

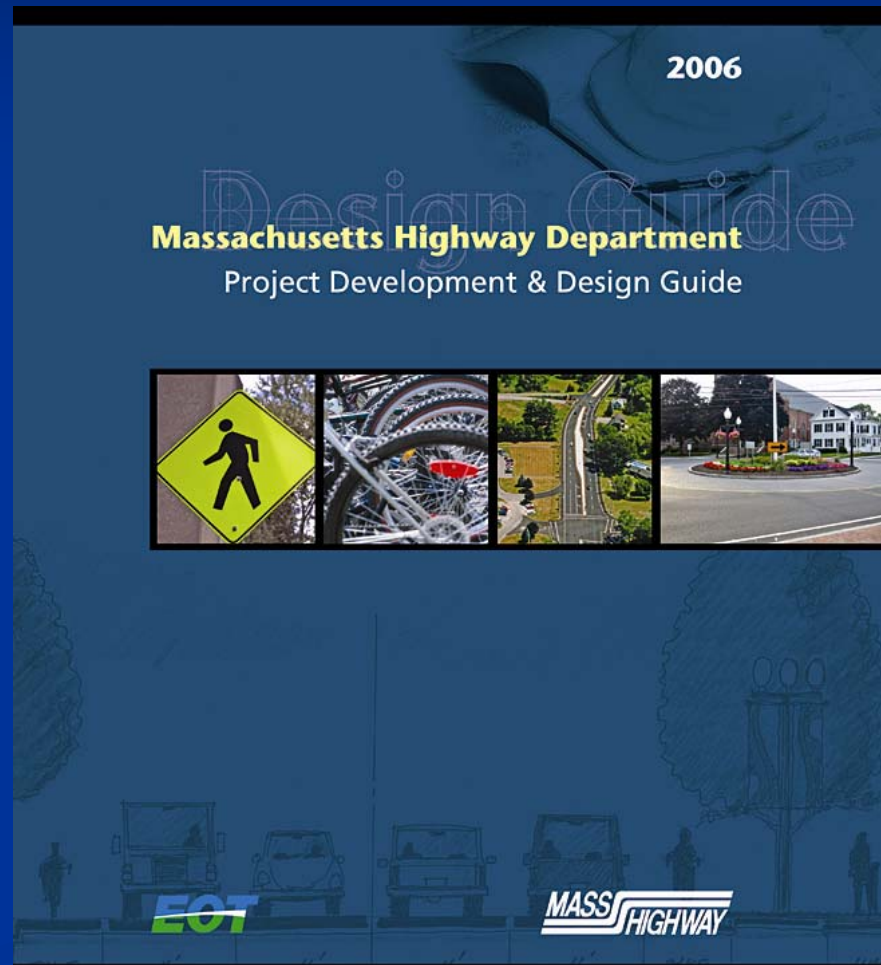
Design Flexibility in Massachusetts

MassHighway Project Development and Design Guide

Minnesota DOT

Flexible Design for
21st Century Challenges:
Balancing Competing
Objectives & Optimizing
Return on Investments

