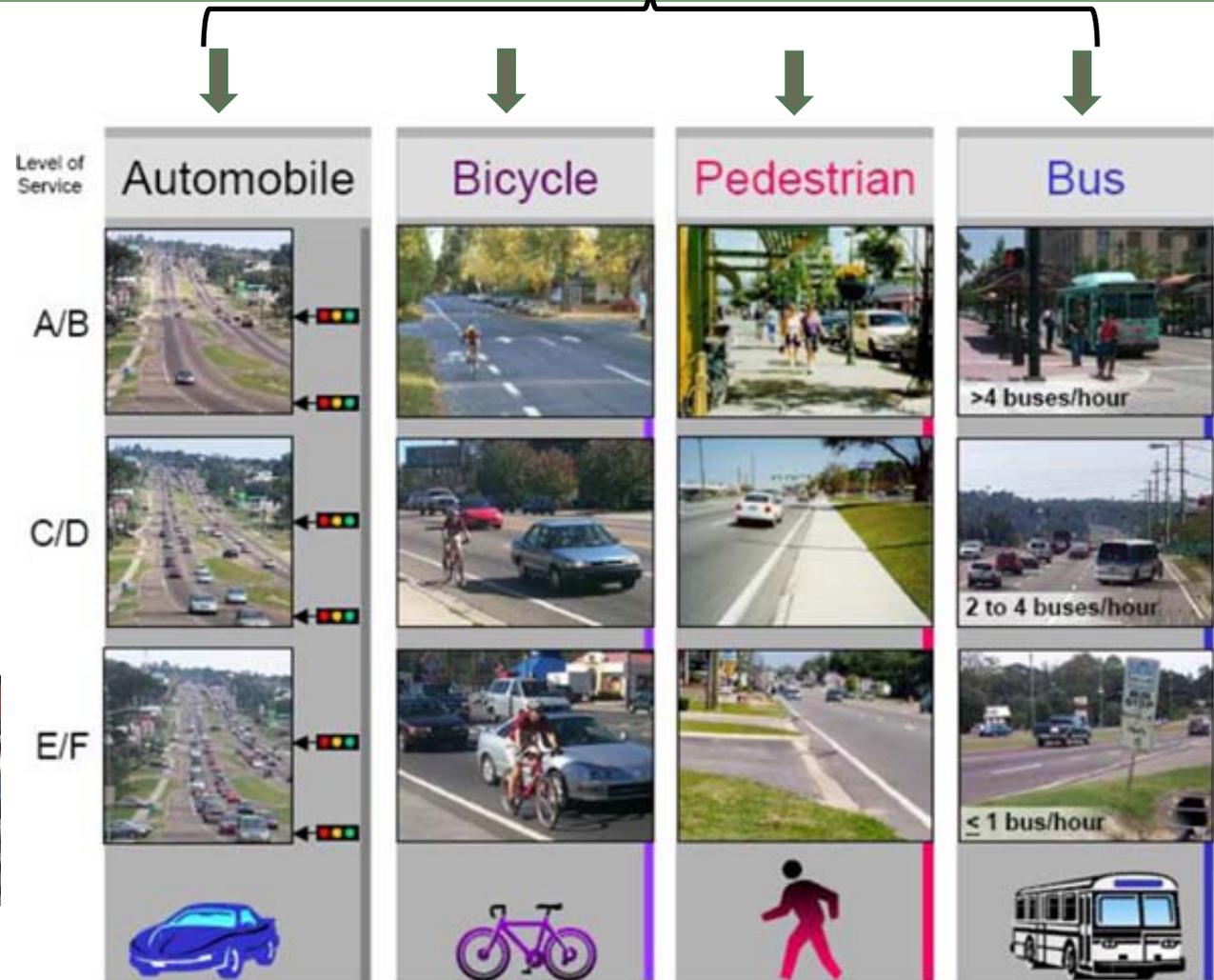
Streetfilms.org - NYC

NYC LOS A examples

Level of Service	Automobile	Bicycle	Pedestrian	Bus
A/B				>4 buses/hour
C/D				2 to 4 buses/hour
E/F				< 1 bus/hour

Designing for Pedestrian Safety - Introduction

Source: FDOT Quality/Level of Service Handbook

Pedestrian LOS

- LOS model determined from research on pedestrians' perceptions

- LOS models are provided for:

