



SOCIETY OF TRAUMA NURSES



W E L C O M E

TRAUMACON

LAS VEGAS

March 30 - April 1

2022

PLANET HOLLYWOOD

# Comprehensive Strategies for Reducing Motor Vehicle vs. Pedestrian/Cyclist Collisions

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## Objectives

Participants should leave with a better understanding of:

- The magnitude of the problem of Motor Vehicle vs. Pedestrian/Cyclist Collisions
- The Root Causes, including Equity issues, associated with the problem
- The comprehensive strategies available to reduce the opportunity that motor vehicles will strike pedestrians or cyclists



My hope is that you will have an “Aha” moment or two when I finish this presentation. As you walk & drive around you will be more sensitive to both changes that have occurred in your environment and will now see opportunities for enhancements where they haven’t yet occurred.



I have nothing of a financial nature to disclose



Extremely limited scientific data on the effectiveness  
of many of the interventions I will talk about

Effectiveness for much of this is based on “Face Validity”



# We Can All Provide Face Validity

All of us are:

- Pedestrians or May Use Assist Devices such as Motorized Wheelchairs
- Most of us are Drivers
- Some of us are Cyclists

We can judge the effectiveness of these approaches on  
both our Driving Habits  
and our Perceived Safety as Pedestrians/Assist Device  
users or cyclists



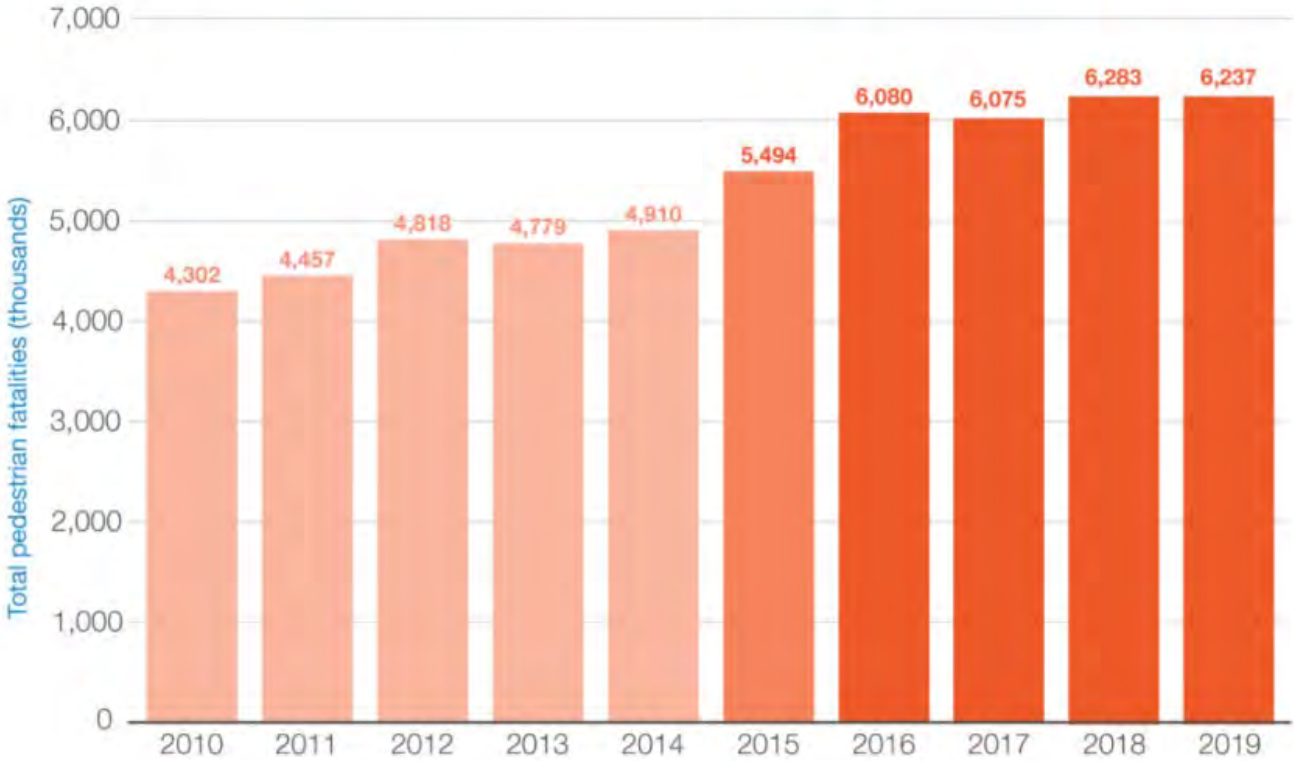
# Scope of Problem: Pedestrian-MV Collisions



### Magnitude of the Problem- United States

### Pedestrians

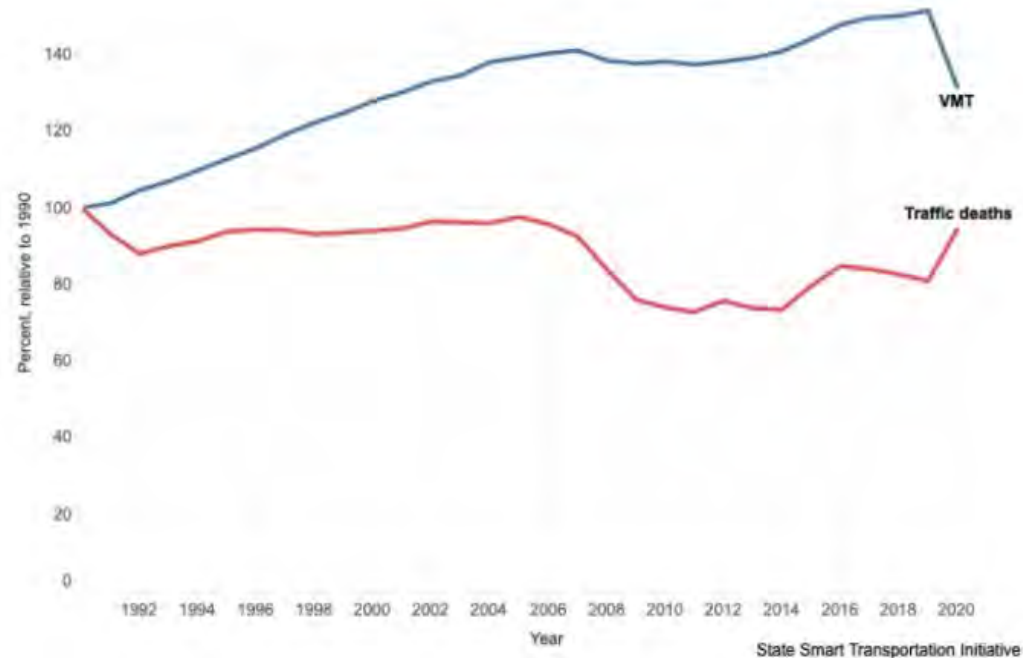
**45% increase in people struck and killed while walking**  
The last four years were the most deadly in three decades



Source: Dangerous by Design-2021, Smart Growth America & National Complete Streets Coalition







VMT= Vehicle Miles Traveled



STREET VIEW | MAR. 10, 2021

## Standstill Traffic May Be the Only Thing Keeping Crash Deaths From Skyrocketing

By Alissa Walker [@aawalkerLA](#)

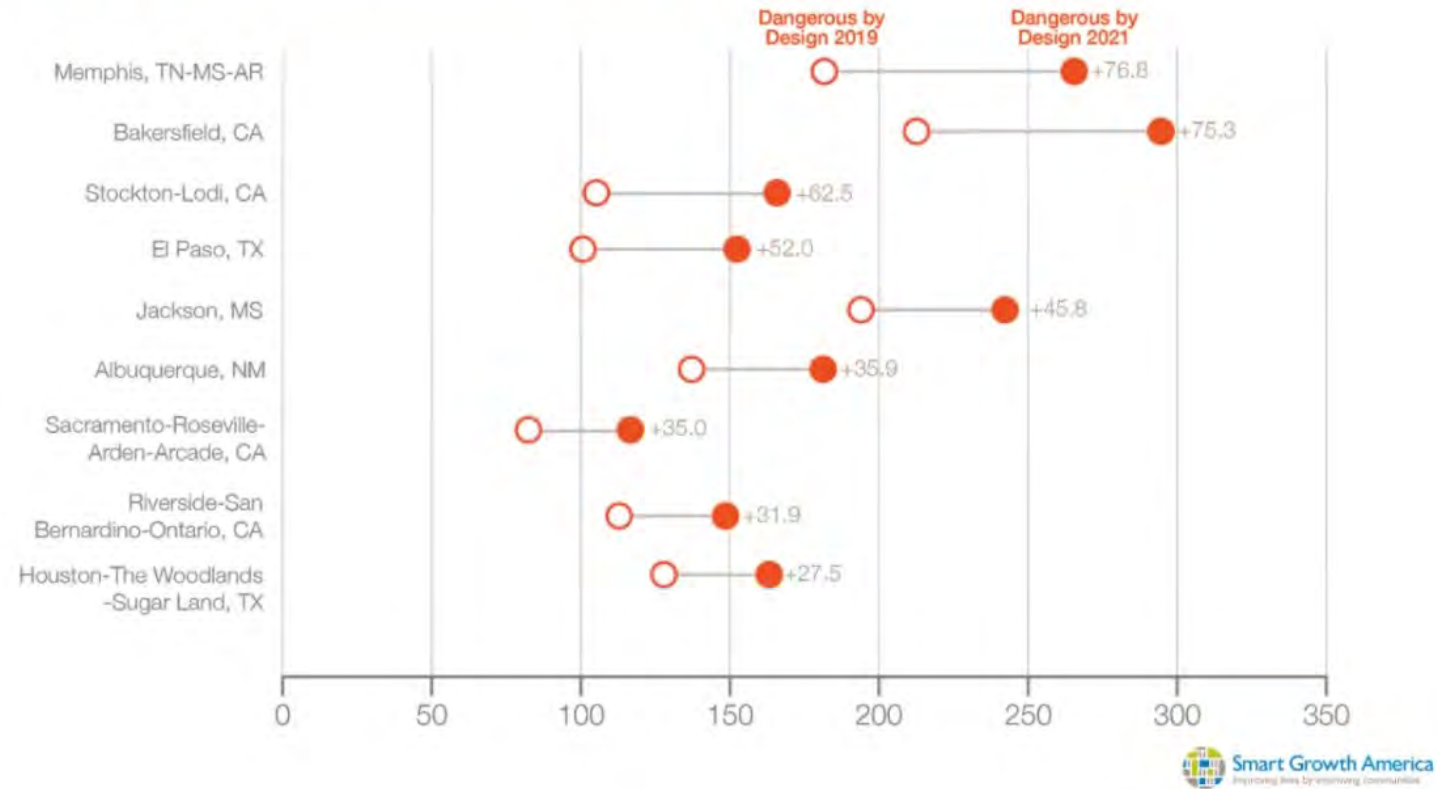
“Drive less,’ which is a fairly decent climate strategy, clearly won’t work as a pedestrian-safety solution unless other changes are made.”

- Alissa Walker / Curbed



# Pedestrian Danger Index

## MSAs with largest increases in 10-year PDI scores

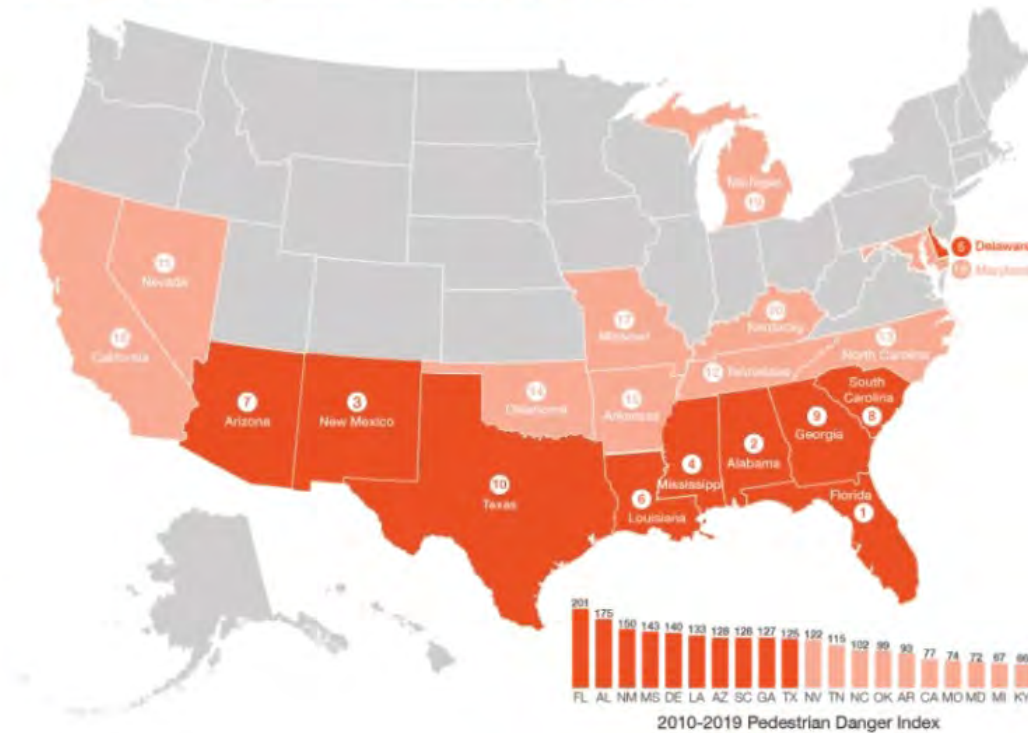


$$PDI = \left( \left( \frac{\text{Pedestrian Deaths}}{\text{Population}} \right) \times 100,000 \right) / \text{Percentage of Walking Trips}$$



# The Most Dangerous Places for Pedestrians

## THE TOP 20 Most dangerous states for pedestrians (2010-2019)



## Top 10 most dangerous states

Dangerous by Design 2019		Dangerous by Design 2021
Florida	1	Florida
Alabama	2	Alabama
Delaware	3	New Mexico
Louisiana	4	Mississippi
Mississippi	5	Delaware
Georgia	6	Louisiana
New Mexico	7	Arizona
Texas	8	South Carolina
Arizona	9	Georgia
South Carolina	10	Texas



# Rural vs. Urban Problem?

Rural pedestrian deaths  
per 100k population: **1.7**



Photo credits: Tom Mason, Dan Kostelec

Urban pedestrian deaths  
per 100k population: **1.6**





## People Don't Have Access to Safe Streets



Only 1 in 7 have access to streets that make walking safe and easy **and** have access to safe and convenient locations that support walking, such as walking trails, parks, and recreational facilities



Hyde, E.T., Omura, J.D., Watson, K.B., Fulton, J.E. and Carlson, S.A., 2019. [Step It Up! Prioritization of community supports for walking among US adults.](#) *American journal of health promotion*, 33(8), pp.1134-1143.





## People Driving Don't Follow Speed Limits



1 in 3

Only **33%** of people reported that they lived in neighborhoods where drivers followed the speed limit.

Carlson, S.A., Watson, K.B., Paul, P., Schmid, T.L. and Fulton, J.E., 2017. [Understanding the demographic differences in neighborhood walking supports](#). *Journal of Physical activity and Health*, 14(4), pp.253-264.



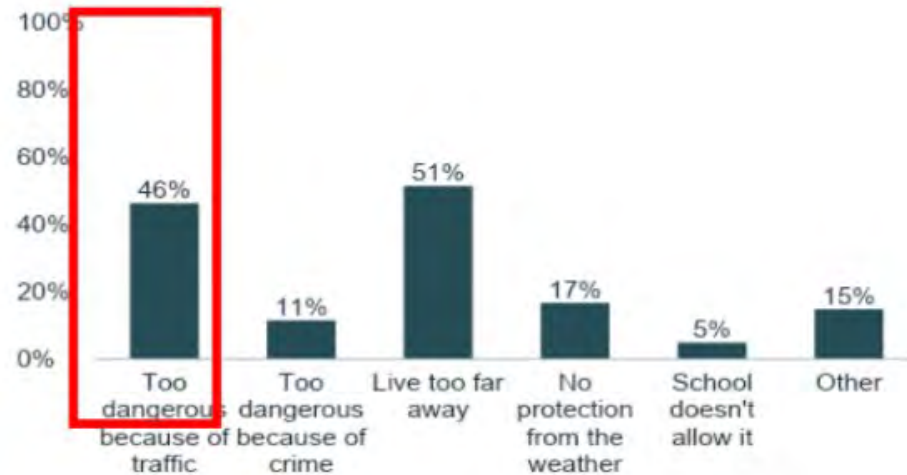


# Traffic Prevents Children from Walking to School

Center



Prevalence of Reported Barriers for a Child to Walk to School

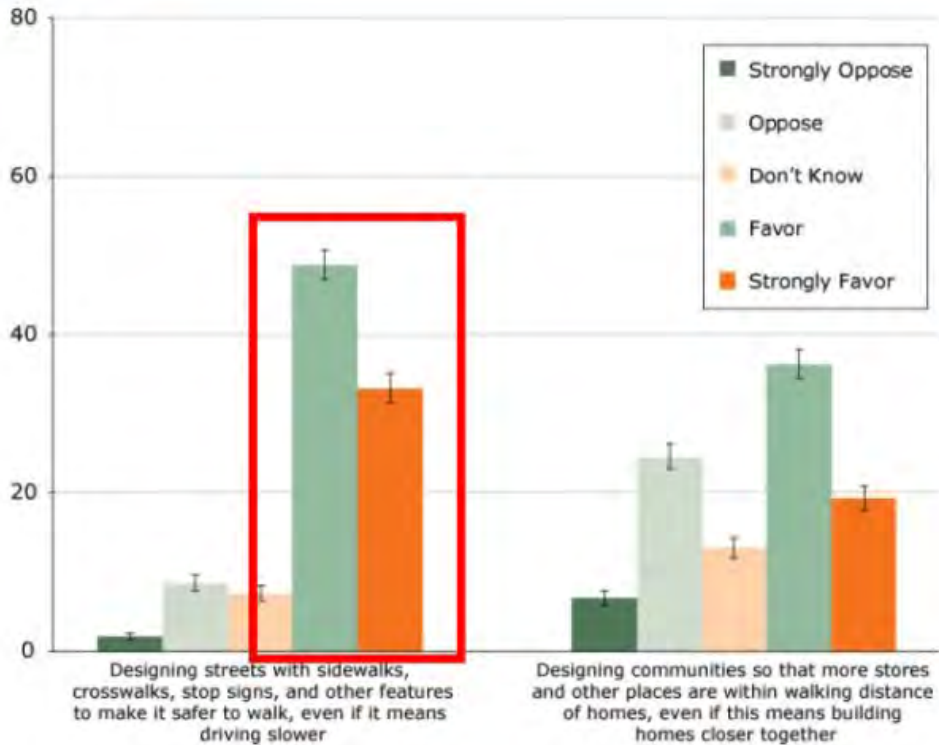


Omura, J.D., Hyde, E.T., Watson, K.B., Sliwa, S.A., Fulton, J.E. and Carlson, S.A., 2019. [Prevalence of children walking to school and related barriers—United States, 2017](#). *Preventive medicine*, 118, pp.191-195.





