

University of Massachusetts
Baystate Roads Program

**MassDOT Design Guide
and
Complete Streets
Primer**



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Housekeeping

- » Emergency Exits
- » Washroom Locations
- » *Halfway Break*
- » Informal Format – Ask Questions
- » Cell Phones on Vibrate



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Agenda

- » General Introductions
- » Introduction to Complete Streets
- » MassDOT Design Guide
- Break --
- » Getting to Complete Streets (Complete Streets Concepts)



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Project Team

- » Massachusetts Department of Transportation
- » Baystate Roads Program/University of Massachusetts - Amherst
- » Fay, Spofford & Thorndike, LLC
- » National Complete Streets Coalition



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Introduction

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Introductions: Who are you?

- » Your name / your organization / your job
- » Have you heard of Complete Streets?
- » What you hope to get out of today

Complete streets' programs give more room for pedestrians, cyclists

Advocates say such programs are needed for more than just safety. They also can help reduce traffic congestion and improve air quality. The programs are designed to make streets safer and more accessible for everyone, including people with disabilities, children, the elderly and those who don't own a car. They also can help reduce traffic congestion and improve air quality. The programs are designed to make streets safer and more accessible for everyone, including people with disabilities, children, the elderly and those who don't own a car.



Monday, July 30, 2007



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Objectives

- » Discover tools you can use to achieve Complete Streets
- » Learn how the MassDOT Design Guide can help
- » Understand fundamental engineering terms



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Project Overview

- » 3-hour Complete Streets Primers are being conducted throughout the state – encore
- » Host a workshop in your community!
Contact Cindy Schaedig: cindy@baystateroads.org



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MassDOT Mission & Sustainability Commitment

Our mission is to deliver excellent *customer service* to the people who travel in the Commonwealth and to provide our nation's *safest* and most reliable transportation system in a way that strengthens our economy and quality of life.



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Embedding Sustainability with GreenDOT Goals



- 1. Reduce Greenhouse Gas (GHG) Emissions
- 2. Promote Healthy Transportation
- 3. Support Smart Growth



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MassDOT's Sustainability & Livability Framework

- » Requires 'Complete Streets', consistent with the 2006 MassDOT Design Guide on all projects



Massachusetts Avenue/Central Square, Cambridge



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Introduction to Complete Streets

- » Examples of Complete and Incomplete Streets
- » Types of Complete Streets
- » Benefits from Complete Streets



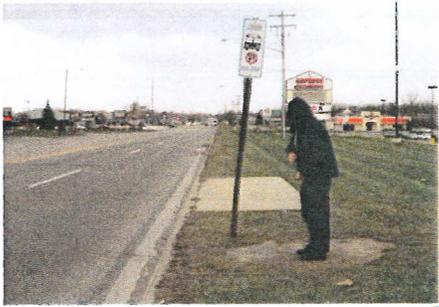
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Incomplete Streets



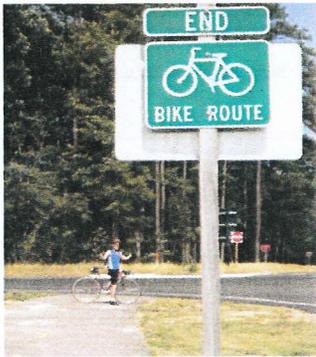
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Incomplete Streets



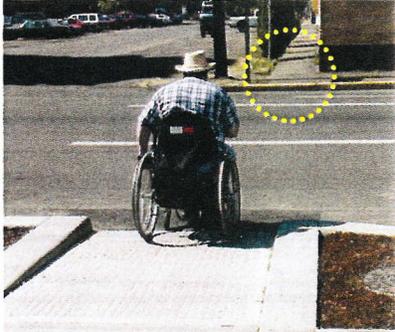
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Incomplete Streets



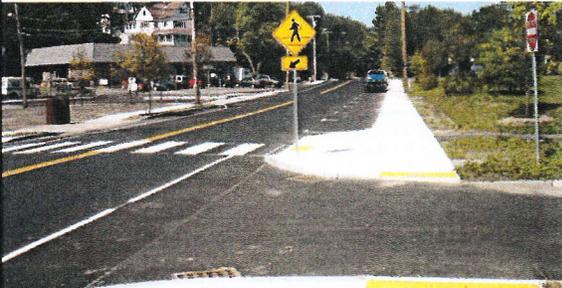
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Incomplete Streets



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We know how to build right

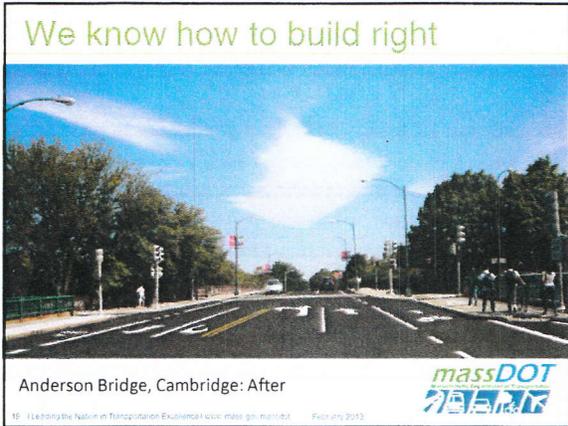


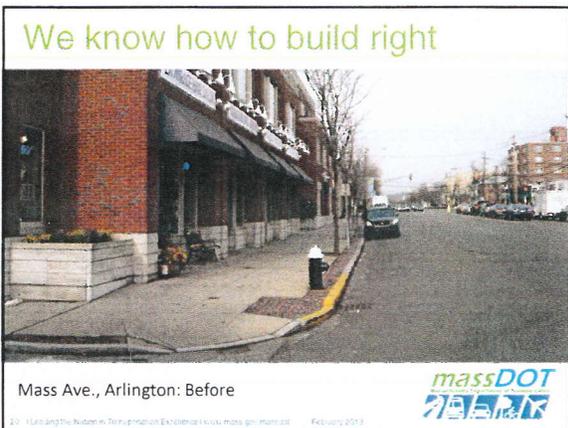
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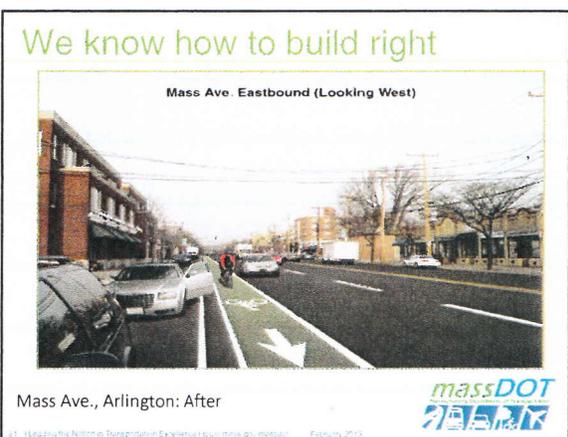
We know how to build right



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We know how to build right



Route 134, Dennis: Before



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We know how to build right



Route 134, Dennis: After



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Introduction to Complete Streets

- » Examples of Complete and Incomplete Streets
- » Types of Complete Streets
- » Benefits from Complete Streets



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What is a Complete Street?