    - Urban street segments

    - Signalized intersections

    - Two Way Stop Controlled (TWSC) intersections

    - Roundabouts

   - Off-street facilities

Pedestrian LOS

- Urban street segments
  - Density of pedestrians and comfort / perceived exposure

- Signalized intersections
  - Pedestrian delay and perceived exposure

A= actual sidewalk width
E= effective sidewalk width

Pedestrian LOS

- ☐ TWSC intersections
  - ◪ Average pedestrian delay crossing major street
- ☐ Off-street facilities
  - ◪ Affected by bicyclists
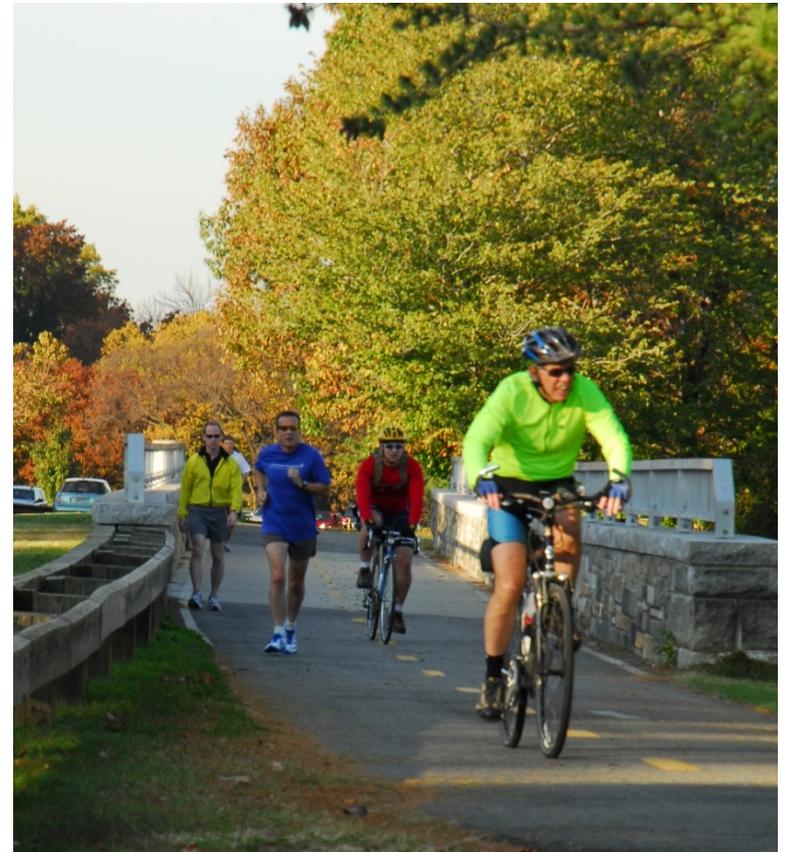
- Why are pedestrians at high risk on this street?

- Multi-lane roadway, high speeds

☐ Why are pedestrians at low risk on this street?

☐ Narrow roadway, low speeds, busy

What is the core safety issue?
## Pedestrians & drivers must use the street together

- Narrow cross-section
- Buildings close to street
- Sidewalks
- Crosswalk
- People!

What does the driver see that says "slow down, watch for pedestrians"? On-street parking

Designing for Pedestrian Safety - Introduction

- Reinventing the roadway:
- Transform a 5-lane commercial strip to …

- …a safer road for everyone
- Discussion: 1. What changed?
- Discussion: 2. What didn't change?
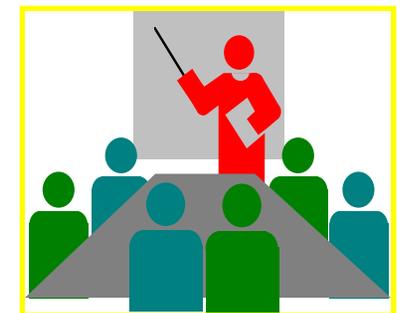
Let's Recap

☐ Why is it important to accommodate pedestrian safety and accessibility?

☐ How does the street environment influence drivers' and pedestrians' expectations and interactions?

☐ Where is the information?

☐ What planning factors influence pedestrian safety and accessibility?

Questions?