# People Want Safer Streets



82.2% of adults reported favoring (48.9%) or strongly favoring (33.3%) safer street design even if driving is slower.

Carlson SA, Omura JD, Watson KB, Fulton JE. [Creating Walkable Communities: Understanding Trade-Offs](#). Prev Chronic Dis 2018;15:180123

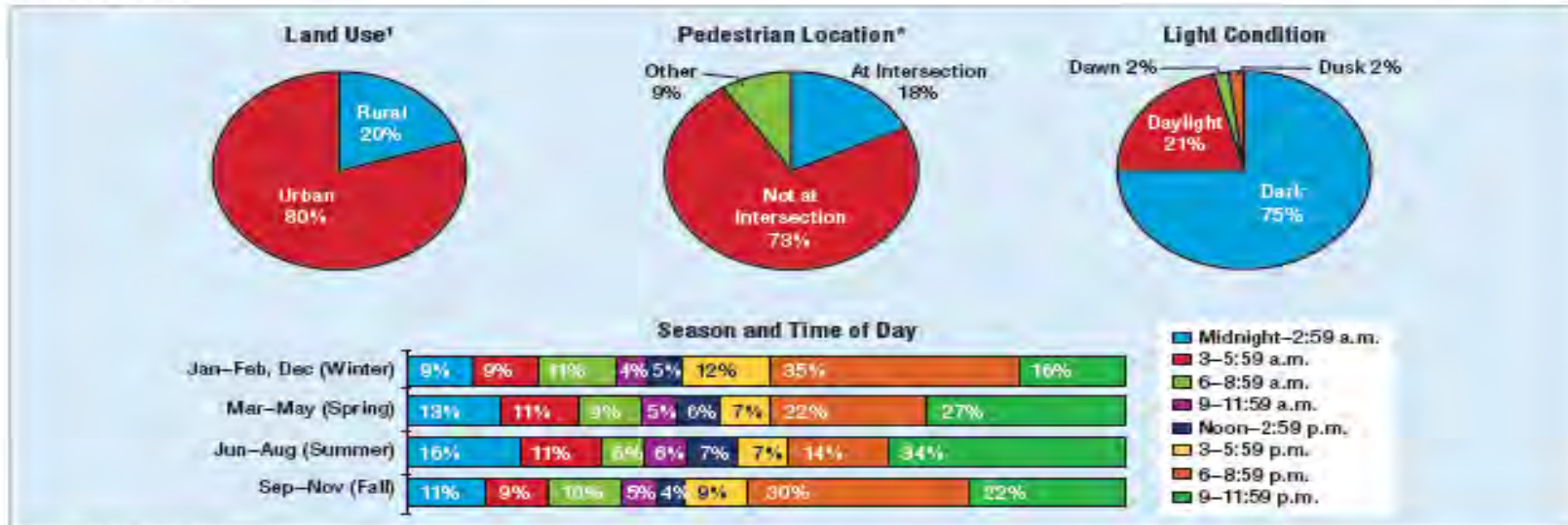




# Magnitude of the Problem-US

- National Numbers
  - ~6000 deaths annually
  - 16 pedestrians per day
  - ~16% of all traffic fatalities

Percentage of Pedestrian Fatalities in Relation to Land Use,<sup>1</sup> Pedestrian Location, Light Condition, and Time of Day and Season, 2017



Source: FARS 2017 ARF

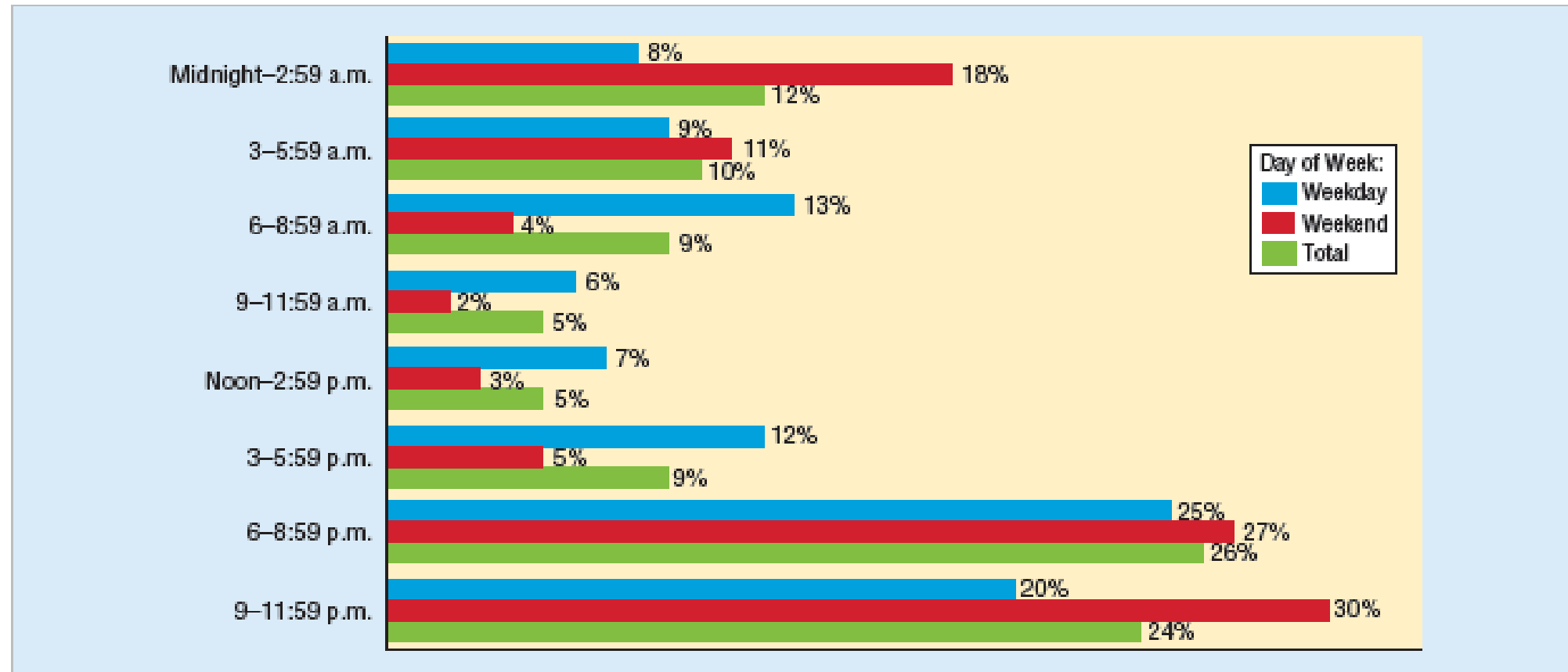
\*Based on location of pedestrian struck at the time of the crash. "Other" includes sidewalk, bicycle lane, median/crossing island, parking lane/zone, shoulder/roadside, driveway access, shared-use path, and non-traffic area, which may or may not have been at intersection, but were not distinguished by collected data. Thus, "At Intersection" and "Not at Intersection" do not include those in the "Other" category that were at intersection or not at intersection.

Note: Percentage values may not add up to 100% due to independent rounding. Unknown values were removed before calculating percentages.



# Magnitude of the Problem-US

Percentage of Pedestrian Fatalities, by Time of Day and Day of Week, 2017



Source: FARS 2017 ARF

Note: Weekday: 6 a.m. Monday to 5:59 p.m. Friday; Weekend: 6 p.m. Friday to 5:59 a.m. Monday



# Magnitude of the Problem-US

2/3 Male

55-59 & 75-79  
y/o highest

Males >80  
highest fatality  
group

32% of  
pedestrians  
with BAL  $\geq 0.08$

17% of drivers  
with BAL  $\geq 0.08$

Evening and  
Night highest  
risk time

Source: Traffic Safety Facts, National Highway Traffic Safety Administration, March 2019, DOT HS 812 681, 2017 Data

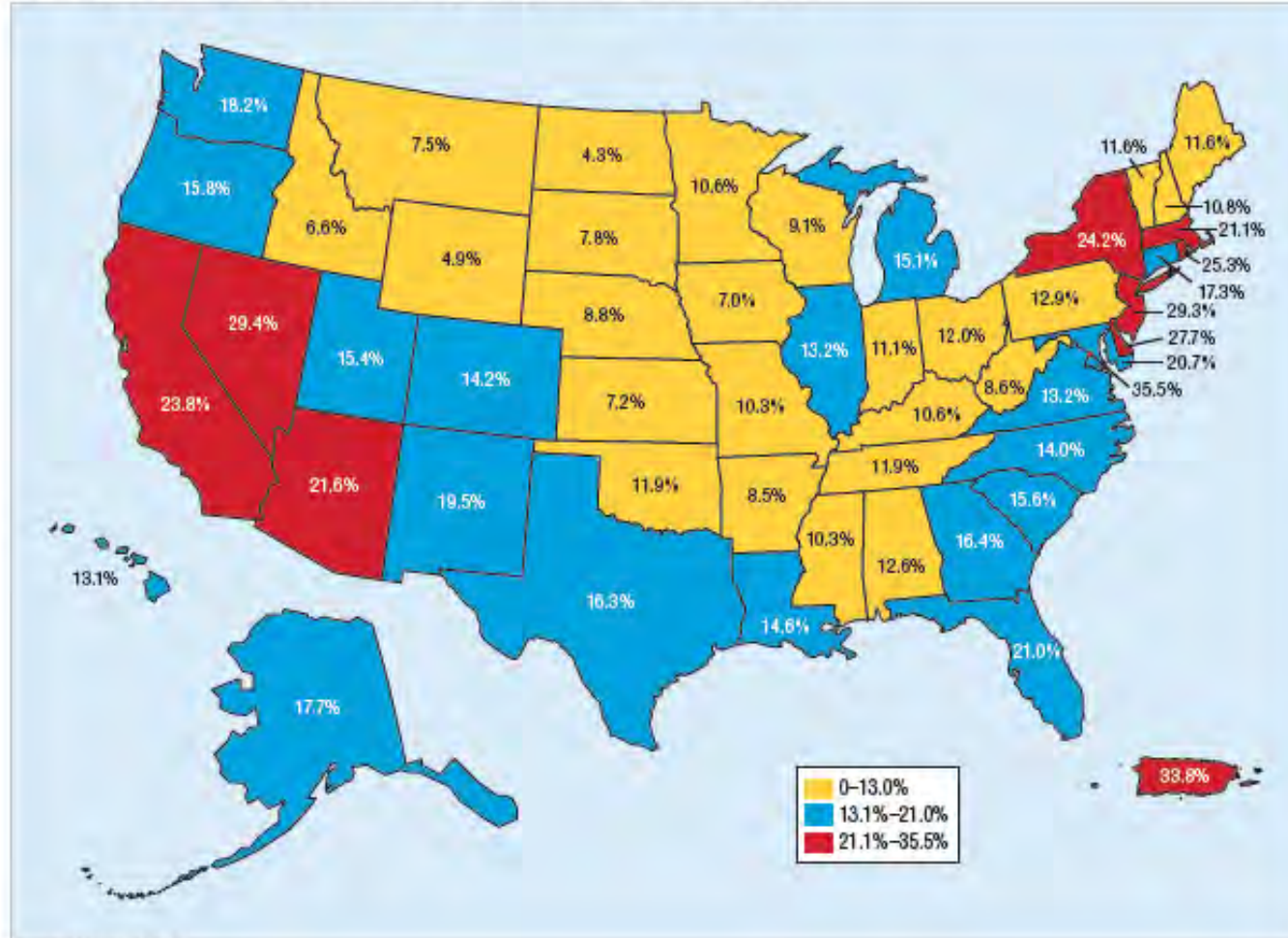
Source: Traffic Safety Facts, National Highway Traffic Safety Administration, March 2019, DOT HS 812.681, 2017 Data



# Variation by Region

• Massachusetts- 2017

Figure 3  
Percentage of Total Traffic Fatalities Who Were Pedestrians, by State, 2017



Source: FARS 2017 ARF



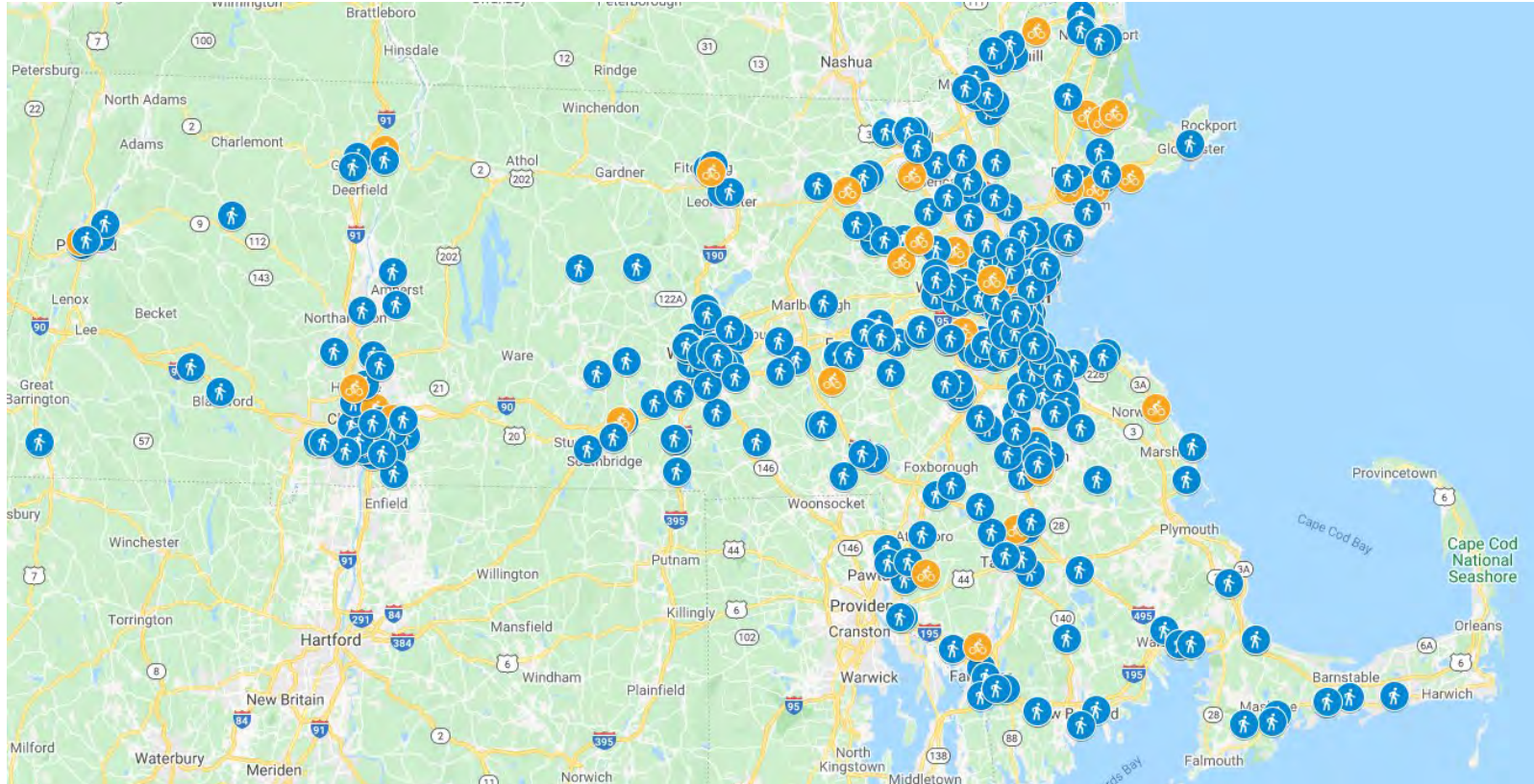
# Magnitude of the Problem-Massachusetts

- 350 total traffic fatalities
- 74 pedestrian fatalities (1.08 per 100K: 10<sup>th</sup> best state)
- 21% of total traffic fatalities were pedestrians



# MASSACHUSETTS PEDESTRIAN AND BICYCLIST FATALITIES 2016-2020

Beth Israel Lahey Health   
Lahey Hospital & Medical Center



Source: Massachusetts Vision Zero Coalition

[https://www.visionzerocoalition.org/fatalities\\_map](https://www.visionzerocoalition.org/fatalities_map)



# Pedestrians- Boston- 2017

11 of 26 traffic fatalities were pedestrians

Pedestrians as 42% of all traffic fatalities ranks 4<sup>th</sup> highest in largest 35 cities