A Complete Street is a facility that is safe, comfortable & convenient for travel via automobile, foot, bicycle & transit



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The many types of Complete Streets



Leonard Street, Belmont, MA

One size doesn't fit all



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The many types of Complete Streets



Trapelo Road, Belmont, MA

One crossing completes a Safe Route to School



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The many types of Complete Streets



Martha's Vineyard, MA

Shoulder bikeways on rural roads



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The many types of Complete Streets



Busy multi-modal thoroughfares



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The many types of Complete Streets



Cambridge, MA

Transit routes



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The many types of Complete Streets



Suburban thoroughfares



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The many types of Complete Streets



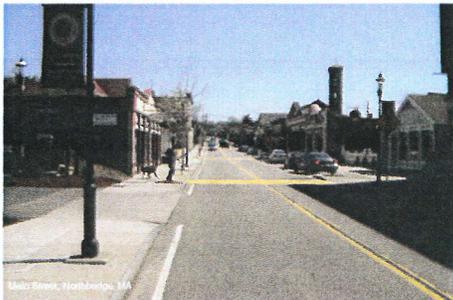
Lake Street, Arlington, MA

Residential streets with shoulder for bikes and sidewalks



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The many types of Complete Streets



Main Street, Northampton, MA

Historic Main Street



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Group Exercise:

- » Discuss examples of Complete Streets in your community



Introduction to Complete Streets

- » Examples of Complete and Incomplete Streets
- » Types of Complete Streets
- » Benefits from Complete Streets



Everyone Benefits

- » About **one-third** of Americans don't drive:
 - ✓ 21% of Americans over 65
 - ✓ Children under 16
 - ✓ Disabled Americans
 - ✓ Those without cars
- » Most Americans would rather drive less & walk more
- » Transit is growing faster than population or driving



Congestion Benefits

Complete Streets are multimodal

Trips in metro areas:

- » 48% are less than 3 miles
- » 28% are less than 1 mile
- » 65% of trips less than 1 mile are taken by car



These are all potential bicycle or walking trips



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Safety Benefits

- » Sidewalks reduce pedestrian crashes 88% (FHWA)
- » Shoulders reduce pedestrian crashes 71% (FDOT)
- » Medians reduce crashes 40% (NCHRP)
- » Road diets reduce crashes 18 – 49% (ITE)
- » Countdown signals reduce crashes 25% (FHWA)



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Transit Benefits

- » Connect transit to work, to shops, to schools, to homes through appropriate planning and design for transit users.



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Equity Benefits

- » Low and moderate income families spend a higher percentage of income on transportation (Roughly 30% vs. 20% for all families)
- » Complete Streets give everybody more control over their expenses, replacing car travel with options like walking, riding bikes, and taking public transportation



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Benefits for People with Disabilities

- » 20% of Americans have a disability that limits their daily activities (physical, visual, and hearing impairments)
- » Complete Streets feature curb cuts, high visibility crosswalks, and other designs for travelers with disabilities
- » Complete Streets reduce isolation and dependence



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Benefits for Older Adults

- » By 2025, nearly 1/5 of Americans will be 65 or older.
- » About 1/2 of all non-drivers over the age of 65 would like to get out more often.
- » Complete streets policies help create streets that support older drivers and pedestrians through better design.
- » Complete streets help older Americans stay active and involved in their communities.



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Benefits for Children

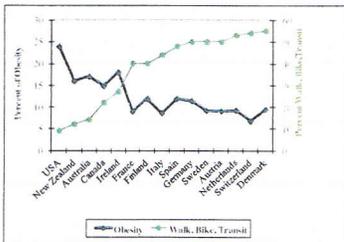
- » Streets that provide dedicated space for bicycling and walking help kids be physically active and gain independence.
- » **More than 1/3** of our nation's children are overweight or obese.
- » Limited physical activity contributes to the obesity epidemic among children.



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Health Benefits

- » Obesity is lower in places where people use bicycles, public transportation, and walk.

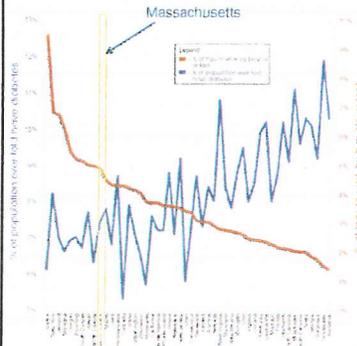


Pucher, "Calline and cycling: Paths to Improved Public Health" at a conference, NYU, June 2009



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Health Benefits



- » States with the lowest levels of biking and walking have, on average, the highest rates of obesity, diabetes, and high blood pressure.



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Health Benefits for MA

Massachusetts spent over \$1.8 B/year on medical costs related to obesity (1998 – 2000)

- » 13.3% of MA children are obese and 16.9% are overweight
- » Childhood obesity rates are as high as 27% in some communities
- » 58.6% of MA adults are overweight or obese
- » Over the last 15 years, obesity rate has increased **more than 90%**



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Health Benefits

- » The Centers for Disease Control and Prevention identified adoption of Complete Streets policies as a recommended strategy to prevent obesity.