February 23, 2009



Massachusetts Context



Massachusetts Context



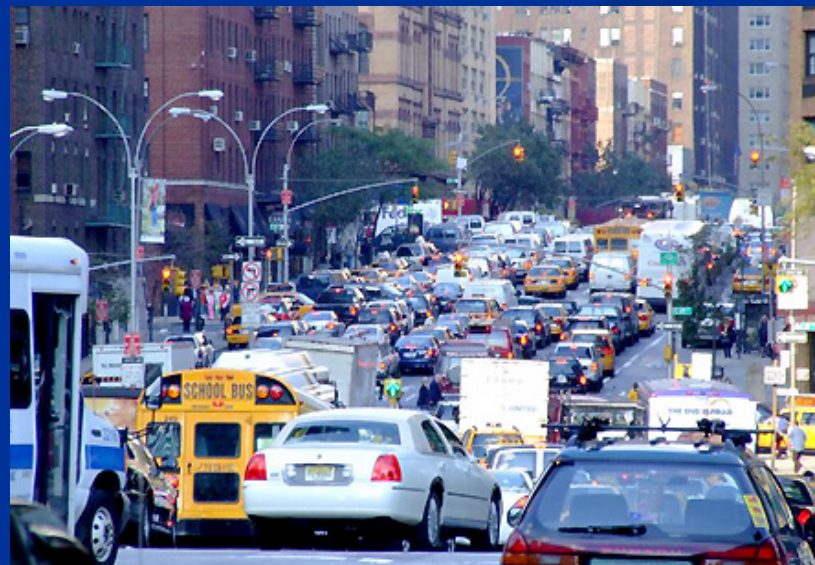
Massachusetts Context



Massachusetts Context



Massachusetts Context



Design Guide Task Force

"VHB had no fewer than 28 'clients' on the Task Force, in addition to MassHighway."
-Luisa Paiewonsky
MassHighway Commissioner



Design Guide Task Force Members

George Allaire
Massachusetts Highway
Association

Neil Andres
Barnstable Department
of Public Works

John Blundo, P.E.
Chief Engineer
MassHighway

Thomas F. Broderick, P.E.
Director of Research and
Materials MassHighway

Hamer D. Clarke, P.E.
Southbridge Department
of Public Works

Joseph J. Costanzo
Merrimack Valley
Regional Transit Authority

Alexandra Dawson
Massachusetts Association of
Conservation Commissions

John DeBenedictis
Boston Transportation
Department

Rob Deblinger
Division of Fisheries
and Wildlife

Thomas DiPaolo, P.E.
Assistant Chief Engineer
MassHighway

Jeffrey Dougan
Massachusetts Office
on Disability

Linda Dunlavy
Massachusetts Association
of Regional Planning Agencies
Franklin Regional
Council of Governments

Bill Edgerton
Concord Department of
Public Works

Judith Eiseman
Massachusetts Association of
Conservation Commissions

Matthew Feher
Massachusetts Municipal
Association

Margo Fenn
Cape Cod Commission

Stanley Gee
Division Administrator
Federal Highway Administration

Joshua Grzegorzewski
Federal Highway
Administration

Ann Hershfang
Walk Boston

Beth Larkin, P.E.
American Council of
Engineering Companies
of Massachusetts

David Loutzenheiser
Massachusetts Bicycle
Coalition

Barbra Lucas
Metropolitan Area Planning
Council

Cara Metz
Massachusetts Historical
Commission

Kenneth S. Miller, P.E.
Executive Office of Transportation

Joseph Orfant
Department of Conservation
and Recreation

John D. Pagini, A.I.C.P.
Massachusetts Association of
Regional Planning Agencies

Luisa Paiewonsky
Commissioner
MassHighway

The Honorable Anne Paulsen
House of Representatives

John Pourbaix
Construction Industries of
Massachusetts

Cara Seiderman
City of Cambridge

Albert Stegemann, P.E.
District 2 Highway Director
MassHighway

Stanley Wood, P.E.
Highway Design Engineer
MassHighway

Guiding Principles

- Provide for the **safety and mobility** of all users
- Incorporate the principles of **Context Sensitive Design** throughout the planning, design, and construction processes
- Provide a clear **Project Development Process**

Basic Design Controls

Traditional AASHTO

- Functional Classification
- Design Vehicles
- Traffic Characteristics
- Design Speed
- Highway Capacity
- Access Control

New MassHighway

- Roadway Context
- Roadway Users
- Transportation Demand
- Measures of Effectiveness
- Design Speed



Area Types

Suburban



Urban

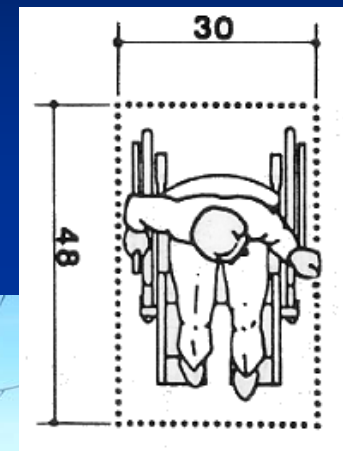
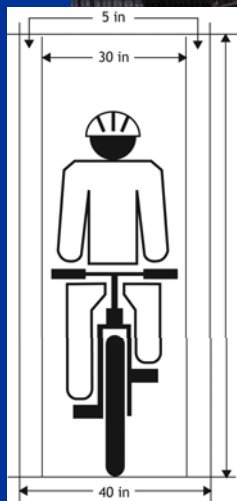