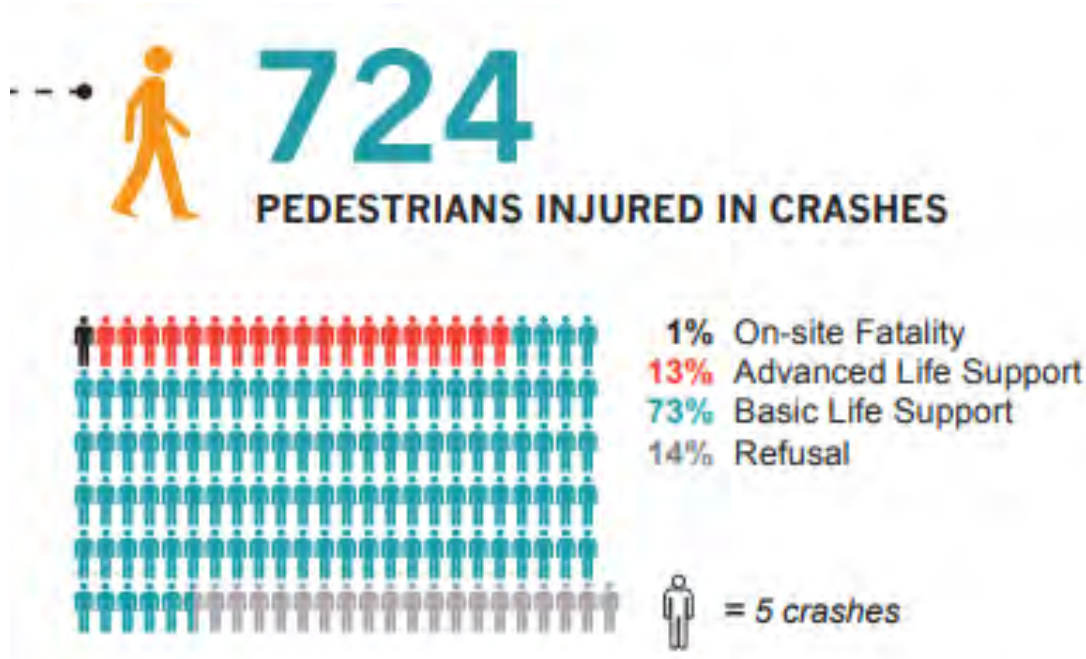
Total traffic fatality rate of 3.8 per 100 K 2<sup>th</sup> lowest in largest 35 cities

Pedestrian fatality rate of 1.61 per 100 K is 4<sup>th</sup> lowest in largest 35 cities

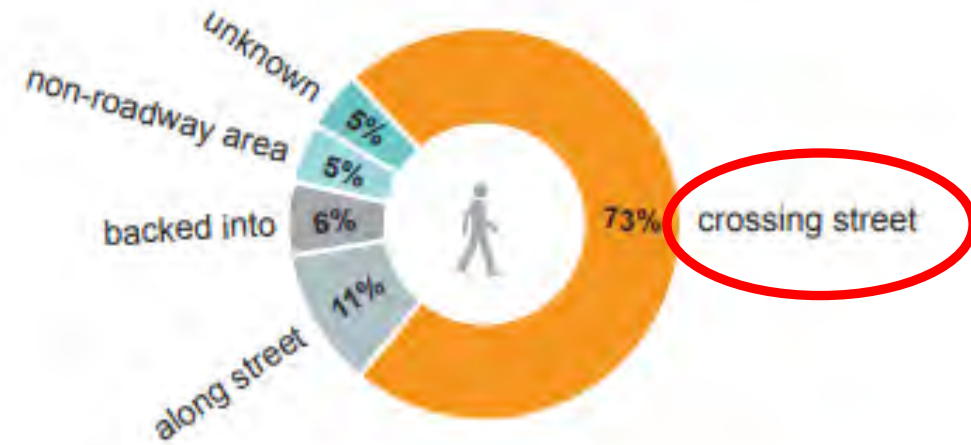
Relatively safe city but opportunities are with % of pedestrian fatalities



# BOSTON PEDESTRIANS 2014



## CRASH TYPE



25 ALS calls for every death





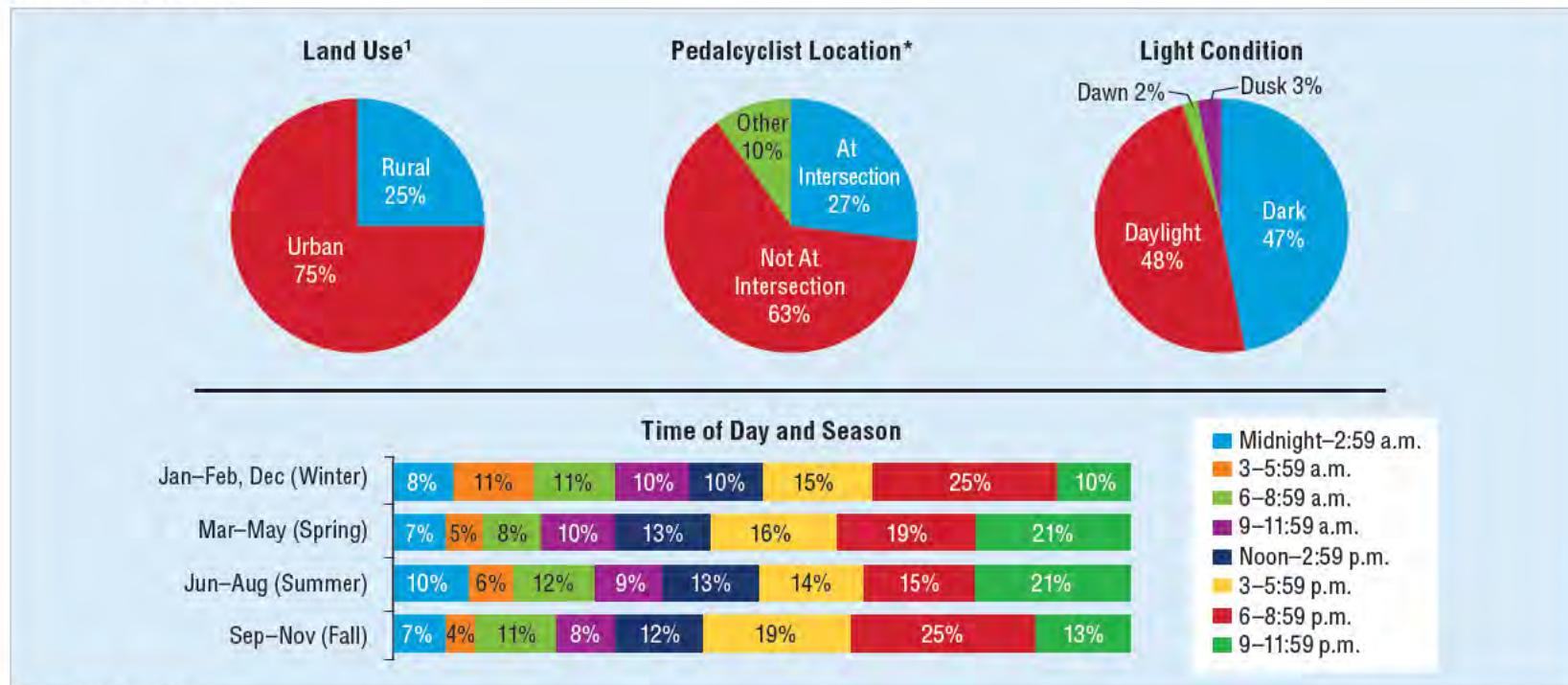
# Pedalcyclist-MV Collisions



# Magnitude of the Problem- US

- Pedalcyclists
- 783 pedalcyclists killed in 2017

Figure 1  
Percentage of Pedalcyclist Fatalities in Relation to Land Use<sup>1</sup>, Pedalcyclist Location, Light Condition, and Time of Day and Season, 2017



Source: FARS 2017 ARF

\*Based on location of pedalcyclists struck at the time of the crash. "Other" includes sidewalk, bicycle lane, median/crossing island, parking lane/zone, shoulder/roadside, driveway access, shared-use path, and non-traffic area, which may or may not have been at intersection, but were not distinguished by collected data. Thus, "At Intersection" and "Not At Intersection" does not include those in the "Other" category that were at an intersection or not at an intersection.

Note: Percent values may not add up to 100 percent due to independent rounding. Unknown values were removed before calculating percentages.



# Mortalities in Pedalcyclists- US

Average age of death increased from 41 to 47 from 2008 to 2017

89% Male

Highest # of fatalities 50-54 age group

Children < 15 account for 7% of deaths

20% of cyclists killed had BAL  $\geq$  0.08 g/dL

26% of drivers had BAL  $\geq$  0.08 g/dL



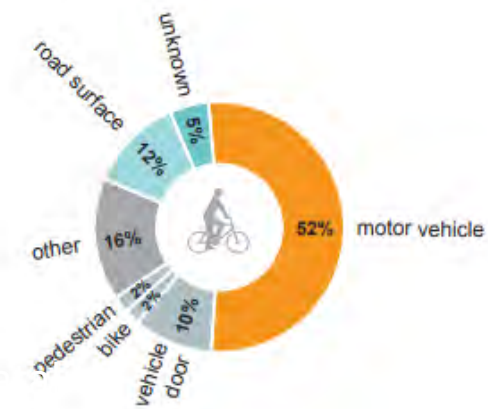
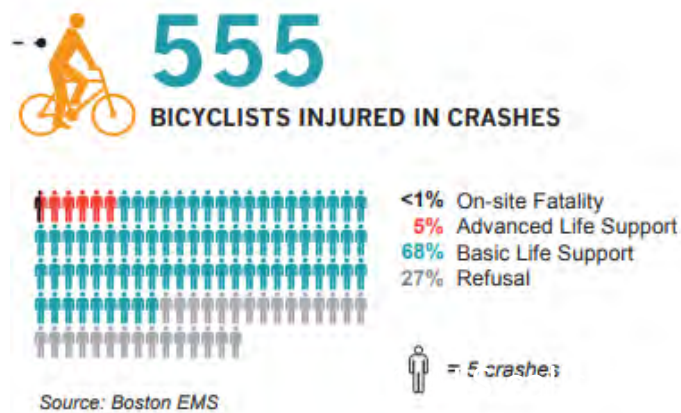
# Magnitude of the Problem- Massachusetts

- 11 pedalcyclist fatalities out of total of 350 traffic fatalities
- 3.1% of total fatalities
- 1.60 pedalcyclist fatalities per 1 M population (ranks 20<sup>th</sup> of 50 states)



# Magnitude of the Problem- Boston

- 2 fatalities out of 26 total traffic deaths
- 7.7% of all traffic deaths
- Overall traffic death fatality rate of 38 per 1 million residents (2<sup>nd</sup> of 35 largest cities)
- Pedalcyclist rate is 2.92 per 1 million residents ( 18<sup>th</sup> of 35 largest cities)



# Root Causes



# Proximate Root Causes

- **Poor separation of walker/rider and MV**
- **Speed of MV**
- **Poor Lighting**
- **Alcohol**



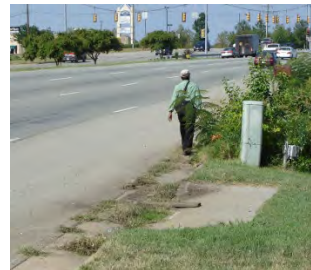
# Systemic Root Causes





# Issues of Equity

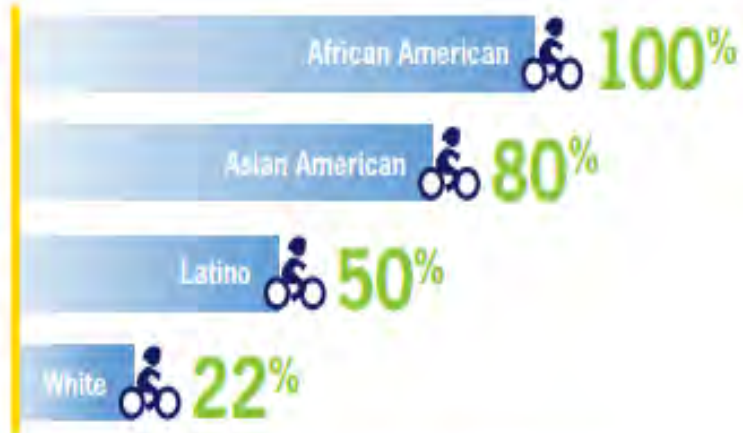
The vast majority of pedestrians or cyclists who are struck by a motor vehicle are not walking or riding for recreational purposes but are doing so because they have no other choice.



# ISSUES OF EQUITY

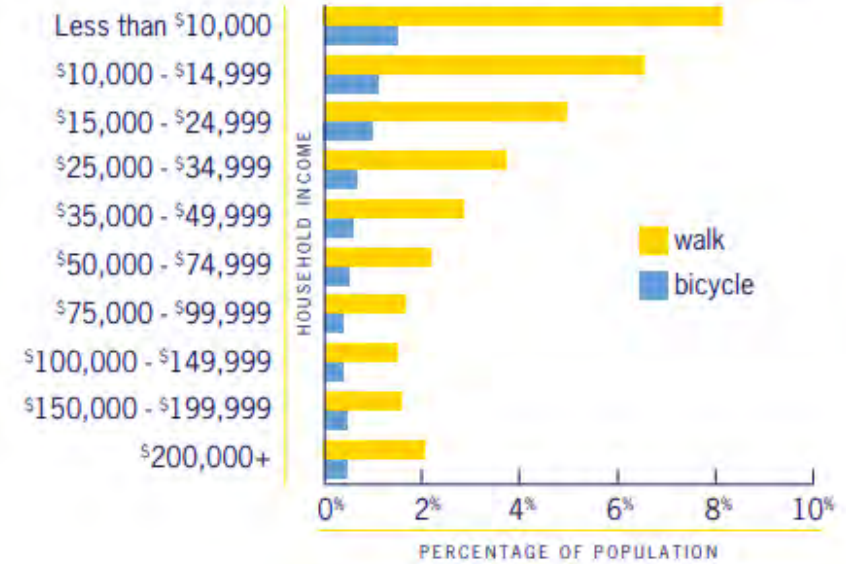
## Growth in Number of Bicycling Trips by Race

2001-2009



National Household Travel Survey

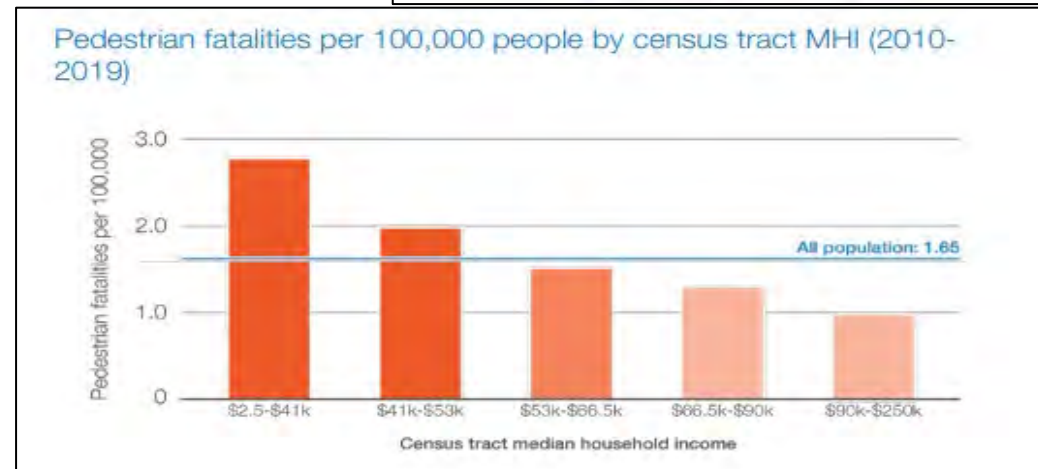
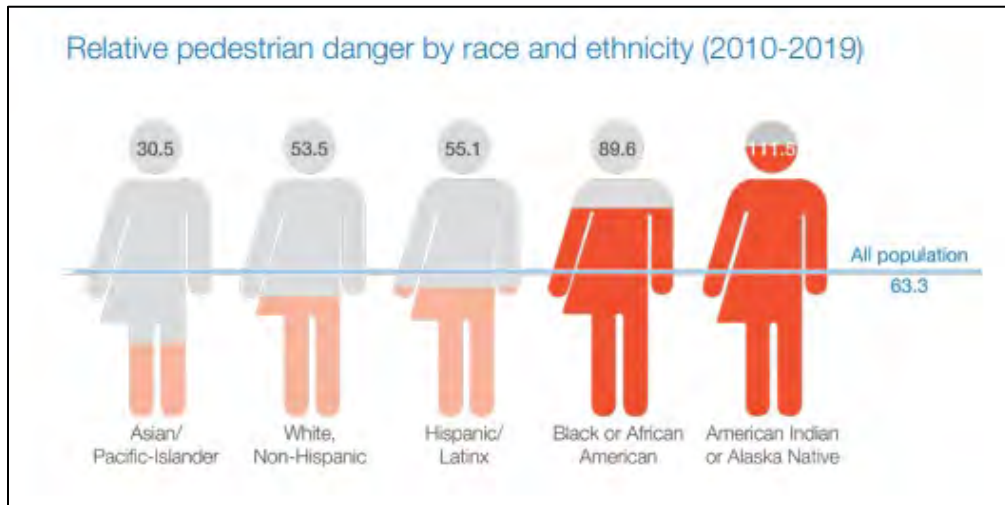
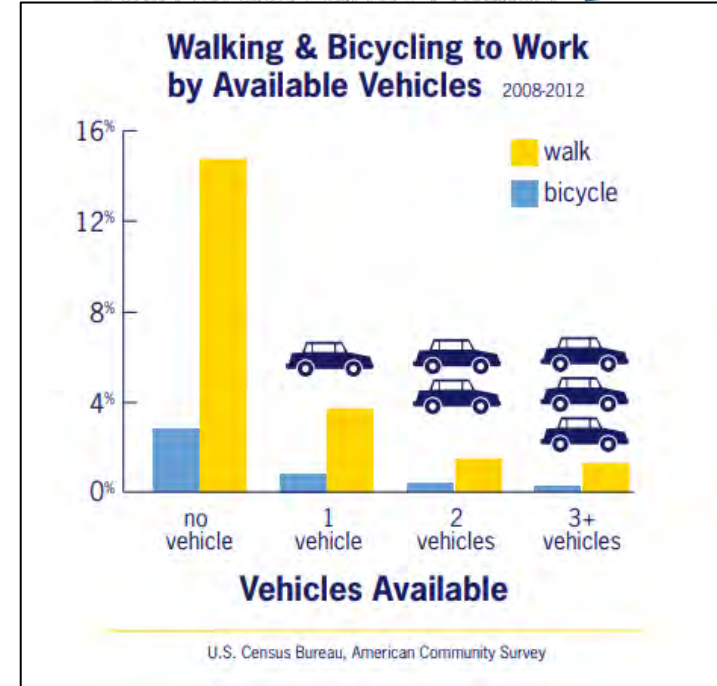
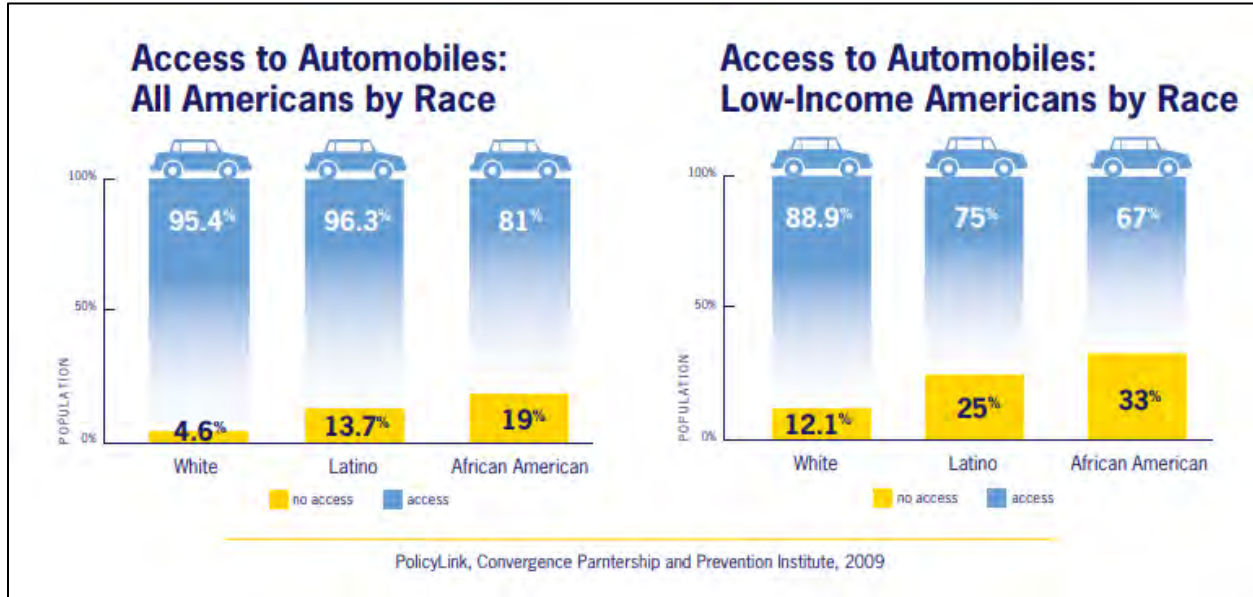
## Walking & Bicycling to Work by Household Income 2008-2012