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Physical Activity Benefits

- » Residents are more likely to walk in a neighborhood with sidewalks
- » Cities with more bike lanes have higher levels of bicycle commuting



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MassDOT Design Guide



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Project Development & Design Guide

» Award Winning in Numerous Categories:

- » Transportation
- » Environmental
- » Public Works
- » Historic Preservation
- » Planning
- » Context Sensitivity
- » Highway Design



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Project Development & Design Guide

» Recognized by organizations spanning disciplines:

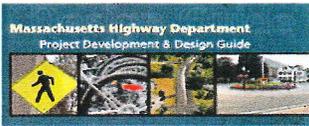
- » Institute of Transportation Engineers
- » Federal Highway Administration
- » American Public Works Association
- » Federal Transit Administration
- » American Planning Association
- » American Association of State Highway and Transportation Officials
- » National Complete Streets Coalition



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Project Development & Design Guide

- » Three key objectives:
 - » Multimodal consideration
 - » Context sensitive design
 - » Clear project development process




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Project Development & Design Guide

- » Design Guide applies when:
 - » MassDOT is the project proponent
 - » MassDOT is responsible for project funding (state or federal-aid projects)
 - » MassDOT controls the infrastructure (projects on state highway)
- » Also appropriate for use:
 - » Chapter 90 funded projects
 - » Any locally funded project
 - » Subdivision developments



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Project Development Process

Sheet 2-1
Overview of Project Development

PROCESS	OUTCOMES
STEP I Pre-Work/Agreements/Study/Escrow	1. Request/Agreement (PWA)
STEP II Planning	2. Project/Request Report (P/RR)
STEP III Project Selection	3. Project Selection Form (PSF) 4. Identification of Appropriate Funding 5. Determination of appropriate Permits 6. Project Business Committee Action
STEP IV Environmental Design (E/D) Process	7. Plans, Specs and Contract (PSC) 8. Environmental Study and Permit 9. Right of Way (ROW) 10. Details
STEP V Bidding	11. Request and State ID 12. Bidding and Bid
STEP VI Procurement	13. Construction Bid and Contractor Selection
STEP VII Construction	14. Build - out
STEP VIII Project Acceptance	



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Do we have to widen roads to fit everything?



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There's room; it needs to be rethought



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Proposed design – from the *outside* → in

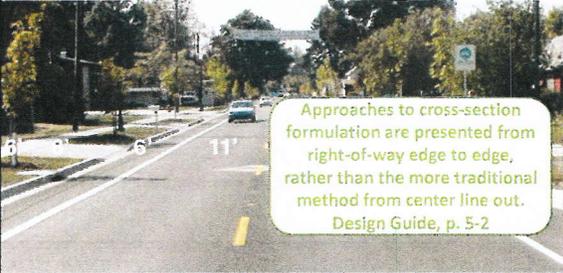


Add up desirable elements, fit in ROW;
result: sidewalks, bike lanes, travel lanes



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Proposed design – from the *outside* → in



Approaches to cross-section formulation are presented from right-of-way edge to edge, rather than the more traditional method from center line out. Design Guide, p. 5-2

Add up desirable elements, fit in ROW; result: sidewalks, bike lanes, travel lanes



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Group Exercise:

- » What are the challenges of implementing Complete Streets in your community?



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Complete Streets Concepts

- » Roadway Type as Part of Context
- » Design Speed Selection
- » Mobility Considerations
- » Lane Widths
- » Road Diets
- » Intersection Curb Radii
- » On-Street Bike Lanes
- » Pedestrian Facilities



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Complete Streets Concepts

- » **Roadway Type as Part of Context**
- » Design Speed Selection
- » Mobility Considerations
- » Lane Widths
- » Road Diets
- » Intersection Curb Radii
- » On-Street Bike Lanes
- » Pedestrian Facilities



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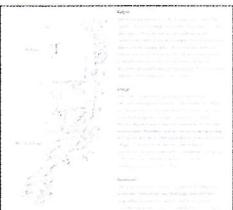
Design Guide/Context

- » Three elements of context:
 - » Area Type
 - » Roadway Type
 - » Access Control



Reference P-32
05 | Leading the Nation in Transportation Excellence | www.mass.gov/massdot | February 2013

Design Guide/Context



- » Area Type:
 - » Rural



Reference P-35
06 | Leading the Nation in Transportation Excellence | www.mass.gov/massdot | February 2013

Design Guide/Context



- » Area Type:
 - » Rural
 - » Suburban

Reference P. 18
67 - Using the National Transportation Design Guide | www.mass.gov/massdot February 2013



Design Guide/Context



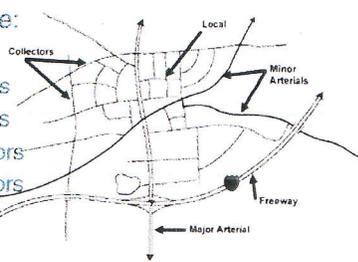
- » Area Type:
 - » Rural
 - » Suburban
 - » Urban

Reference P. 9-9
69 - Using the National Transportation Design Guide | www.mass.gov/massdot February 2013



Design Guide/Context

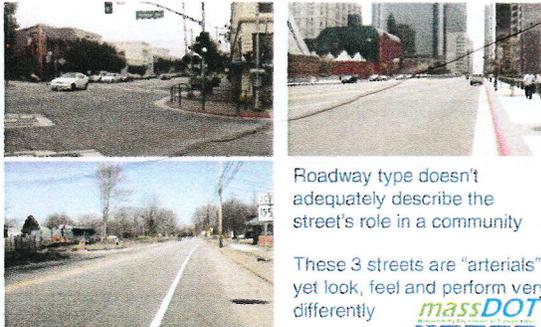
- » Roadway Type:
 - » Freeways
 - » Major arterials
 - » Minor arterials
 - » Major collectors
 - » Minor collectors
 - » Local roads



Reference P. 38
63 - Using the National Transportation Design Guide | www.mass.gov/massdot February 2013

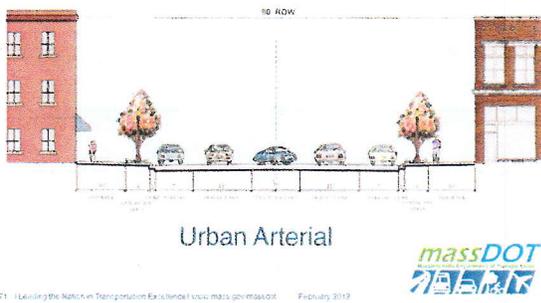


Should Street Width be Based Solely on Roadway Type?