Rural



9 Area Types defined to compliment Roadway Types to aid with **Context Sensitive Design**

Roadway Users



Measures of Effectiveness

Transportation Measures

(for all users)

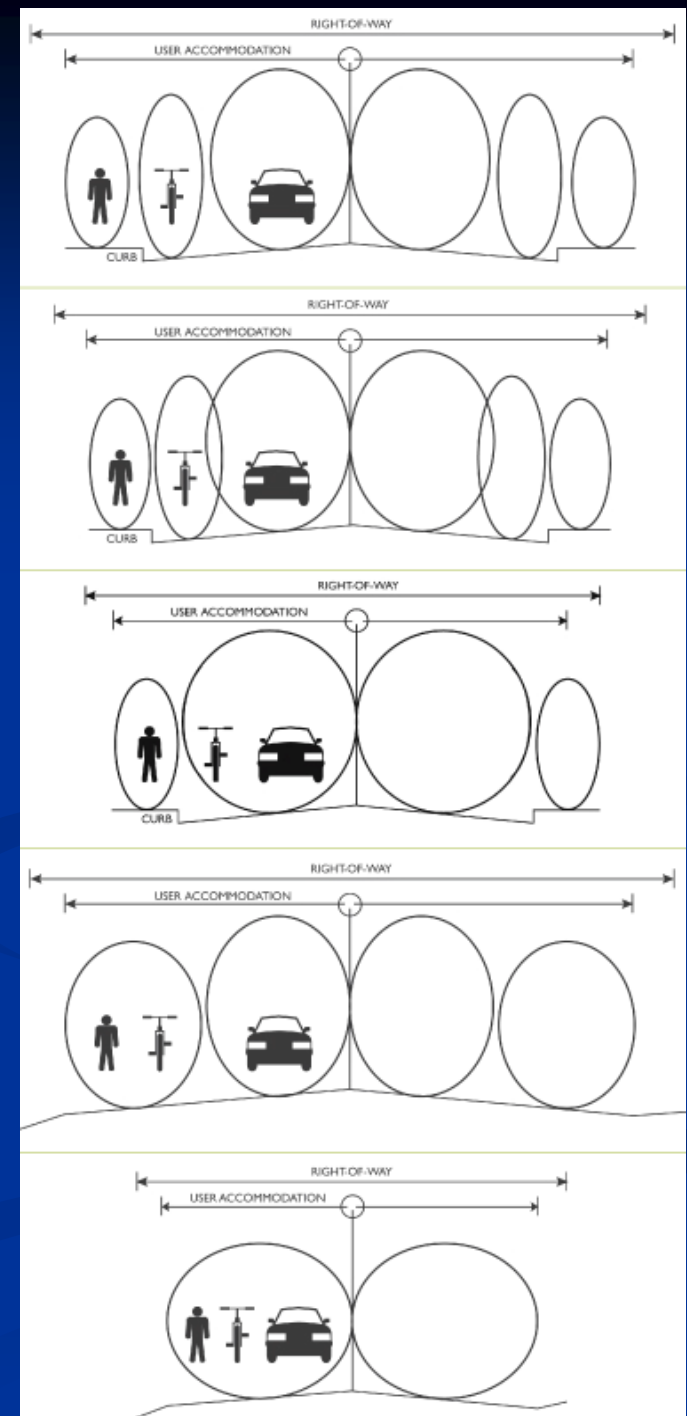
- Condition of facilities
- Safety and comfort
- Mode choice
- Network connectivity
- User population
- Traditional LOS
 - Travel time
 - Congestion
 - Specific measures elsewhere

Other Measures

- Environment preservation
- Cultural resource preservation
- Community enhancement
- Economic development
- Aesthetics
- Environmental justice/equity
- Impact mitigation
 - Noise
 - Air Quality
 - Wildlife Habitat