U.S. Census Bureau, American Community Survey



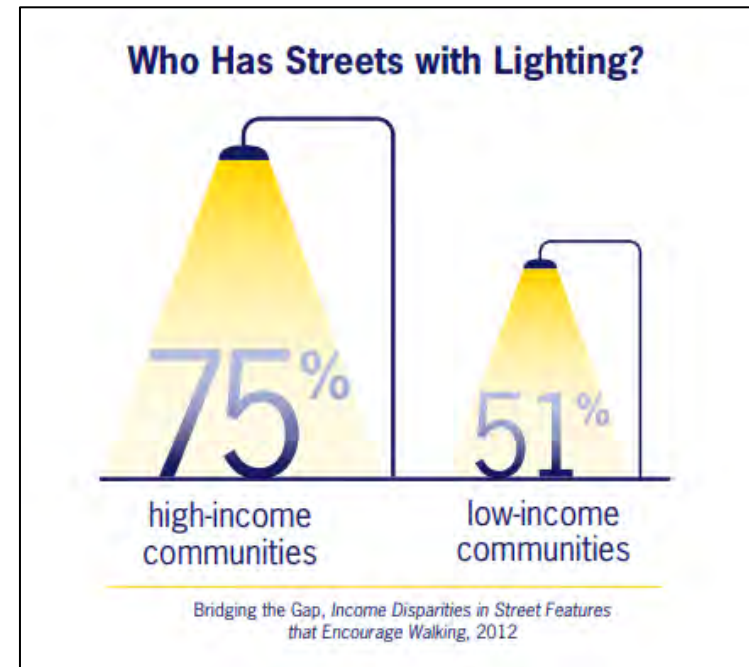
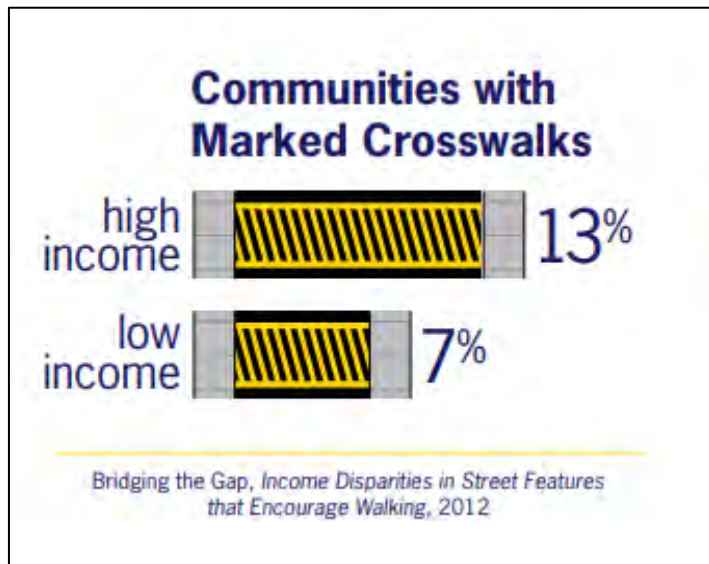
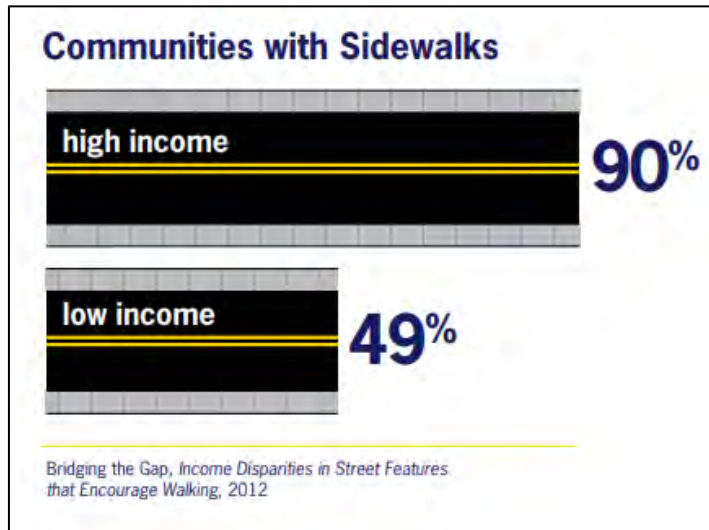
# ISSUES OF EQUITY



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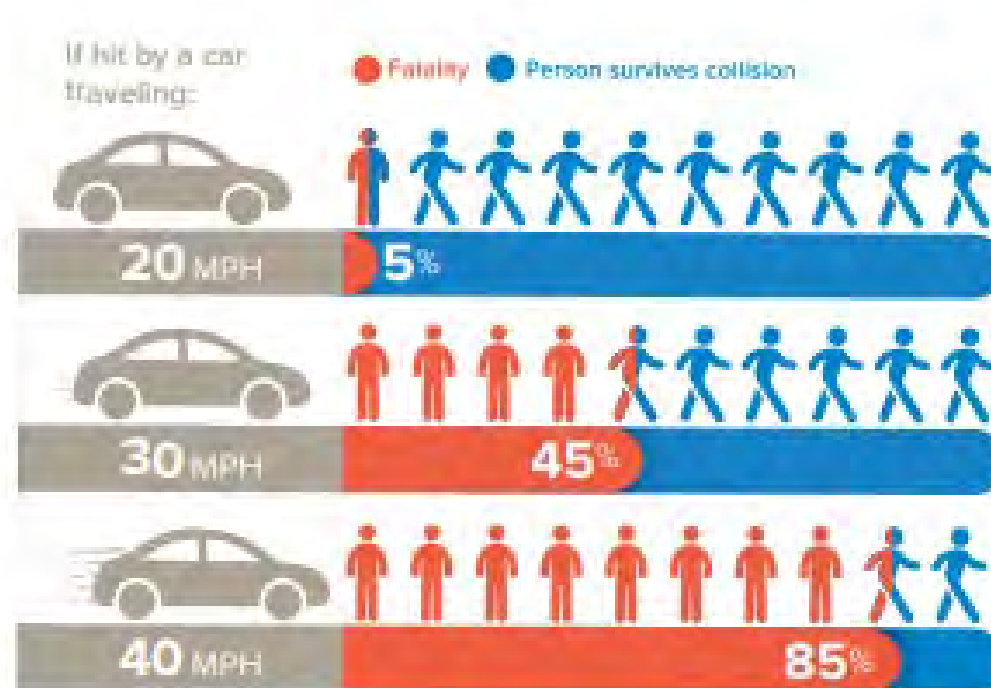


# Countermeasure Tactics



# DESIGN PRINCIPLES

- Provide adequate separation of pedestrians (and cyclists) from motorized traffic
- Designing for slower motor vehicle speeds



National Traffic Safety Board (2007) Reducing Speeding-Related Crashes Involving Passenger Vehicles.  
Available from: <http://www.nhtsa.gov/safety/safety-studies/Documents/SS1701.pdf>

## Pedestrian and Cyclist Safety

- Roadway design features
- Traffic control devices





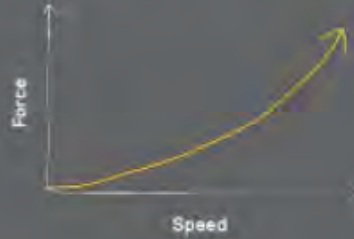
# What Makes a Safe Street?



# How Speed Kills

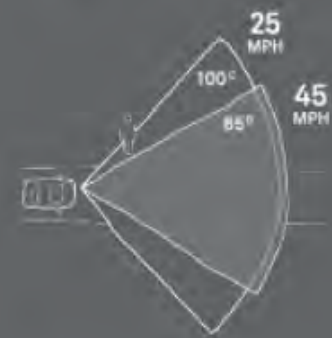
1

Crashes at higher speeds are more **forceful** and thus more likely to be fatal.



2

Drivers traveling at higher speeds have a **narrower field of vision**.

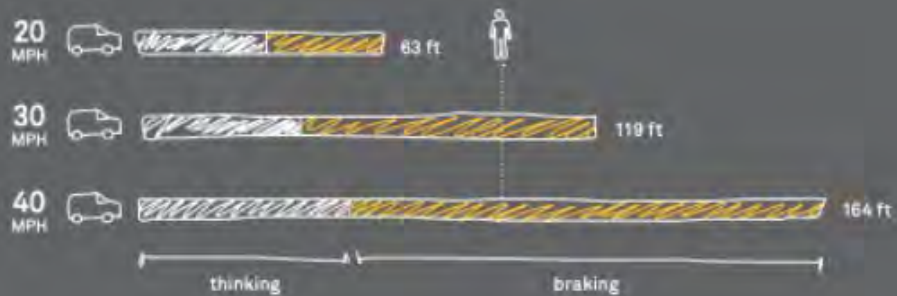


3

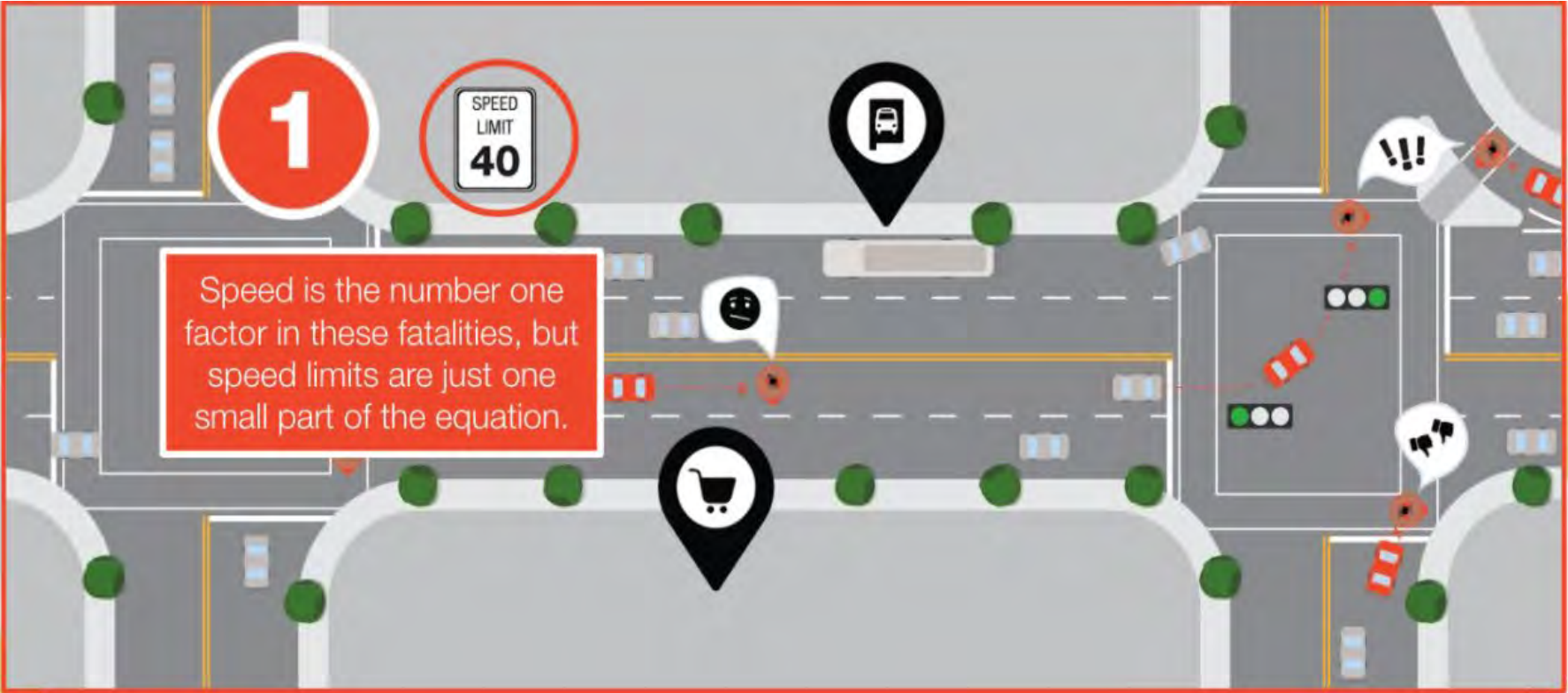
Drivers traveling at higher speeds **travel further** before they can react.

4

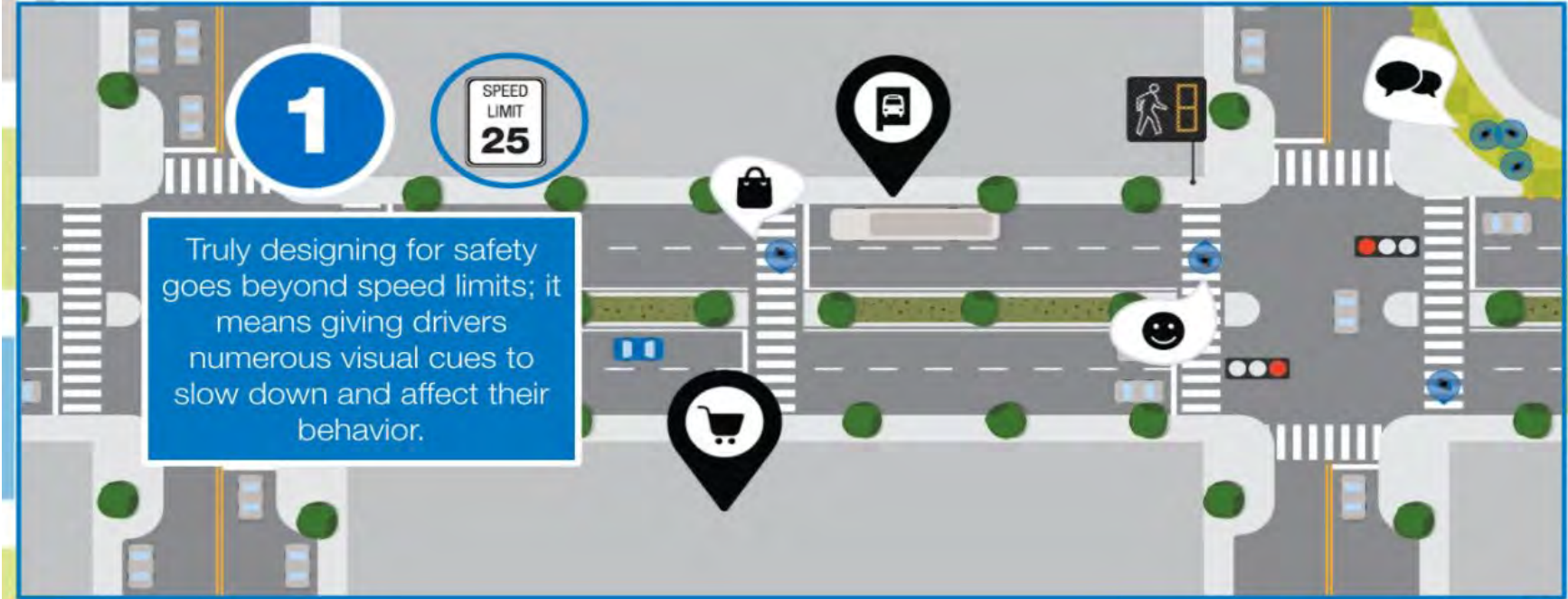
Vehicles traveling at higher speeds have **longer braking distances**.