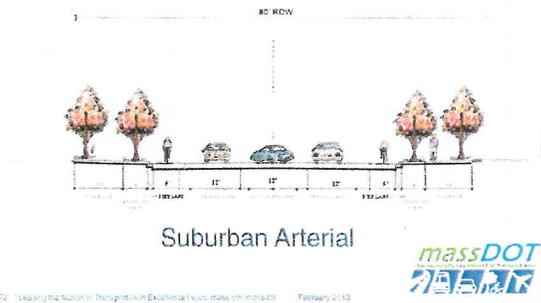
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Cross-section based on context



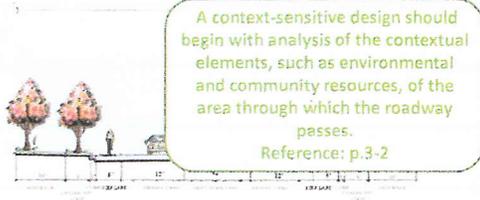
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Cross-section based on context



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Cross-section based on context



A context-sensitive design should begin with analysis of the contextual elements, such as environmental and community resources, of the area through which the roadway passes.
Reference: p.3-2

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Design Guide/Context

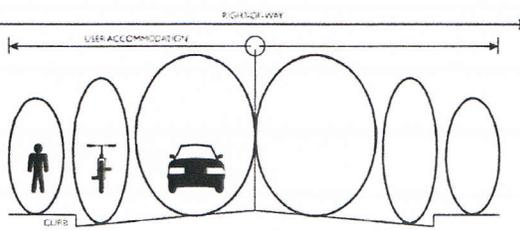
- » Most highway design guides use typical sections
- » Typical sections can lead to inadequate user accommodation or superfluous width
- » MassDOT Design Guide use “descriptive cases” rather than “typical sections”
- » Descriptive cases are based on context

Reference: P. 5-4

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Case 1



USER ACCOMMODATION

RIGHT-OF-WAY

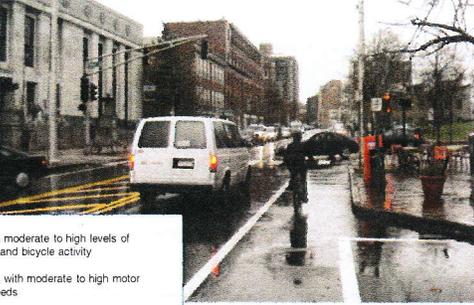
CLIFF

Separate accommodation for all users

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Case 1



•Appropriate for:
•Areas with moderate to high levels of pedestrian and bicycle activity
•Roadways with moderate to high motor vehicle speeds
•Areas without substantial environmental or right-of-way constraints

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Case 1



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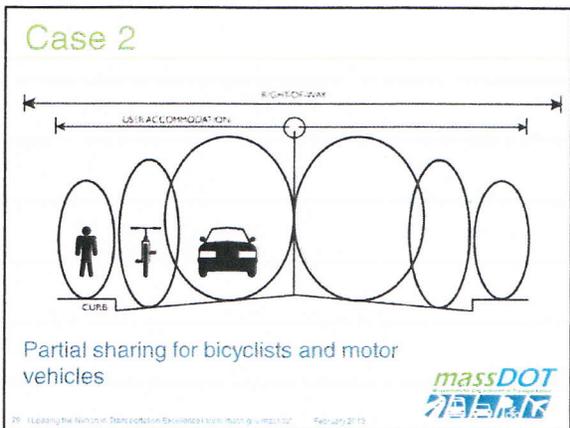
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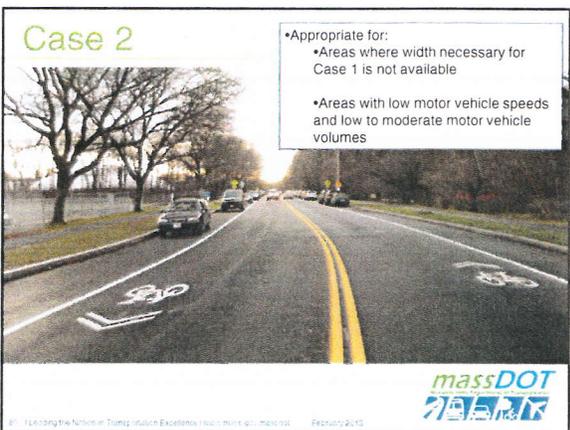
Case 1



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Case 3

The diagram illustrates a cross-section of a road with a central curb. On the left side of the curb, there are three overlapping ovals representing the accommodation for a pedestrian, a bicycle, and a car. A double-headed arrow above the road indicates the 'RIGHT-OF-WAY' boundary. A longer double-headed arrow above the road, extending further to the left, is labeled 'USER ACCOMMODATION'. The curb is labeled 'CURB' at the bottom left. The massDOT logo is in the bottom right corner.

Shared bicycle/motor vehicle accommodation

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Case 3

A photograph of a residential street with a dedicated bicycle lane. The lane is marked with a white bicycle symbol and a white arrow pointing forward. The street is lined with trees and a sidewalk. The massDOT logo is in the bottom right corner.

- Appropriate for:
 - Densely developed areas where right-of-way is constrained
 - Residential/local streets where speeds and traffic volumes are low

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Case 3

A photograph of a residential street with a yellow diamond-shaped speed limit sign that reads 'THICKLY SETTLED 30 MPH'. A car is driving away on the road. The massDOT logo is in the bottom right corner.