 = Pedestrian at Risk



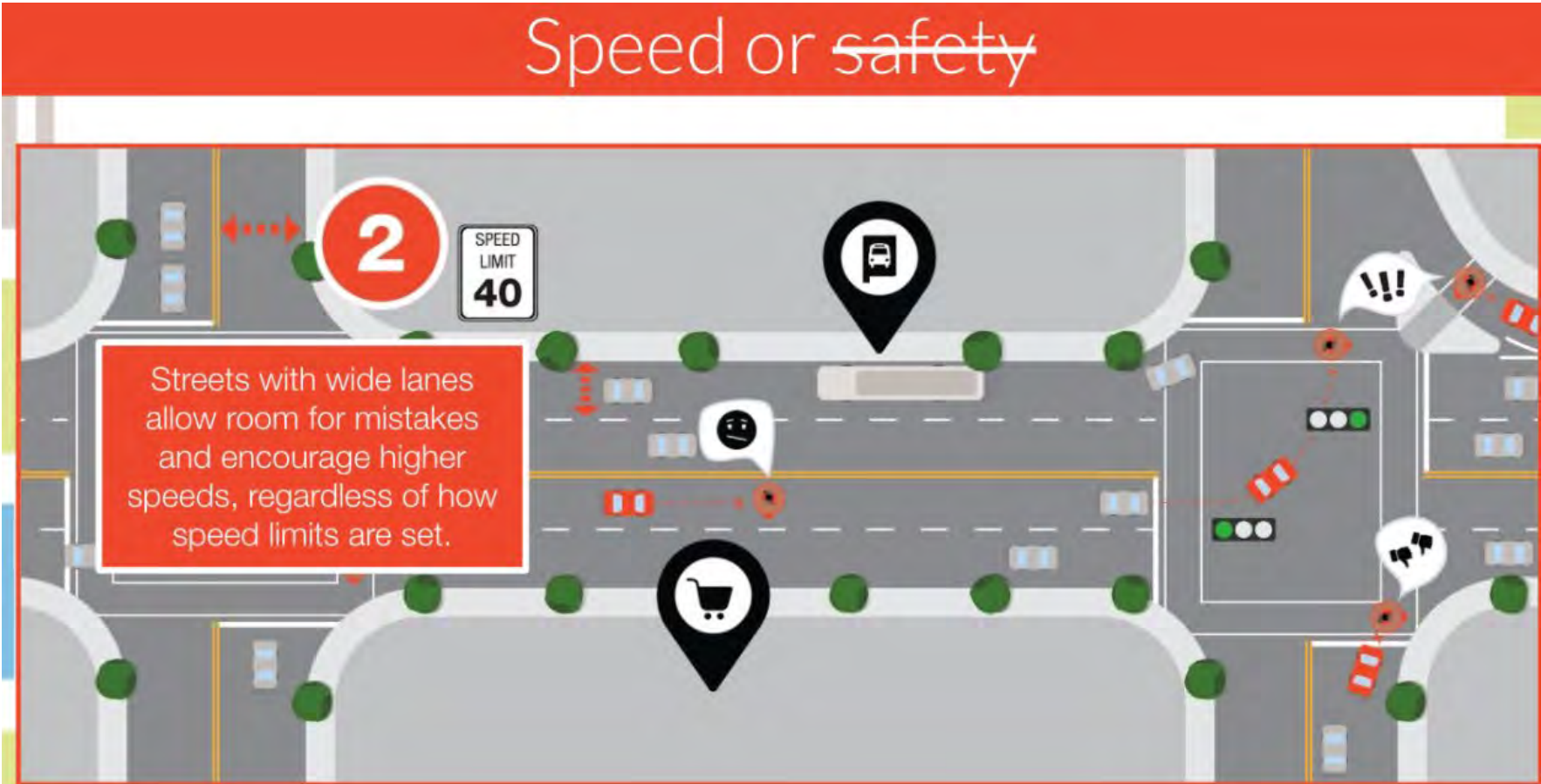
# Speed or safety



Truly designing for safety goes beyond speed limits; it means giving drivers numerous visual cues to slow down and affect their behavior.

 = Pedestrian at Risk

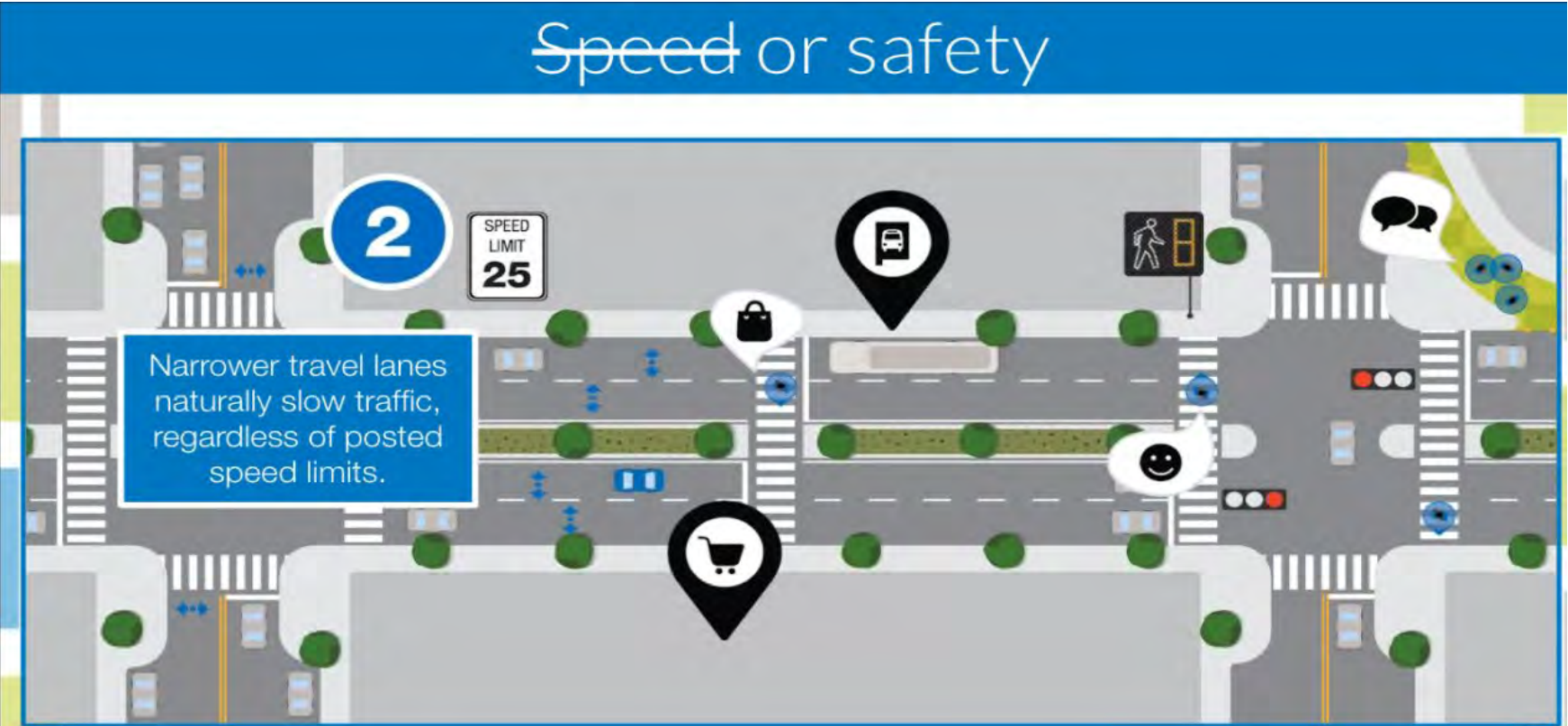
### Speed or ~~safety~~



Streets with wide lanes allow room for mistakes and encourage higher speeds, regardless of how speed limits are set.




# Speed or safety



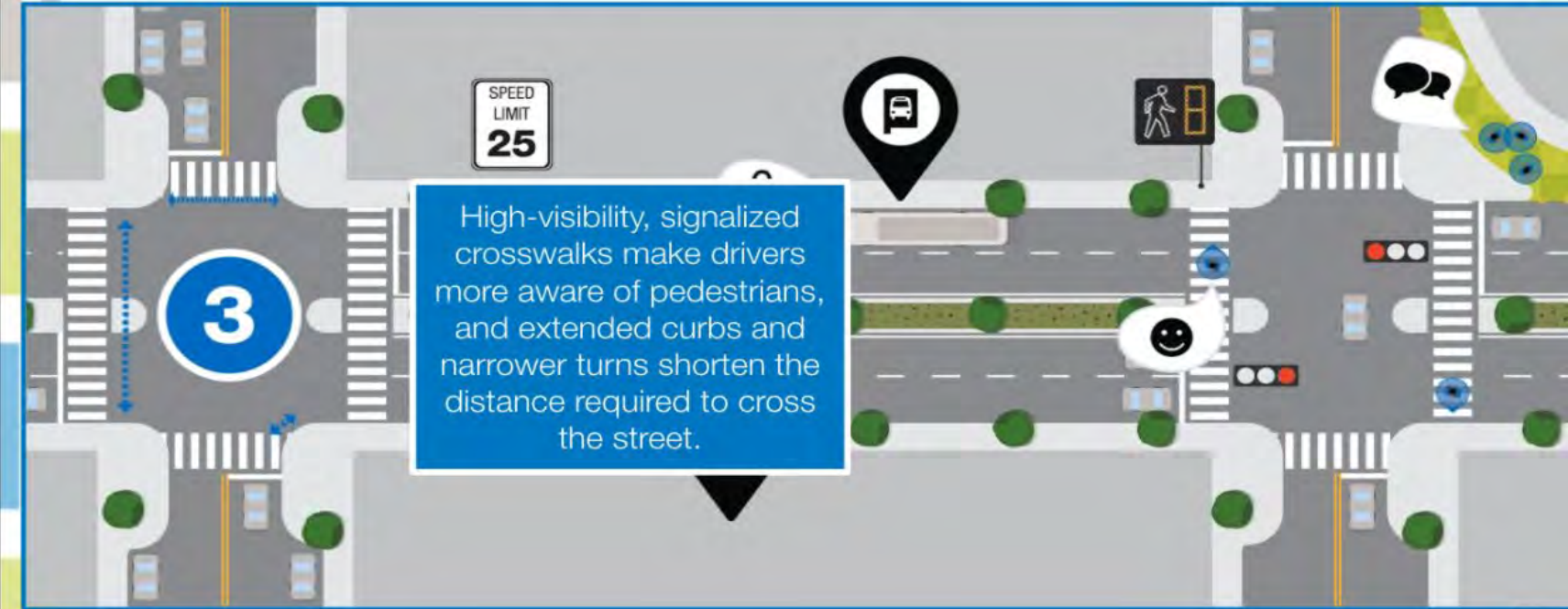
 = Pedestrian at Risk

## Speed or ~~safety~~



Many streets lack basic safety essentials like curb ramps or high-viz crosswalks. Wide corners (to prioritize cars turning without slowing down) create long crossing distances which put people in harm's way for longer than necessary.

# Speed or safety

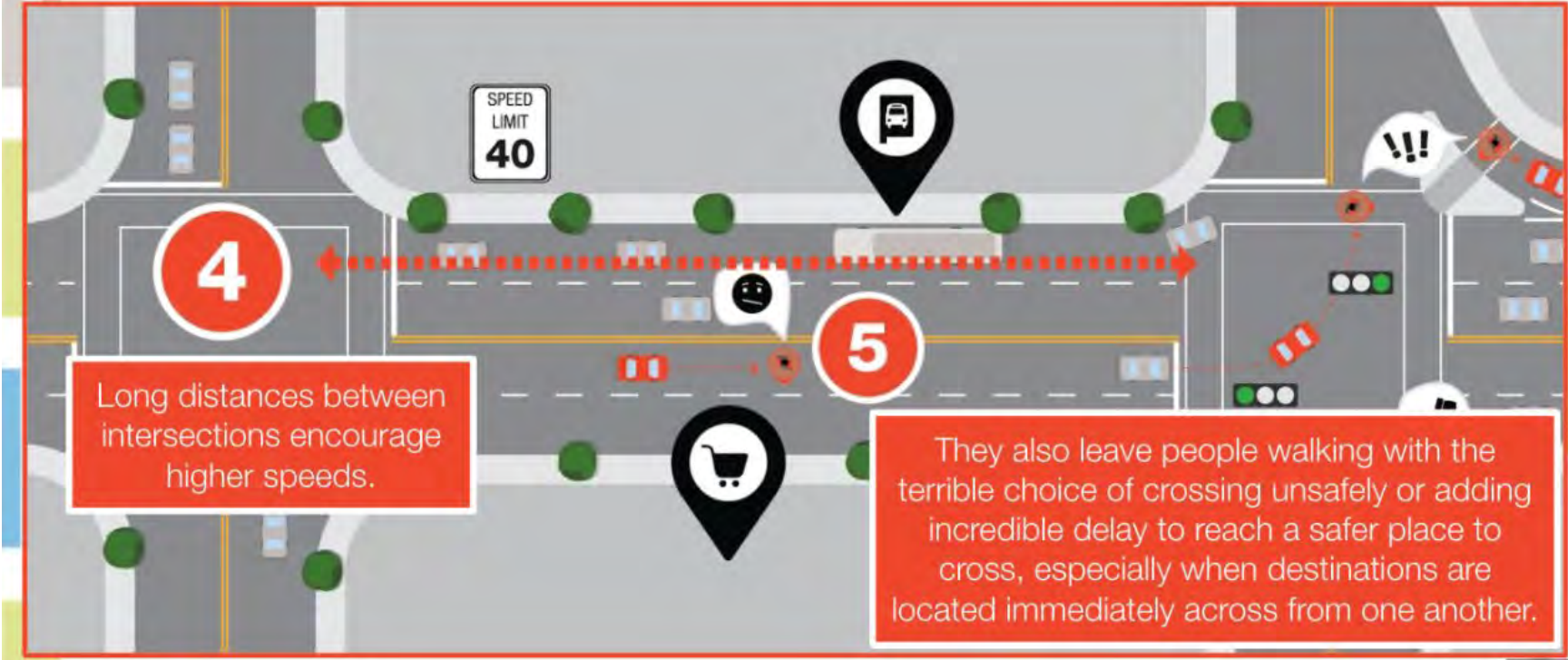


High-visibility, signalized crosswalks make drivers more aware of pedestrians, and extended curbs and narrower turns shorten the distance required to cross the street.

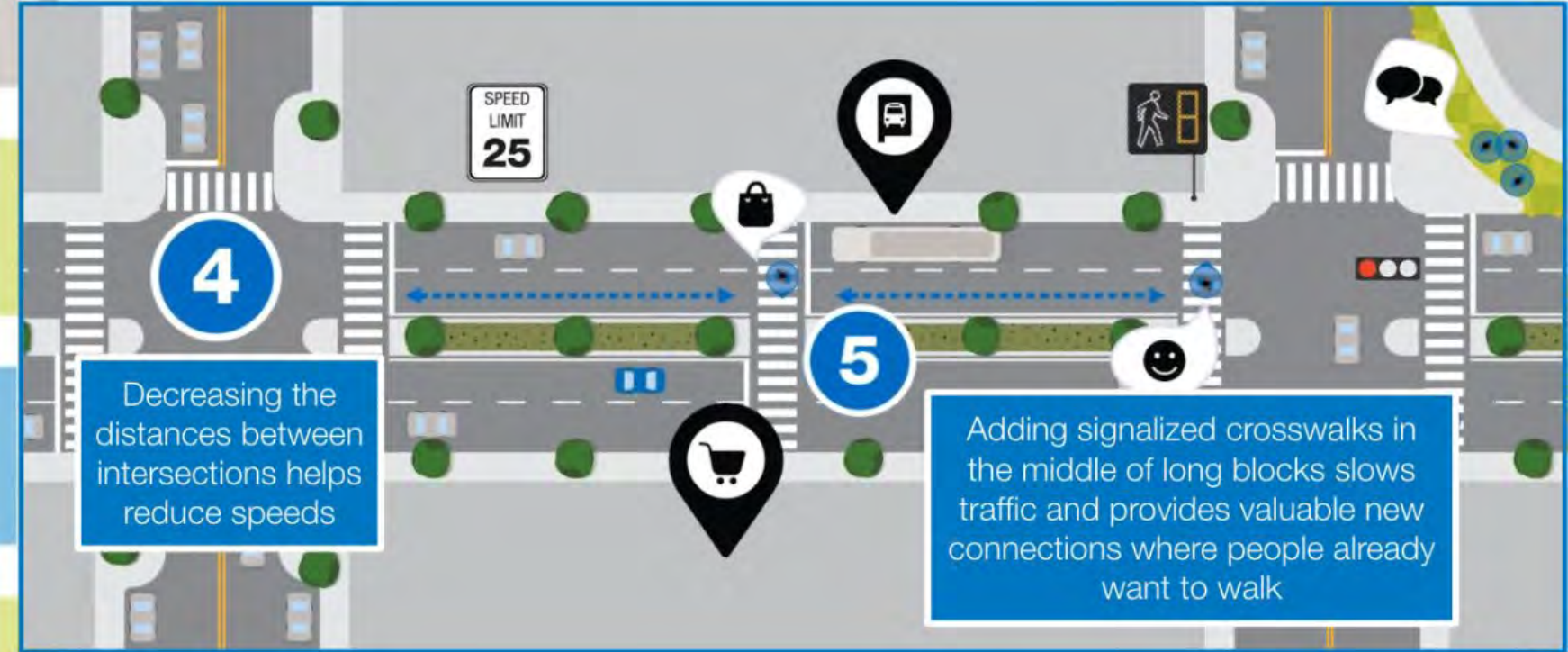


 = Pedestrian at Risk

# Speed or safety



# Speed or safety



 = Pedestrian at Risk


## Speed or ~~safety~~



Right turn "slip" lanes were designed for one reason: to keep vehicles from slowing down on right turns. They are fundamentally unsafe for people walking

Smart Growth America  
Improving lives by improving communities





Eliminating right turn "slip" lanes in favor of right-angle turns produces slower, safer turns and shorter crossing distances for people.

**Slip lanes are deadly for people**



**Stop building them**

Eliminating right turn "slip" lanes in favor of right-angle turns produces slower, safer turns and shorter crossing distances for people.



# COUNTERMEASURE CATEGORIES

- **Along Roadway**
- **At Crossing Locations**
- **Roadway Design**
- **Intersection Design**
- **Traffic Calming**
- **Traffic Management**
- **Signals and Signs**
- **Other Measures**



# ALONG ROADWAY: SIDEWALKS & PAVED SHOULDERS



- 8% of pedestrian crashes occur while walking along roadway
- Presence of sidewalk or wide shoulder (> 4 feet) associated with 88% reduction in pedestrian crashes
- Speed and higher traffic volumes associated with more pedestrian crashes

# ALONG ROADWAY: SIDEWALK-STREET FURNITURE/WALKING IMPROVEMENTS

- **Four sidewalk zones:**
  - Curb
  - Furniture/Planting/Amenity
  - Pedestrian
  - Frontage
- Furniture zone should purposefully include poles, signposts, newspaper racks, benches, water fountains, bicycle racks and transit shelters
- All of these should channel traffic away from the curb



# CROSSINGS: CURB RAMPS

Both Israel Leiby Health

Medical Center

- wheelchairs
- strollers
- walkers
- crutches
- handcarts
- bicycles
- other mobility restrictions

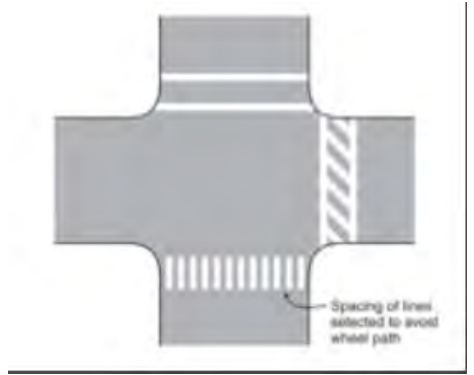


- Separate ramps for each crosswalk at an intersection rather than a single ramp at the corner. Provides orientation for visibly impaired
- Tactile warnings alert pedestrians of street edge



## CROSSINGS: MARKED CROSSWALKS

- Indicate optimal or preferred locations for pedestrians to cross and help designate right-of-way for motorists to yield to pedestrians
- Needs to be convenient because pedestrians are sensitive to out-of-the-way travel
- Needs to have good visibility
- Need re-enforcing adjuncts like signage and speed reduction tactics



The enhancements shown in this rendering of a midblock crosswalk include high-visibility markings, curb extensions, in-street pedestrian crossing signs, lighting, and warning signs. *Federal Highway Administration.*

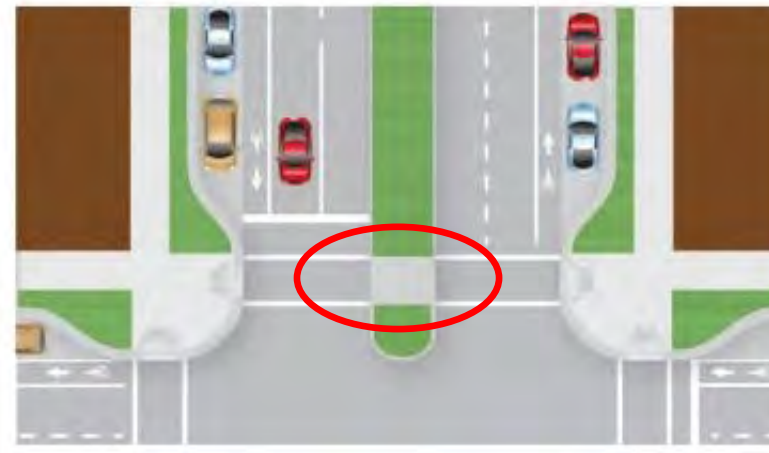


# AT CROSSINGS: CURB EXTENSIONS & CROSSING ISLANDS

- Extensions/Bulb-outs/Neckdowns extend the sidewalk or curb line into the parking lane to reduce the effective street width
- Reduces pedestrian crossing distance
- Reduces time pedestrians are in the street
- Visually and physically narrows the roadway to impact MV speed (road “diet”)
- Increases turning radius slowing down turning cars
- Improves the ability of pedestrians and motorists to see each other
- Crossing islands=pedestrian refuge minimum 4 ft wide



Curb extensions  
(Credit: Michele Weisbart)



# CROSSINGS: RAISED PEDESTRIAN CROSSINGS

- Ramped speed tables often used in midblock crossing locations
- Slows oncoming traffic with sufficient signage
- Reduce the need for curb ramps



# AT CROSSINGS: LIGHTING AND ILLUMINATION

- **Streetlights need to be on both sides of a crosswalk and provide consistent level of lighting across the roadway. Single bulb in middle inadequate**
- **Should be placed 10 feet ahead of the crosswalk in relationship to oncoming traffic**



*Proper placement of crosswalk illumination (Credit: Michele Weisbart)*

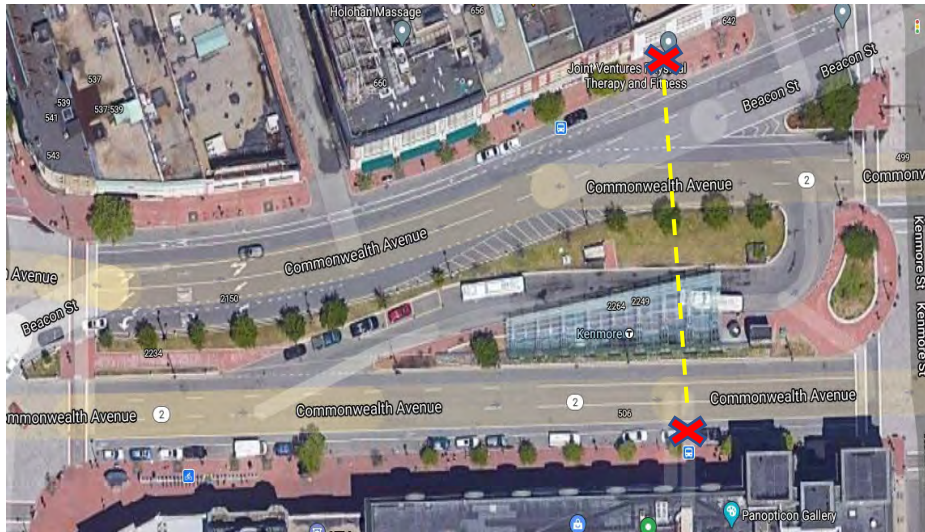
# AT CROSSINGS: PARKING RESTRICTIONS (AT CROSSING LOCATIONS)

- Improves sightline between motorists and pedestrians



# AT CROSSINGS: OVERPASSES/UNDERPASSES

- **Completely separates but are costly, visually intrusive (if you can find them) and often poorly lit. They are poorly utilized when a more direct at-grade crossing is possible**



**Kenmore Square MBTA Underpass Route**



**Not the MBTA Underpass Route**

# AT CROSSINGS: AUTOMATED PEDESTRIAN DETECTION DEVICES

- **Infrared, microwave or pressure sensitive mat that can detect a lingering individual waiting to cross and automatically trigger the WALK phase of the signal**
- **Able to adjust if a the pedestrian is taking longer than usual to cross**
- **Can also cancel the crosswalk signal if the person leaves**
- **Reduces waiting time for both pedestrian and motorist**



# CROSSINGS: LEADING PEDESTRIAN INTERVAL

- **Triggers the pedestrian WALK signal 3-7 seconds before the motorists are allowed to right or left turn**
- **Less likely that there will be an unanticipated conflict**
- **Increase the percentage of motorists who yield right-of-way to pedestrians**
- **Pedestrians are especially vulnerable to left turning vehicles**



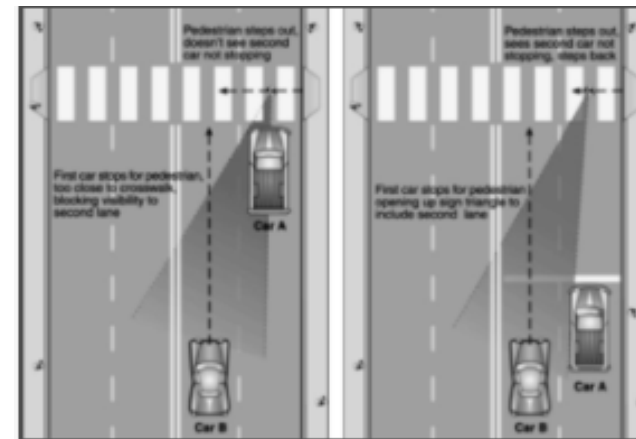


# AT CROSSINGS: ADVANCE YIELD/STOP LINES

- Include both the STOP BAR and the SHARKS TEETH yield markings placed 20-50 feet ahead of a marked crosswalk (only work if drivers understand “SHARKS TEETH”)
- Effective for multi-lane midblock unsignalized crossings where stopped far right lane driver obscures the pedestrian from being seen by right/center lane motor vehicle
- Particularly effective when paired with signs and beacons



Advance yield markings at a midblock crosswalk with a refuge island.  
[pedbikeimages.org](http://pedbikeimages.org) - Toole Design Group.



Advance stop lines and yield markings improve the visibility of pedestrians to motorists and prevent multiple-threat crashes.

# ROADWAY DESIGN: BIKE LANES

- **Designing streets for bicycle use helps create more predictable traffic**
- **Encourages lower motor vehicle speeds**
- **Reduces pedestrian exposure to motor vehicles**
- **Not clear that it reduces bike-pedestrian accidents**



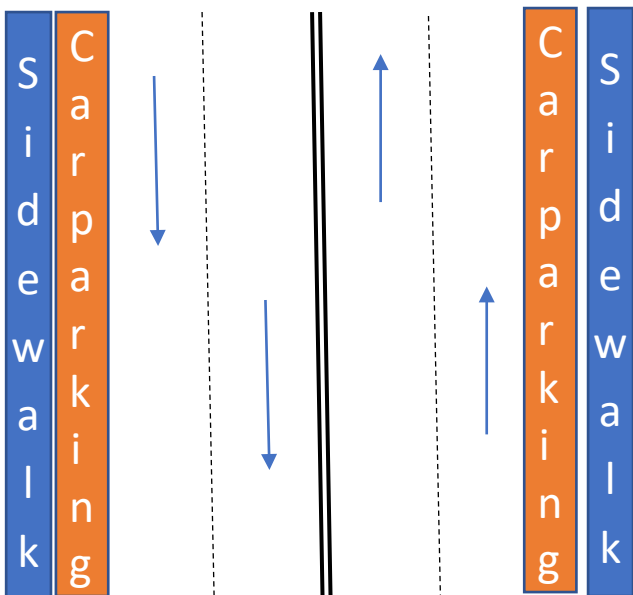
Bicycle lane placed between curb and transit stop platform, Seattle, Washington Source: Michael Hintze, Toole Design Group



Bike lane provides a buffer for pedestrians.

# ROADWAY DESIGN: ROAD DIETS (LANE REDUCTION)

- **Reduce lane widths to reduce vehicle speeds, reduce crossing widths and redistribute roadway space to other users such as bike lanes**



Lane diet (center lane narrowed) creates space to install bike lanes which also provides additional buffer for pedestrians on sidewalks. Seattle, Washington *Source: Gina Coffman, Toole Design Group*



Lane diet on Harvard Ave in Boston, Massachusetts *Source: Bill Schultheiss, Toole Design Group*

# ROADWAY DESIGN: DRIVEWAY IMPROVEMENTS

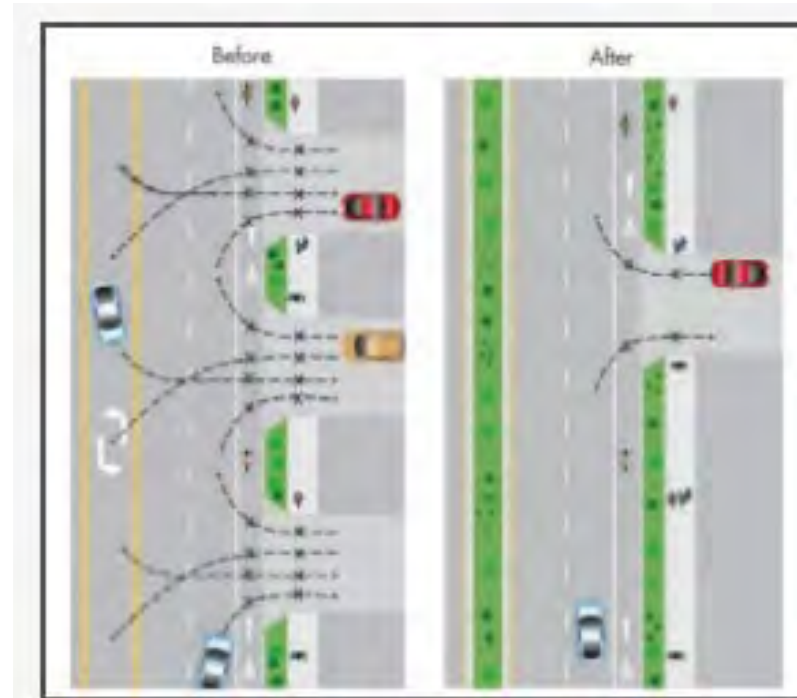
- **Make driveways more like driveways than intersections**
- **Consolidate driveways to balance risks and access**



Driveways built like intersections encourage high-speed turns.



Driveways built like driveways encourage low-speed turns and encourage motorists to yield to pedestrians.



Adding medians and consolidating driveways to manage access.

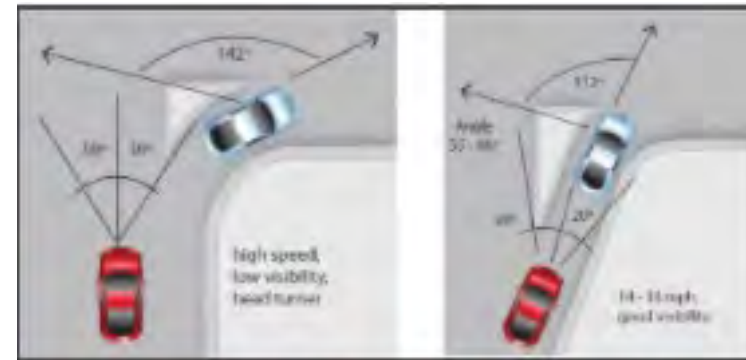
Source: *Living Streets* (Michele Weisbart)

# ROADWAY DESIGN: IMPROVED RIGHT-TURN SLIP-LANE DESIGN

- **Pork chop island**
- **Enhanced visibility of pedestrians by motorist entering turn**
- **Narrow slip lane slows speeds**
- **No acceleration lane coming out of slip lane reduces speed further**



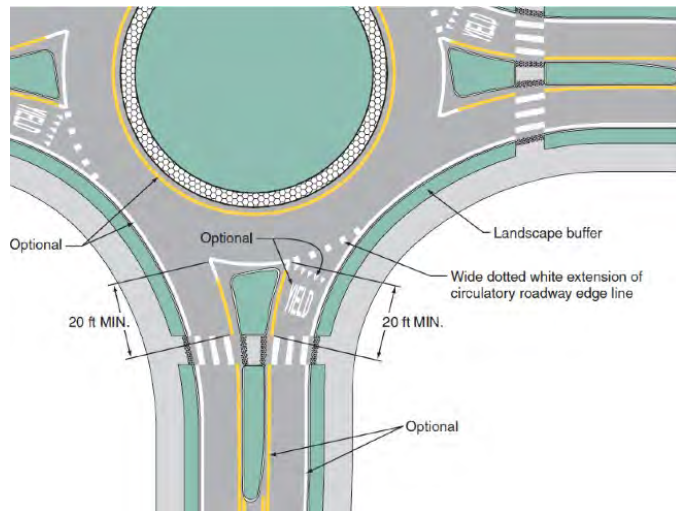
Recommended design for right-turn slip lane.



Shaper angles of slip lanes are important to slow cars and increase visibility.

# INTERSECTION DESIGN: IMPROVED ROTARIES/ROUNDBABOUTS

- **Challenge on rotaries/roundabouts is that while they are designed to slow traffic they also lack signals which makes pedestrian crossings a challenge, especially for the visually impaired**
- **Depends on well-positioned cross-walks and accessible pedestrian signals**



# INTERSECTION DESIGN: MODIFIED T- INTERSECTIONS

- **Designed strictly to slow down speed by altering a straight-away.**

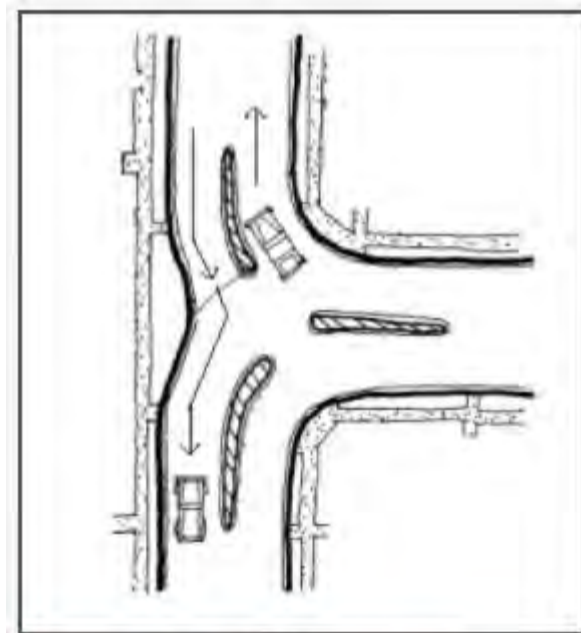
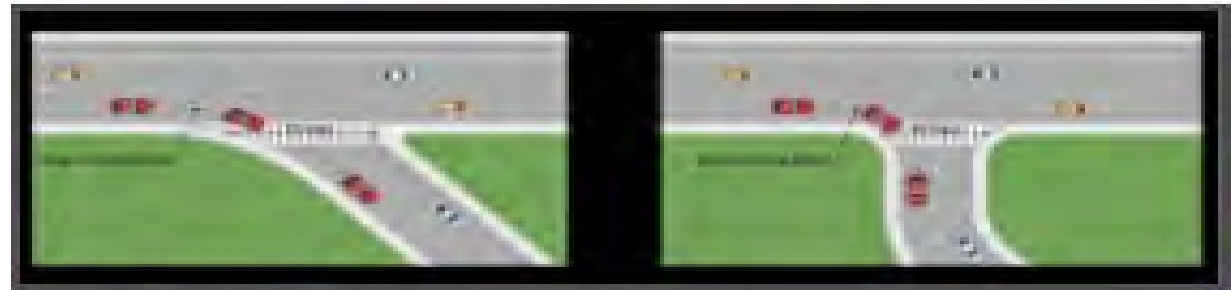
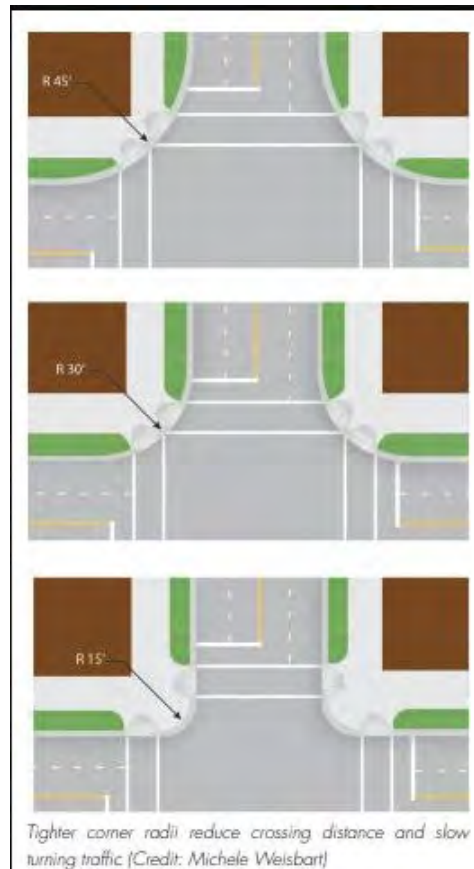


Illustration of a modified T-intersection.