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Case 4

Shared bicycle/pedestrian accommodation

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05 | 14494786 National Transportation Expenditure Survey | 05/01/13 | February 2013

Case 4

•Appropriate for:
•Rural or sparsely developed areas
•Areas with infrequent pedestrian and bicycle use

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Case 4

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Case 5

Shared accommodation for all users

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Case 5

- Appropriate for:
 - Areas where user demands and motor vehicle speeds are very low
 - Areas where severe constraints limit the feasibility of providing separate accommodation

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Case 5

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Case 5



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Break/10 Minutes

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Complete Streets Concepts

- » Roadway Type as Part of Context
- » **Design (Target) Speed Selection**
- » Mobility Considerations
- » Lane Widths
- » Road Diets
- » Intersection Curb Radii
- » On-Street Bike Lanes
- » Pedestrian Facilities

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Design for street types

- » Design criteria:
 - » Physical configuration
 - » Surrounding context
- » Dimensions for
 - » Sidewalk environment
 - » Street
 - » Intersections
- » **Target speed** (desirable operating speed)



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Why Speed Matters

High speeds lead to greater chance of serious injury & death

Speed	Chance of death
32 km/h (20 MPH)	5%
50 km/h (30 MPH)	45%
65 km/h (40 MPH)	85%

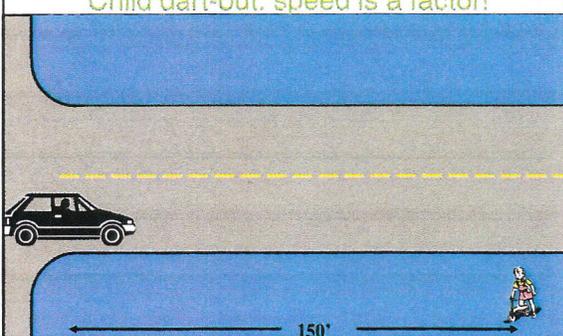
Doubling the speed from 20 mph to 40 mph reduces the survivability from 95% to just 15%

Pedestrians' chances of death if hit by a motor vehicle
SOURCE: King, Speed and Saving Lives, UK Department of Transportation



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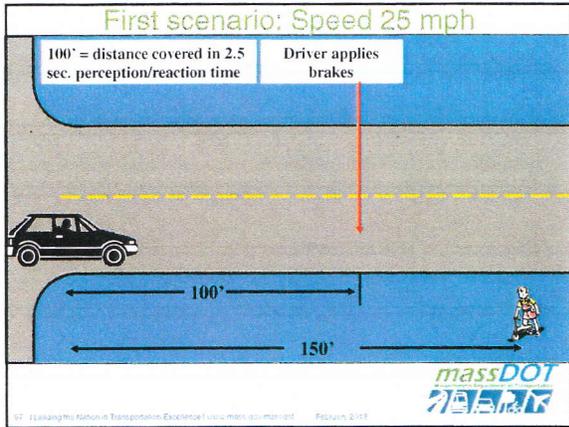
Child dart-out: speed is a factor!

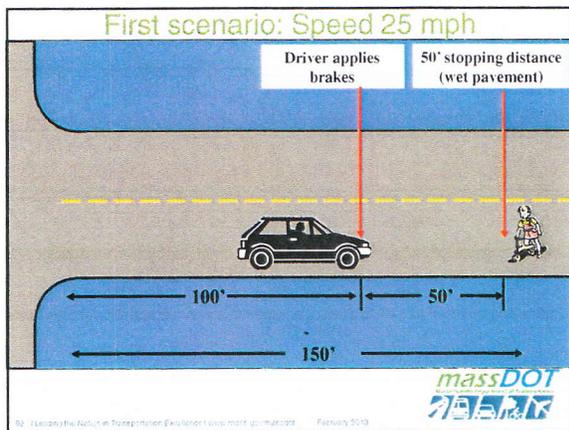


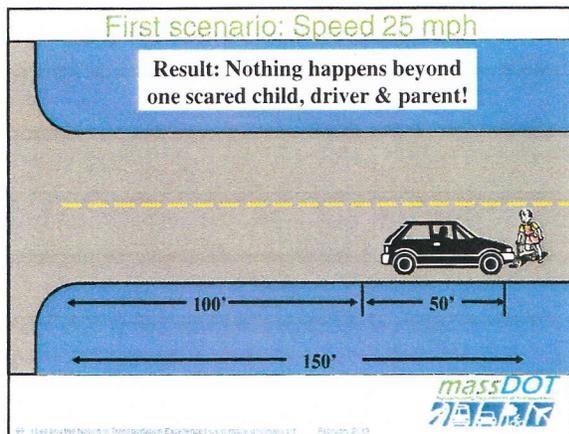
150'

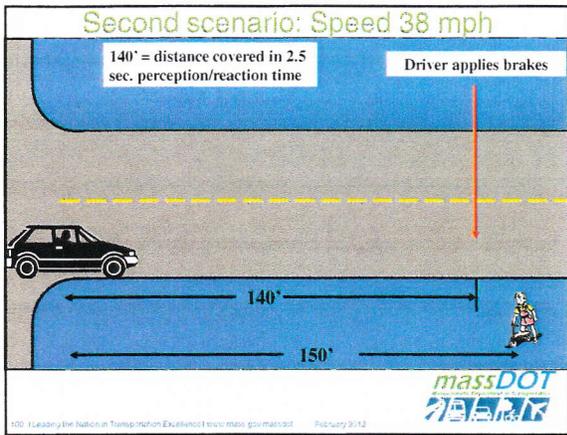


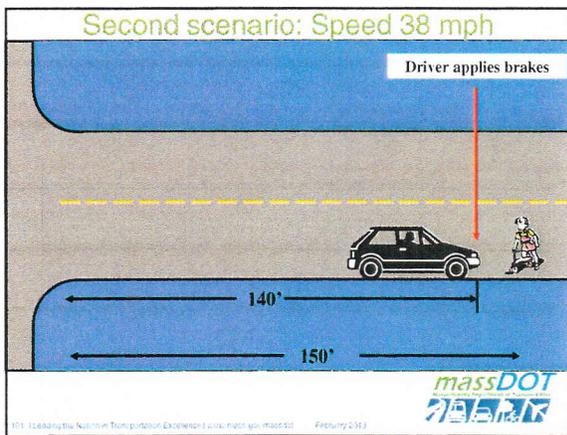
56 | Leaving the Nation's Transportation Experiences | www.mass.gov/massdot | February 2013

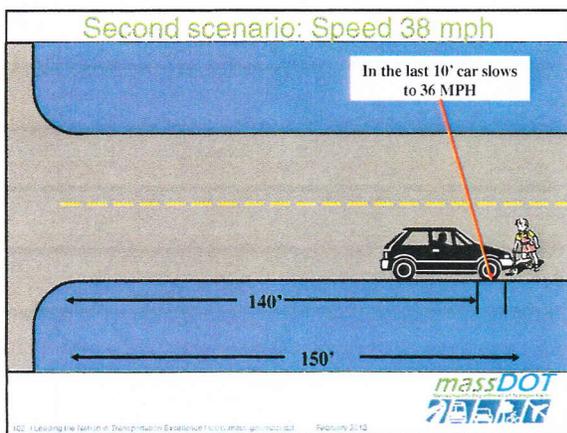


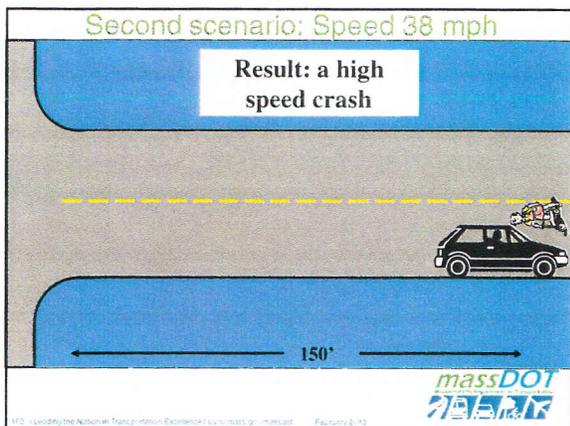


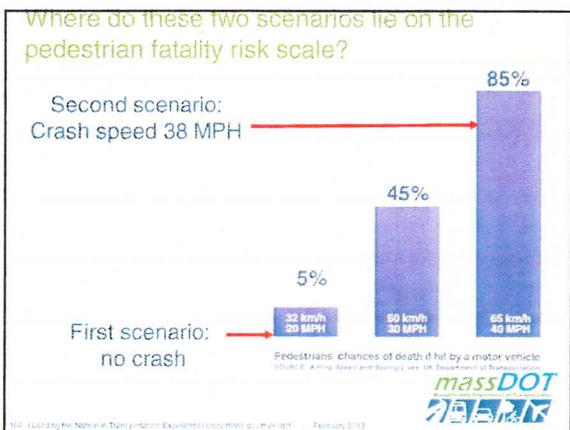












Design Guide/Speed

- » Appropriate **target speed** should consider:
 - » The context of the roadway including area type, roadway type, and access control
 - » The volume, mix, and safety of facility users
 - » The anticipated driver characteristics and familiarity with the route

massDOT

Reference P-132

103 | Leading the National Transportation Excellence | www.mass.gov/massdot | February 2013

Group Exercise:

- » How fast would you like people to drive on different roads in your community?

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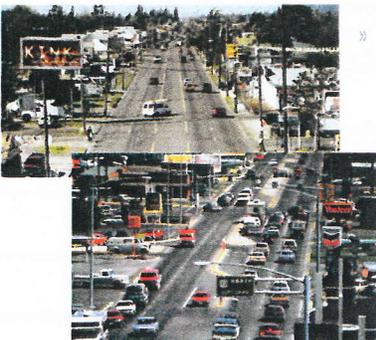
Complete Streets Concepts

- » Roadway Type as Part of Context
- » Design (Target) Speed Selection
- » **Mobility Considerations**
- » Lane Widths
- » Road Diets
- » Intersection Curb Radii
- » On-Street Bike Lanes
- » Pedestrian Facilities

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Redefining Mobility



- » Typical experience:
 - » 45 mph speed
 - » 2 min wait at signal

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Redefining Mobility

- » Viable alternative:
 - » Time signals for 30 mph uninterrupted flow



Complete Streets changes mobility for **all users**



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Roadway Capacity Analysis

- » Roadway design based on peak hour (or half hour) traffic for design year (typically 20 years hence)

Level of Service (LOS) Intervals		
Signalized Intersection		
Delay Per Vehicle (sec)	LOS	Description
≤10	A	Free flow
>10 and ≤20	B	Minor delays
>20 and ≤35	C	Occasional delays
>35 and ≤55	D	Typical urban flow
>55 and ≤80	E	Practical capacity
>80	F	Stop-and-go

Source: Highway Capacity Manual, 2000.



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Roadway Capacity Analysis

- » Designing for Level of Service C future peak hour means:

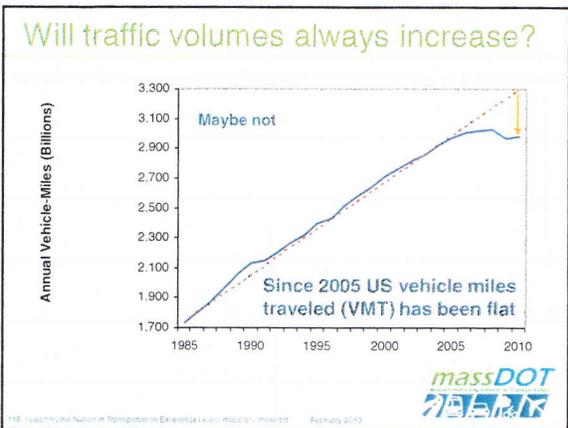
- » Increased pavement widths
- » Increased operating speeds for non-peak hours
- » Increased pedestrian crossing times, thus reducing vehicular movement times



Designing urban roadways to LOS D or lower is usually the most cost effective.



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Design Guide/Forecasts

- » To evaluate future conditions, first establish a baseline using existing conditions data
- » Forecasts should include estimates of pedestrian and bicycle activity, taking into account latent demand

Reference F-222
116 Looking for the Future in Transportation: Evolving from MassDOT's Vision 2030 February 2013



Design Guide/Forecasts

- » To evaluate future conditions, planners

Although the typical process for forecasting traffic volumes assumes that traffic will increase over time, in some situations traffic volumes may decline or remain relatively constant.

Reference F-222
116 Looking for the Future in Transportation: Evolving from MassDOT's Vision 2030 February 2013



Level of Service - Service Measures

System Element	Mode	Model Components
Urban Street Facility	Automobile	Weighted avg. of segment LOS scores
	Pedestrian	Street segment and intersection LOS, midblock crossing difficulty
	Bicycle	Street segment and intersection LOS, driveway conflicts
	Transit	Weighted avg. of segment LOS scores
Urban Street Segment	Automobile	Stops per mile, left-turn lane presence
	Pedestrian	Sidewalk width, separation from vehicles, traffic vol. and speed
	Bicycle	Separation from vehicles, pavement quality, traffic vol. and speed
	Transit	Service frequency, speed, pedestrian LOS
Signalized Intersection	Pedestrian	Delay, exposure to turning vehicles, crossing distance
	Bicycle	Separation from vehicles, crossing distance

Source: Highway Capacity Manual, 2010



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Design Guide/Level of Service

- » Level of Service:
 - » Desired LOS is determined through consensus of the affected community and the facility owner
 - » Evaluate LOS of **each user group** and test alternatives to meet goals of the project.