# INTERSECTION DESIGN: TIGHT RADIUS CORNERING & MODIFIED SKEWED INTERSECTIONS

- **Designed to slow down speed around a corner**
- **Added benefit of shortening crossing distance**



Before: The skewed intersection results in longer crossing distances for pedestrians and facilitates higher speed turning movements by vehicles. After: Correcting skewed intersections provides safer crossing conditions for pedestrians of all abilities.



# TRAFFIC CALMING: CHOKERS AND CHICANES

- **Designed to create a pinch point in a street to slow speeds**



Choker



Chicane

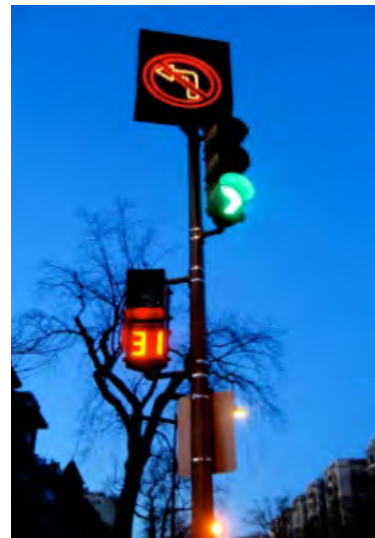
# TRAFFIC CALMING: MINI-CIRCLE /SERPENTINE/SPEED HUMPS/GATEWAYS/LANDSCAPING

- **Designed to create a physical “barrier” in a street to slow speeds or with a gateway to signify a change of environment**



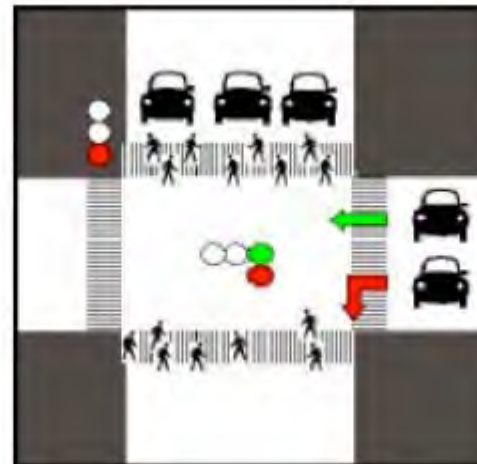
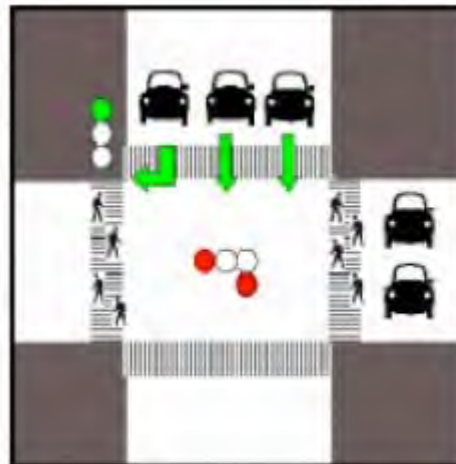
# TRAFFIC MANAGEMENT: DIVERTERS/STREET CLOSURE/LEFT TURN PROHIBITIONS

- **Designed to prevent or limit through or turning traffic movement**



# SIGNALS AND SIGNS: TRAFFIC SIGNALS AND PEDESTRIAN SIGNALS

- Designed to create gaps in traffic but only with cooperative drivers unless signal timing is coordinated to limit conflicts

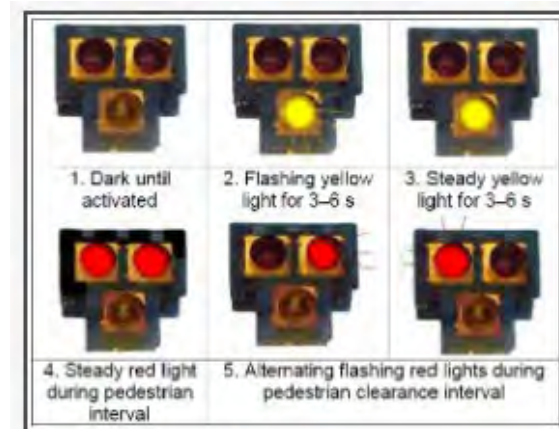


# SIGNALS AND SIGNS: PEDESTRIAN HYBRID BEACON

- Warn and control traffic at unsignalized locations



Pedestrian Hybrid Beacon installation shown with accompanying signs and pavement markings.  
*Federal Highway Administration.*

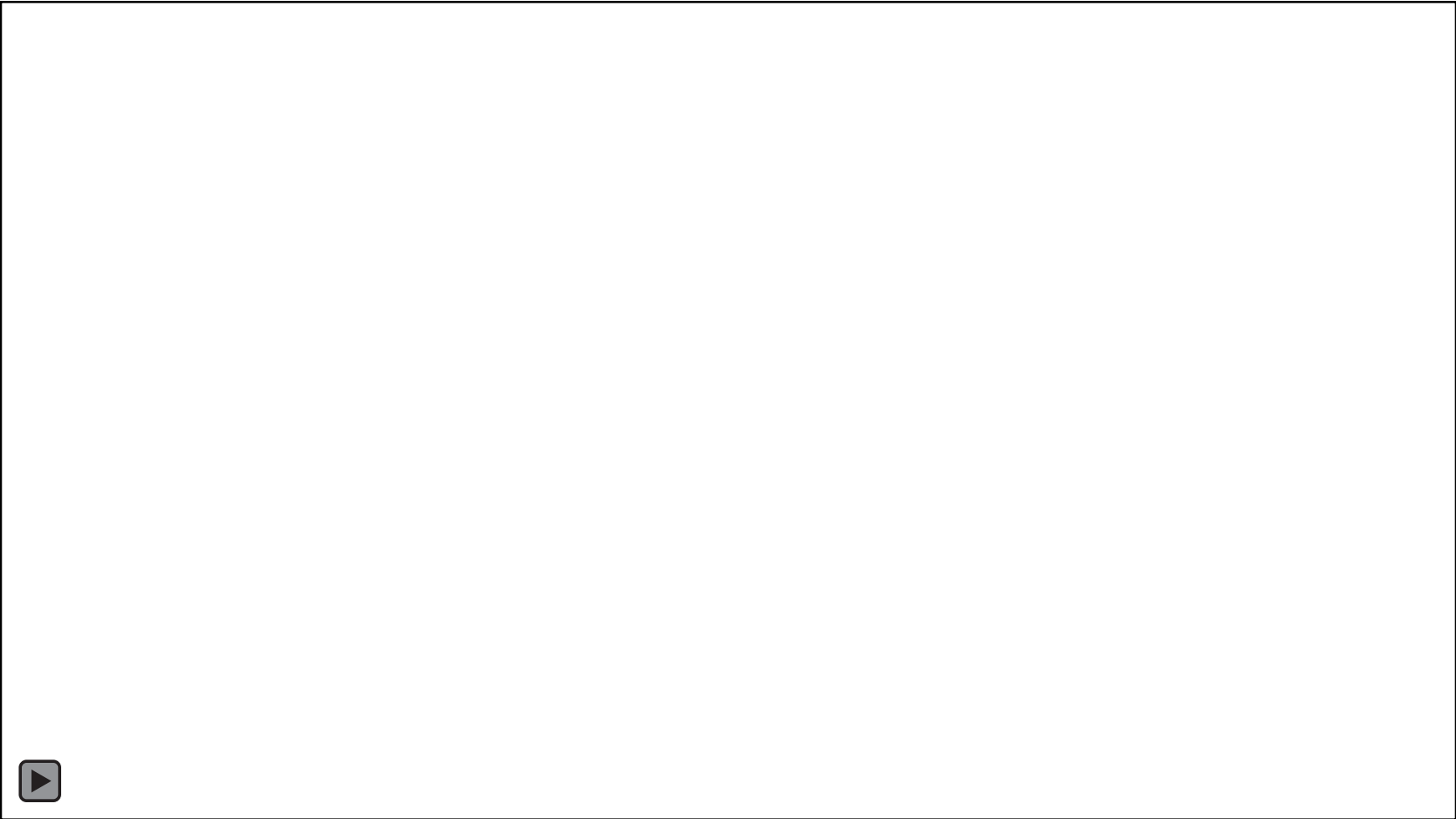


The progression of a PHB.

# SIGNALS AND SIGNS: RECTANGULAR RAPID-FLASHING BEACON (RRFB)

- **Warn and control traffic at unsignalized locations**









# SIGNALS AND SIGNS: PEDESTRIAN USER FRIENDLY INTELLIGENT INTERSECTION (PUFFIN)

Beth Israel Lahey Health   
Lahey Hospital & Medical Center

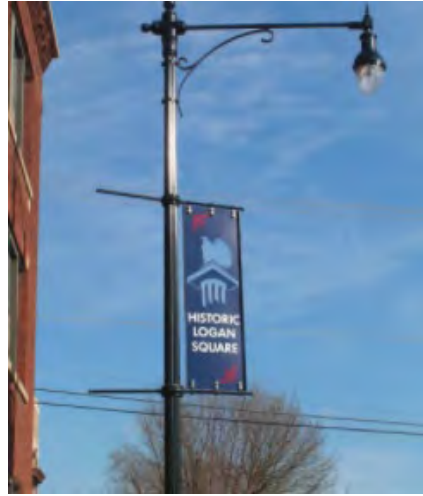
- **Adjusts for pedestrians with challenges or no pedestrians**
- **Sensors can tell whether there are still pedestrians in crosswalk and lengthen signal or cancel signal if the crossing is completed quickly or abandoned**



# OTHER MEASURES:



School Zones



Neighborhood Identity



Speed Monitoring Trailers



Pedestrian Education



Simulation Training



Automated Enforcement

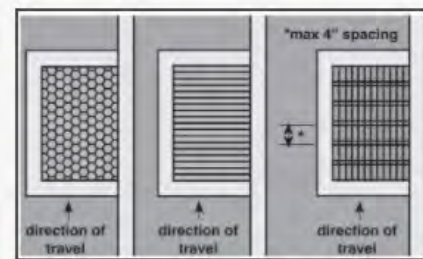
# Pedalcycle Directed Interventions



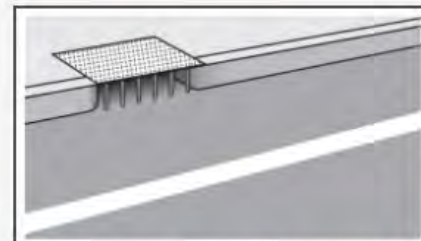
# PEDALCYCLE INTERVENTIONS SHARED ROADWAY

- **Road Surface Improvements**

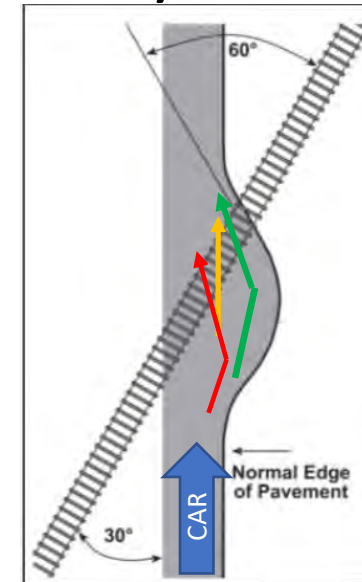
- Indirectly can cause pedalcycle-MV collisions because cyclist has to avoid an obstacle forcing them into the roadway



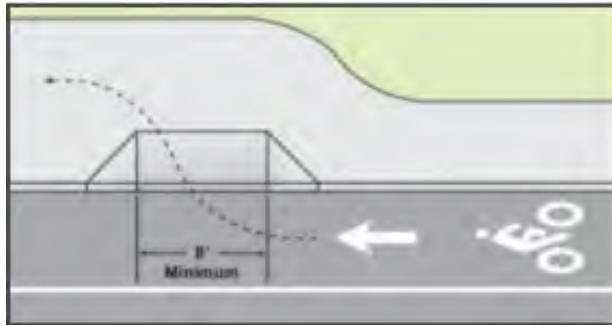
Bicycle safe grates. Note: grates with bars perpendicular to the roadway must not be placed at curb cuts, as bicycle tires could get caught in the slot. *Illustration from Oregon Bicycle and Pedestrian Design Guide, Oregon DOT*



Bicycle safe grates. Note: particularly with new or reconstruction, curb inlets could be installed. *Illustration from Oregon Bicycle and Pedestrian Design Guide, Oregon DOT*



# PEDALCYCLE INTERVENTIONS: SHARED ROADWAY



Bridge and Overpass Access to Sidewalk



Underpass Access



Merge and Weave Redesign

# PEDALCYCLE INTERVENTIONS: SHARED ROADWAY



Separated Bike Lanes



Wide Shoulders



Paved Shoulders



Shared Bus-Bike Lanes



Separated Bike Lanes

# Pedalcycle interventions shared with pedestrian interventions

## Common Approaches with Pedestrian Safety

- Lighting Improvements
- Median/Crossing Island
- Driveway Improvements
- Traffic Calming Measures
  - Road Diet
  - Lane Narrowing
  - Curb Radius Reduction
  - Roundabouts
- Intersection Markings
- Sight Distance Improvements
- Turning Restrictions
- Signaling



# Vehicle Technology- Adaptive Driving Beam Headlights

- Uses automatic headlight beam switching technology to shine less light on occupied areas of the road and more light on unoccupied areas light on unoccupied areas. Useful for distance illumination of pedestrians, etc.





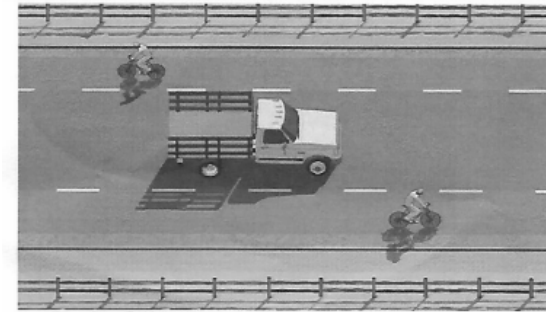
# Suburban and Rural Pedestrian & Cycling Opportunities



# SUBURBAN/RURAL APPROACHES

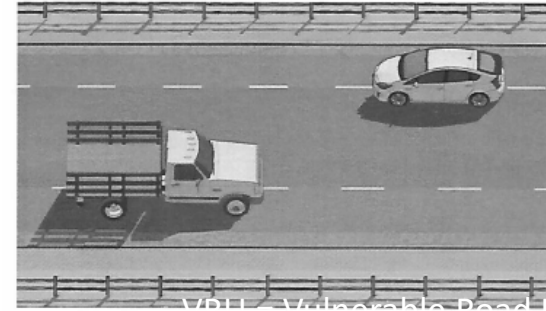
- Not an exclusively urban problem
- All traffic calming approaches are effective
- Might be more of a recreational consideration

**VRU= Vulnerable Road User**



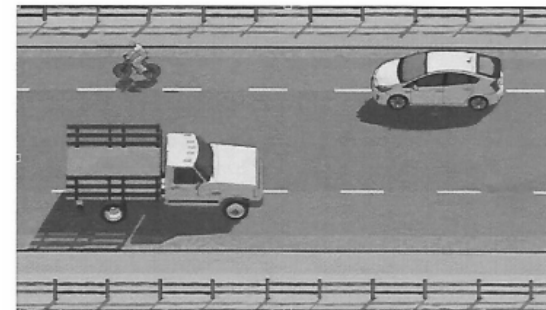
### Single vehicle, no VRU

When a single vehicle encounters VRUs traveling in opposite directions, the driver steers their vehicle to the middle of the road, affording ample safe distance for the VRUs.



### Two vehicles, opposite directions, no VRUs

With vehicles traveling in both directions and no VRUs, drivers use the edge lane enough to pass one another safely. It's a dashed line and with no VRU present, it's fine for vehicles to occupy the advisory shoulder.



### Two vehicles, opposite directions, w/VRUs

The driver of a vehicle following a VRU must wait for the oncoming vehicle to clear so it can pass the VRU safely. Advisory shoulders do not change how the road should be used given the law and safe practice. They advise drivers & VRUs of what they should do to ensure the safety of all road users. This reduces vehicle speeds, improves safety, and reduces the stress of VRUs.