Reference: P. 3-2a

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Design Guide/Level of Service

- » Level of Service:

In most instances, the designer should not propose a design that provides a level-of-service improvement for one user group at the expense of another.



Reference: P. 3-2b

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Complete Streets Concepts

- » Roadway Type as Part of Context
- » Design (Target) Speed Selection
- » Mobility Considerations
- » **Lane Widths**
- » Road Diets
- » Intersection Curb Radii Road Diets
- » On-Street Bike Lanes
- » Pedestrian Facilities



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Design Guide/Lane Width

- » Travel lane width is selected through consideration of:
 - » Roadway context
 - » Approach to multimodal accommodation
 - » Dimension of vehicles
 - » Speeds
 - » Other traffic flow characteristics



Reference F. 5.2 | 122 | Leading the Nation in Transportation Excellence | www.mass.gov/massdot February 2013

Design Guide/Lane Width

- » Travel lane widths range 10 to 12 feet
- » 11 to 12-foot lanes are selected where:
 - » **Design speeds ≥ 45 mph**
 - » Average Daily Traffic $\geq 2,000$
 - » Truck/bus volumes > 30 /hour



Reference F. 5.3 | 123 | Leading the Nation in Transportation Excellence | www.mass.gov/massdot February 2013

Design Guide/Lane Width

- » Lanes wider than 12 feet are used in:
 - » Some cases where shoulders are not provided (e.g. rural villages, suburban villages and town centers, or urban areas)
 - » Areas with high driveway density

Reference: P. E-51

124 - Leading the Nation in Transportation Excellence (www.mass.gov/massdot) February 2013



Design Guide/Lane Width

- » Lanes wider than 12 feet are used in:
 - » Some cases where shoulders are not provided (e.g. rural villages, suburban villages and town centers, or urban areas)
 - » Areas with high driveway density
- If more than 12 feet is available, it is often preferable to stripe a shoulder

Reference: P. E-21

125 - Leading the Nation in Transportation Excellence (www.mass.gov/massdot) February 2013



Design Guide/Lane Width

- » Lanes narrower than 11 feet:
 - » Appropriate for lower speed, lower volume roads that primarily provide access
 - » May be striped to allow a shoulder that provides separation for bicyclists and pedestrians
 - » Minimize right-of-way requirements
 - » Minimize impact to the built and natural environment

Reference: P. E-31

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Design Guide/Lane Width

» Lanes narrower than 11 feet:

- » May
- » r
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- » M

Flexibility is permitted to encourage independent designs tailored to particular situations.

Reference # 211

127 | Leading the Nation in Transportation Excellence | www.mass.gov/massdot | February 2013



Group Exercise:

- » Do you know how wide your roads are? Your lanes and shoulders?
- » Do you think that certain widths are better than others? Why?

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Complete Streets Concepts

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How to Make Room: Road Diets

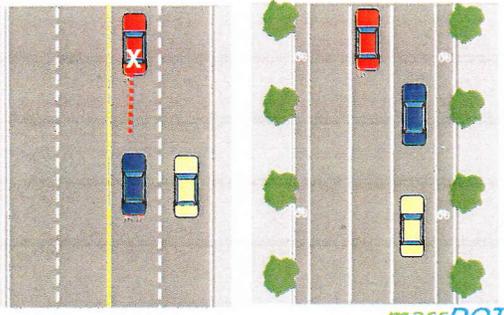


Convert 4-Lane Road to 3-Lane including Center Turn Lane
→ 18 – 49% crash reduction (ITE)

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Crash Reduction

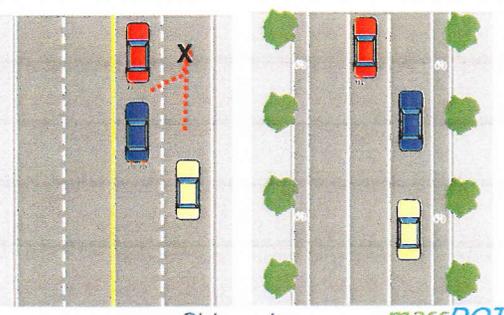


Rear end

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Crash Reduction

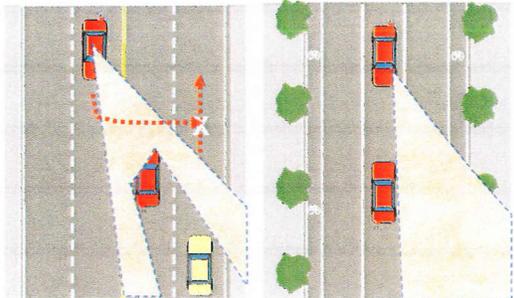


Side swipe

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Crash Reduction

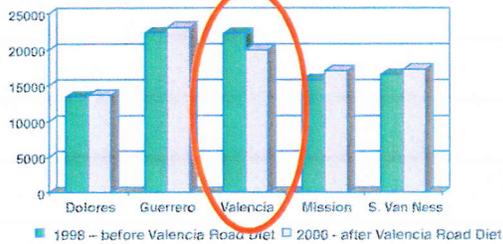


Left turn/broadside



103 - Leading the Nation in Transportation: Evaluation of Road Diets - February 2013

Capacity



Road Diets can handle roughly 20,000 daily vehicles



103 - Leading the Nation in Transportation: Evaluation of Road Diets - February 2013

Road Diet



Reclaiming road space creates room for pedestrian islands



103 - Leading the Nation in Transportation: Evaluation of Road Diets - February 2013

Road Diet

Concept



Reclaiming road space creates room for pedestrian islands

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Road Diet

After



07/31/2006

Reclaiming road space creates room for pedestrian islands

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Road Diet



- » Which road improves mobility for all users?
- » Which road carries more traffic?

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Road Diet



- » Which road produces higher speeds?
 - » 4-lane: faster driver can pass others
 - » 2-lane: slower driver sets speed
- » Which road produces a higher crash rate?

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Group Exercise:

- » Do you have any candidates for road diets in your community?