# SYSTEMATIC SOLUTIONS

Beth Israel Lahey Health   
Lahey Hospital & Medical Center

- **Comprehensive**
- **Integrated**
- **Preventative**



# EXAMPLES OF SOLUTIONS

- **“Complete Streets” Policies**
- **“Safe Routes to Schools” Program**
- **“Vision Zero” Initiatives**



# Complete Streets Act of 2021

## The Complete Streets Act of 2021 does three basic things:

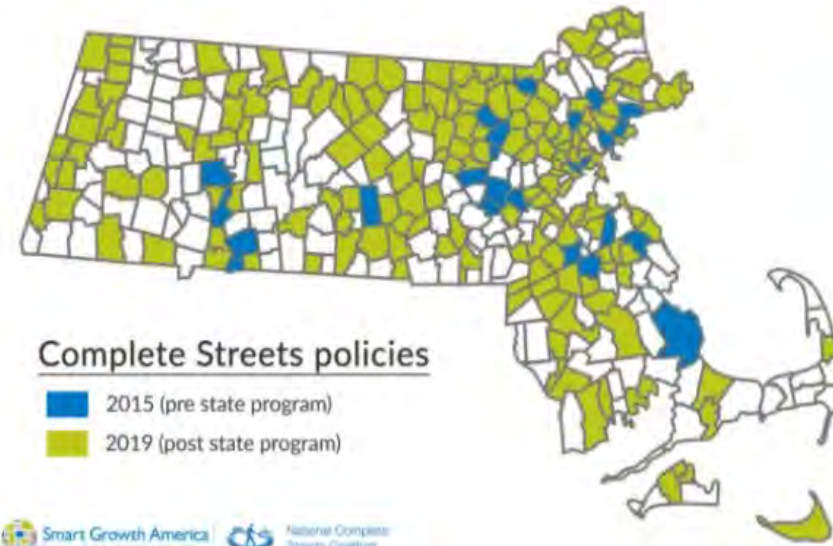
1. **Sets aside federal funds** to support Complete Streets projects (five percent of annual federal highway funds).
2. **Requires states to create a program** to provide technical assistance and **award funding** for communities to build Complete Streets projects.
3. **Directs localities to adopt a Complete Streets policy** that meets a minimum set of standards to access that dedicated funding.



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3. **Directs localities to adopt a Complete Streets policy** that meets a minimum set of standards to access that dedicated funding.



# “COMPLETE STREETS” POLICIES

- Coalition of national, regional and local leaders supporting policies to allow all people to use streets safely:
  - older adults
  - those with disabilities
  - those without access to a car
- Makes it easy to:
  - cross the street
  - walk to shops, jobs and schools
  - bicycle to work
  - move actively with assist devices
- Allows buses to run on time and make it safe for people to walk or move actively to and from the train



# “COMPLETE STREETS”

- **A Resource for Policies/Plans/Ordinances**
  - Ordinances and resolutions
  - Rewrites of design manuals
  - Inclusion of comprehensive plans
  - Internal memos from directors of transportation agencies
  - policies adopted by city and county councils
  - executive orders from elected officials





# “SAFE ROUTES TO SCHOOLS” PROGRAM

- **National non-profit working to advance safe walking and rolling to and from schools and in everyday life.**
- **Congressional funding provided seed and continued support through the Transportation Alternative Program (TAP)**
- **State departments of transportation receive TAP funding to support local governments and school systems**
- **Focused on 6 E's:**
  - Evaluation
  - Education
  - Encouragement
  - Engineering
  - Enforcement
  - Equity



# “SAFE ROUTES TO SCHOOLS” PROGRAM

- **Expanding beyond schools to include the concept of “Active Communities”**
- **Aligns and incorporates “Complete Streets” concepts**
  - Safe Routes to Parks
  - Safe Routes to Healthy Food
- Not just limited to traffic safety but expanded to many other elements- comprehensive
  - Traffic Safety
  - Cost Savings
  - Climate and Clean Air
  - Safety from Crime
  - Community Connectedness
  - Academic Performance
  - Healthier Students
  - School Transportation



# “SAFE ROUTES TO SCHOOLS” PROGRAM

## TRAFFIC SAFETY

- Reduced traffic injuries & dangers for students and community members at arrival & dismissal through street improvements near schools
- More chances to learn & practice road safety for students



**Safe Routes Partnership**

### Benefits of Safe Routes to School

Safe Routes to School improves sidewalks and street crossings and creates safe, convenient, and fun opportunities for children to bicycle and walk to and from school. The CDC has recognized Safe Routes to School as one of a handful of programs that are cost-effective and show significant population health impacts within five years. [saferoutespartnership.org](http://saferoutespartnership.org)

- COST SAVINGS**
  - Household savings from reduced gas costs
  - Education budget savings through reduced student busing costs
- TRAFFIC SAFETY**
  - Reduced traffic injuries & dangers for students and community members at arrival & dismissal through street improvements near schools
  - More chances to learn & practice road safety for students
- SAFETY FROM CRIME**
  - Increased safety from crime & violence due to more people on the streets, good lighting & better street design
  - Less harassment, bullying, or violence when students walk or bike together or with adults
- HEALTHIER STUDENTS**
  - Better health & stronger bones, muscles & joints through more walking & biking
  - Reduced risk of chronic disease, diabetes, & obesity
- SCHOOL TRANSPORTATION FIXES**
  - Solutions to reduced or non-existent bus service through Safe Routes to School
  - Reduced traffic congestion at pick-up/drop-off times
- BETTER ACADEMIC PERFORMANCE**
  - Better focus, improved concentration & less distraction for students who are active before school
  - Fewer absences and less tardiness when students walk or bike in groups
- COMMUNITY CONNECTEDNESS**
  - Stronger student friendships & relationships through walking & biking together
  - Positive social connections for families & neighbors
- CLIMATE BENEFITS AND CLEANER AIR**
  - Fewer student asthma attacks due to less driving & reduced air pollution results
  - Cleaner air & reduced greenhouse gas emissions

# “VISION ZERO” NETWORK

- **First implemented in Sweden in 1990s and adopted across Europe**
- **Strategy to eliminate all traffic fatalities and severe injuries while increasing safe, healthy and equitable mobility for all**

## A New Vision for Safety



# “VISION ZERO” NETWORK

- **Building and sustaining leadership, collaboration and accountability among a diverse group of stakeholders:**
  - transportation professionals
  - policymakers
  - public health officials, EMS services and healthcare providers
  - police
  - community members
- Collecting, analyzing and using data to understand trends and impacts
- Prioritizing equity and community engagement
- Managing speed to safe levels
- Setting a timeline to achieve zero traffic

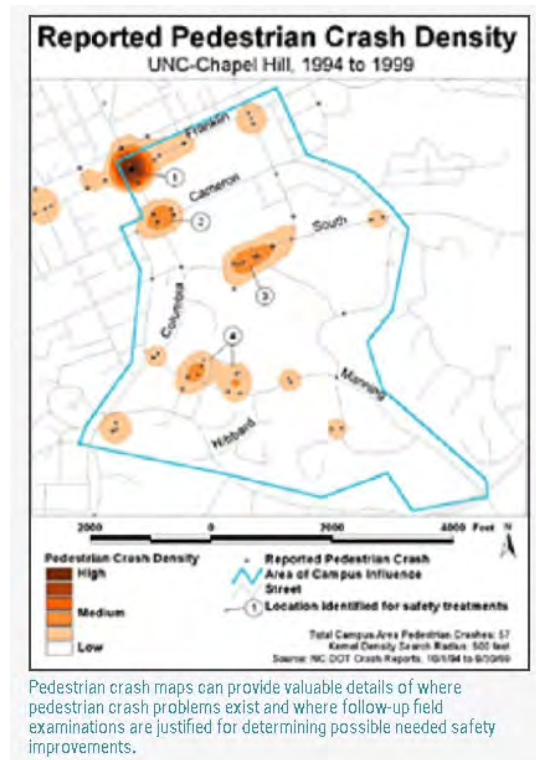


# How Do Tactics Roll Up?



# PRIORITIZATION

- **Multiple models available from federal government**
  - Crash analysis (relatively infrequent events don't offer many "hotspots")
  - community complaints
  - Public input during plan development



# PRIORITIZATION

- **Multiple models available from federal government**
  - Crash analysis (relatively infrequent events don't offer many "hotspots")
  - community complaints
  - Public input during plan development

**Crash Type Matrix**  
View the Performance Objective Matrix [here](#).

Crash Type	Along Roadway	Crossing Locations	Transit	Roadway Design	Intersection Design	Traffic Calming	Traffic Mgmt.	Signals/ Signs	Other
Dart/Dash	X	X	X	X		X	X	X	
Multiple Threat/Trapped		X	X	X	X	X		X	X
Unique Midblock		X		X		X		X	X
Through Vehicle at Unsignalized Location		X	X	X	X	X		X	X
Bus-Related	X	X	X	X				X	X
Turning Vehicle		X	X	X	X	X	X	X	X
Through Vehicle at Signalized Location		X	X	X	X	X	X	X	X
Walking Along Roadway	X	X	X	X				X	X
Working or Playing in Roadway	X	X		X		X	X	X	X
Non-Roadway	X	X		X	X	X		X	X
Backing Vehicle	X	X		X		X			X
Crossing an Expressway		X						X	X

**Performance Objective Matrix**  
View the Crash Type Matrix [here](#).

Objective Type	Along Roadway	Crossing Locations	Transit	Roadway Design	Intersection Design	Traffic Calming	Traffic Mgmt.	Signals/ Signs	Other
Reduce Speed of Motor Vehicles	X	X		X	X	X		X	X
Improve Sight Distance and Visibility for Motor Vehicles and Pedestrians		X	X	X	X	X		X	X
Reduce Volume of Motor Vehicles				X		X	X		X
Reduce Exposure for Pedestrians		X	X	X	X	X	X	X	X
Improve Pedestrian Access and Mobility	X	X	X	X	X	X	X	X	X
Encourage Walking by Improving Aesthetics	X	X	X	X	X	X			X
Improve Compliance With Traffic Laws						X	X	X	X
Eliminate Behaviors That Lead to Crashes		X			X	X	X	X	X





# PRIORITIZATION

- Systematic screening tools
  - Intersection Safety Indices

$$\text{Ped ISI} = 2.372 - 1.867\text{SIGNAL} - 1.807\text{STOP} + 0.335\text{THRULNS} + 0.018\text{SPEED} + 0.006(\text{MAINADT} * \text{SIGNAL}) + 0.238\text{COMM}$$

Where:

Ped ISI	Safety index value (pedestrian)	
SIGNAL	Signal-controlled crossing	0 = no 1 = yes
STOP	Stop-sign controlled crossing	0 = no 1 = yes
THRULNS	Number of through lanes on street being crossed (both directions)	1, 2, 3, ...
SPEED	Eighty-fifth percentile of speed of street being crossed	Speed in miles per hour
MAINADT	Main street traffic volume	ADT in thousands
COMM	Predominant land use on surrounding area is commercial development (i.e. retail, restaurants)	0 = not predominantly commercial area 1 = predominantly commercial area

FIGURE 2 FHWA Pedestrian Intersection Safety Index model equation and index values. Reproduced from Table 1 in Carter et al. (2006).

- Road Safety Audit (RSA)



# PRIORITIZATION

- Systematic screening tools
  - Guides for Assessing Risks and Selecting Treatments

MATRIX OF RECOMMENDATIONS FOR INSTALLING MARKED CROSSWALKS AND OTHER NEEDED PEDESTRIAN IMPROVEMENTS

Roadway Type (number of travel lanes and median type)	Vehicle ADT ≤ 9,000			Vehicle ADT > 9,000 to 12,000			Vehicle ADT > 12,000 to 15,000			Vehicle ADT > 15,000		
	Speed Limit*											
	≤ 48.3 km/h (30 mph)	56.4 km/h (35 mph)	64.4 km/h (40 mph)	≤ 48.3 km/h (30 mph)	56.4 km/h (35 mph)	64.4 km/h (40 mph)	≤ 48.3 km/h (30 mph)	56.4 km/h (35 mph)	64.4 km/h (40 mph)	≤ 48.3 km/h (30 mph)	56.4 km/h (35 mph)	64.4 km/h (40 mph)
Two lanes	C	C	P	C	C	P	C	C	N	C	P	N
Three lanes	C	C	P	C	P	P	P	P	N	P	N	N
Multilane (four or more lanes with raised median)**	C	C	P	C	P	N	P	P	N	N	N	N
Multilane (four or more lanes without raised median)	C	P	N	P	P	N	N	N	N	N	N	N

*Note:* Reproduced from Zegeer et al. (2005) Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations, Table 11, p. 54. These guidelines include intersection and midblock locations with no traffic signals or stop signs on the approach to the crossing. They do not apply to school crossings. A two-way center turn lane is not considered a median. Crosswalks should not be installed at locations that could present an increased safety risk to pedestrians, such as where there is poor sight distance, complex or confusing designs, a substantial volume of heavy trucks, or other dangers, without first providing adequate design features or traffic control devices or both. Adding crosswalks alone will not make crossings safer, nor will they necessarily result in more vehicles stopping for pedestrians. Whether or not marked crosswalks are installed, it is important to consider other pedestrian facility enhancements (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic-calming measures, curb extensions), as needed, to improve the safety of the crossing. These are general recommendations; good engineering judgment should be used in individual cases for deciding where to install crosswalks.

\* Where the speed limit exceeds 64.4 km/h (40 mph), marked crosswalks alone should not be used at unsignalized locations.

\*\* The raised median or crossing island must be at least 1.2 m (4 ft) wide and 1.8 m (6 ft) long to serve adequately as a refuge area for pedestrians, in accordance with MUTCD and AASHTO guidelines.

ADT = Average daily traffic.

C = Candidate sites for marked crosswalks. Marked crosswalks must be installed carefully and selectively. Before installing new marked crosswalks, an engineering study is needed to determine whether the location is suitable for a marked crosswalk. For an engineering study, a site review may be sufficient at some locations, while a more in depth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, and other factors may be needed at other sites. It is recommended that a minimum utilization of 20 pedestrian crossings per peak hour (or 15 or more elderly or child pedestrians) be confirmed at a location before placing a high priority on the installation of a marked crosswalk alone.

P = Possible increase in pedestrian crash risk may occur if crosswalks are added without other pedestrian facility enhancements. These locations should be closely monitored and enhanced with other pedestrian crossing improvements, if necessary, before adding a marked crosswalk.

N = Marked crosswalks alone are insufficient, since pedestrian crash risk may be increased by providing marked crosswalks alone. Consider using other treatments, such as traffic-calming treatments, traffic signals with pedestrian signals where warranted, or other substantial crossing improvement to improve crossing safety for pedestrians.



# Boston's Journey: Example of Adoption



# BOSTON'S JOURNEY

- **2015- Vision Zero program adopted to reduce serious and fatal traffic crashes**
- **2016- Focused initially on prioritizing corridors based on crash histories**
  - Focused on Codman Square and Mass Ave in the Back Bay, Fenway and South End
  - focused on crosswalks and bike lanes
- Adopted Citywide Default 25 MPH Speed Limit
- Identified Neighborhood Slow Street Initiatives with traffic calming devices
  - Tabot-Norfolk Triangle in Dorchester
  - Stonybrook neighborhood in Jamaica Plan
- Quick fix program to be put in place in response to severe crashes
  - high visibility crosswalks
  - signs
  - flex posts
  - signal changes
- Community Engagement Activities

Sources: Boston.gov (Boston 2030, Healthy Streets, Transportation Project Across Boston web pages)



# BOSTON'S JOURNEY

- **2017**
  - Expanded Priority Corridors
  - Expanded Neighborhood Safety Projects
  - Moved into Equitable Decision Making
    - People- those with greater vulnerability
    - Places- where people to gather or receive services
      - Schools
      - Libraries
      - Centers for Youth and Families
      - Parks
      - Homeless shelters
      - Places of opportunity-higher ed and job centers



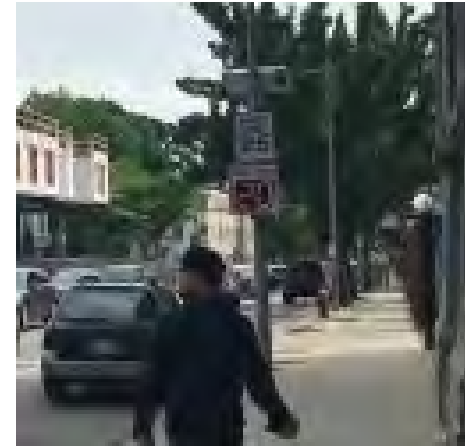
# BOSTON'S JOURNEY

- **2018**
  - Expanded Neighborhood Slow Streets zones
  - Expand protected bike lanes
    - Bike Share Network Expansion
    - Better Bike corridors
  - Increase Priority Corridors
    - Neighborhood Complete Street Designs
  - Tactical Plazas
- **2019-2020 “Healthy Streets”**
  - Enhancing and expanding safe and reliable transit
    - Expanded bus stops to improve safe waiting
    - Expanded routes to reduce the need for long distance walking
    - Expanded dedicated bus lanes to improve service
  - Connecting Bike Routes between Corridors



# BOSTON'S JOURNEY

- 25 MPH Speed Limit Change



# BOSTON'S JOURNEY

- Traffic Calming in “Neighborhood Slow Street Zones”





# BOSTON'S JOURNEY

- **Priority Corridor Changes**



Improved sight lines at corners



Road diet and separated bike lane



Modified WALK signals



Left turn lane adds predictability



Crosswalk and curb extensions



crosswalk, refuge island, rapid flash beacons

# BOSTON'S JOURNEY

- **Included examples of prioritization initially based on crash data**
- **Includes many examples of traffic interventions**
- **Starting to migrate to address equity**
- **Expanding into “transit” concepts**
- **Expanding into more comprehensive programs**



# CONCLUSIONS

- **COMPLEX MULTI-LAYERED ISSUE**
- **WILL REQUIRE COMPREHENSIVE APPROACH**
- **MODELS PROGRAMS ARE BEING ACTIVELY IMPLEMENTED**
- **MANY STRUCTURAL AND DESIGN SOLUTIONS**
- **EQUITY ISSUES AT ROOT OF MANY OF THE SOLUTIONS**