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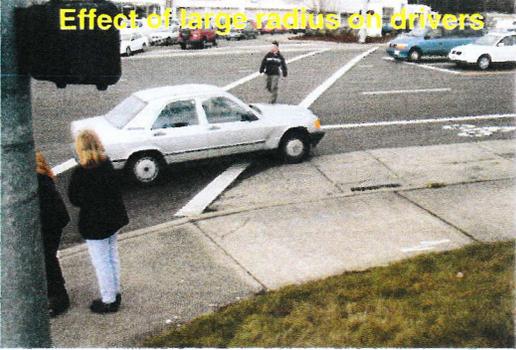
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- » Pedestrian Facilities

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Effect of large radius on drivers



They drive fast, ignoring pedestrians

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Tighten Corner Curb Radii

Large corner radii:

- » Allow high-speed turns by cars
- » Less likely to yield
- » Injury severity is higher at higher speeds



143 | Leading the Nation in Transportation Excellence | www.mass.gov/massdot | February 2013



Tighten Corner Curb Radii

Large corner radii:

- » Increase crossing distance
- » Longer crosswalk means more pedestrian signal time, reducing roadway capacity for vehicles



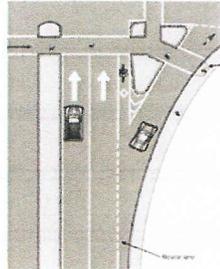
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Corner "Pork Chop" Islands

Benefits:

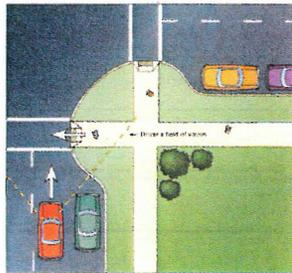
- » Separate conflicts & decision points
- » Reduce crossing distance
- » Improve signal timing
- » Reduce ped crashes (29%)



105 Looking for National Transportation Excellence? You can't go home without it. February 2013

Curb Bulb-outs

- » Reduce crossing distance
- » Improve sight distance and sight lines
- » Prevent encroachment by parked cars
- » Create space for curb ramps and landings



106 Looking for National Transportation Excellence? You can't go home without it. February 2013

Design Guide/Curb Radius

- » Simple curb radius (preferred):
 - » Controls motor vehicle speeds
 - » Minimizes crossing distance
- » Compound curves:
 - » Used where encroachment by large vehicles must be avoided
- » Turning roadways (separate right turn lane):
 - » Employs channelizing islands
 - » Used where high speed turns are desired.



Reference F-6-20
107 Looking for National Transportation Excellence? You can't go home without it. February 2013

Design Guide/Curb Radius

» Simple curb radius (preferred):

The pavement corner radius is a key factor in the multimodal performance of the intersection.

» Co

» Tu

- » Employs channelizing islands
- » Used where high speed turns are desired.

Reference: P. 6-36
149 | Leading the Nation in Transportation Excellence | www.mass.gov/massdot February 2013



Complete Streets Concepts

- » Roadway Type as Part of Context
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- » Mobility Considerations
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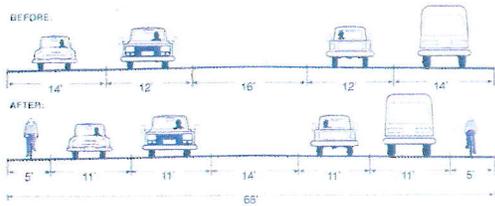
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Retrofitting for Bike Lanes

» Bicycle Lanes

OK to reduce travel lane



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Group Exercise:

- » What are the challenges of accommodating all users within the available roadway cross section?



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Complete Streets Concepts

- » Roadway Type as Part of Context
- » Design (Target) Speed Selection
- » Mobility Considerations
- » Lane Widths
- » Road Diets
- » Intersection Curb Radii
- » On-Street Bike Lanes
- » **Pedestrian Facilities**



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Pedestrian Signals

- » 50% of pedestrians in the U.S. do not understand the "Flashing Don't Walk" really means it's OK to continue walking

So we put signs like this to "correct" the problem



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Countdown Signals

- » Pedestrian countdown signal tells pedestrians how much crossing time is left.
- » Reduces all crashes by 25%



107 | Using the National Transportation Expenditure Survey | www.mass.gov | February 2013

Pedestrian Signal Timing

- » Pedestrian walking speed revised in 2009 MUTCD from 4.0 feet per second (fps) to 3.5 fps
- » Recognizes many users need more time to cross the street



108 | Using the National Transportation Expenditure Survey | www.mass.gov | February 2013

Design Guide/Pedestrian Signals

- » The WALK indication should be concurrent with parallel traffic
- » Signal timing should accommodate the average walking speed of the type of pedestrian using signal
- » Pedestrians should be given the longest possible walk time, while balancing vehicular flow and pedestrian delay



Reference P. 6-10 | Using the National Transportation Expenditure Survey | www.mass.gov | February 2013

Pedestrians and Transit



Every bus stop is a pedestrian crossing



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Design Guide/Bus Stops

- » Bus stops and pedestrian routes should be considered together
- » Midblock bus stops can create crossing difficulties for pedestrians unless a midblock crosswalk is also provided



Reference F-027
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Rectangular Rapid Flash Beacon

- » Beacon in yellow, rectangular, and has a rapid "stutter" flash
- » Beacon located between the warning sign and the arrow plaque
- » Must be pedestrian activated (pushbutton or passive)
- » Studies indicate motorist yielding rates increased from 18.2% to 81.2% for 2 beacons and to 87.8% for 4 beacons (TRB)
- » Interim approval from FHWA in July 2008 & MassDOT in 2012



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Group Exercise:

- » Provide examples of streets that are "incomplete" and should be fixed.

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Closing

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CS changes intersection design



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CS changes intersection design



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CS changes bicycling



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CS changes bicycling



165 - Leading the Nation in Transportation Excellence | www.mass.gov/massdot February 2013

CS changes transit



69. Using the Future in Transportation Experience | mass.gov/massdot | February 2013



CS changes transit



70. Using the Future in Transportation Experience | mass.gov/massdot | February 2013



CS changes accessibility



71. Using the Future in Transportation Experience | mass.gov/massdot | February 2013





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Objectives

Have we achieved today's objectives?

- » Discover tools you can use to achieve Complete Streets
- » Learn how the MassDOT Design Guide can help
- » Understand fundamental engineering terms



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