Flexible Multimodal Accommodation Framework

- **Type 1:** Independent Accommodation
- **Type 2:** Partial Bicycle/MV Sharing
- **Type 3:** Bicycle/MV Sharing
- **Type 4:** Pedestrian/Bicycle Sharing
- **Type 5:** Shared by All Users



Examples of Flexibility in the Design Guide



Design Speeds

Exhibit 3-7
Design Speed Ranges (Miles per Hour)

Area Type	Roadway Type					
	Freeway	Arterials		Collectors		Local Roads
		Major*	Minor	Major	Minor	
Rural Natural	50 to 75	40 to 60*	35 to 60	30 to 60	30 to 55	20 to 45
Rural Developed	50 to 75	40 to 60*	35 to 60	30 to 60	30 to 55	20 to 45
Rural Village	N/A	30 to 45	30 to 40	25 to 40	25 to 35	20 to 35
Suburban Low Intensity Development	50 to 75	30 to 60*	30 to 55	30 to 55	30 to 55	20 to 45
Suburban High Intensity Development	50 to 75	30 to 50*	30 to 50	25 to 50	25 to 40	20 to 40
Suburban Town Center	N/A	25 to 40	25 to 40	25 to 40	25 to 35	20 to 35
Urban	50 to 75	25 to 50	25 to 40	25 to 40	25 to 35	20 to 35

N/A Not Applicable

* A higher design speed may be appropriate for arterials with full access control

Source: Adapted from A Policy on Geometric Design of Highways and Streets, AASHTO, 2004 – Chapter 3 Elements of Design

Comparison of Design Speeds

Roadway Type (Based on 1997)	1997 Manual	2006 Guidebook
Rural Arterial (Level Terrain)	60 to 75 mph	40 to 60 mph
Urban Arterial	30 to 60 mph	25 to 50 mph
Rural Collector (Level Terrain)	60 mph	30 to 60 mph
Urban Collector	30 mph (minimum)	25 to 40 mph

- Additional flexibility provided in the Guidebook by further definition of Roadway and Area Types to reduce the ambiguity of “urban vs. rural” and terrain type

Ranges of Acceptable Lane and Shoulder Widths

**Exhibit B-12
Widths of Usable Shoulders (in Feet)**

Area Type	Roadway Type			
	Freeway ^a	Arterial ^{a*}	Collector ^{a*}	Local Roads
Rural Natural	10 to 12	4 to 12	4 to 10	2 to 8
Rural Developed	10 to 12	4 to 12	4 to 10	2 to 8
Rural Village	N/A	4 to 12	4 to 10	2 to 8
Suburban Low Density	10 to 12	4 to 12	4 to 10	2 to 8
Suburban High Density	10 to 12	4 to 12	4 to 10	2 to 8
Suburban Village/Town Center	N/A	4 to 12	4 to 10	2 to 8
Urban	10 to 12	4 to 12	4 to 10	2 to 8

^a Left shoulders are required on Freeways and other divided roadways. See the AASHTO Green Book for left-shoulder guidance.

^{a*} Shoulder widths less than the values shown above may be used if a design exception is obtained (See Chapter 2 for a description of the design exception procedure). Situations where narrower shoulders may be considered are described below.

**Exhibit B-14
Range of Travel Lane Widths (in Feet)**

Area Type	Roadway Type			
	Freeway	Arterial ^{a*}	Collector ^{a*}	Local Roads
Rural Natural	12	11 to 12	10 to 12	9 to 12
Rural Developed	12	11 to 12	10 to 12	9 to 12
Rural Village	N/A	11 to 12	10 to 12	9 to 12
Suburban Low Density	12	11 to 12	10 to 12	9 to 12
Suburban High Density	12	11 to 12	10 to 12	9 to 12
Suburban Village/Town Center	N/A	11 to 12	10 to 12	9 to 12
Urban	12	11 to 12	10 to 12	9 to 12

^a Lane widths less than the values shown above may be used if a design exception is obtained (See Chapter 2 for a description of the design exception procedure). Situations where narrower lanes may be considered are described below.

^{a*} Minimum 11' shoulder is required for design speed of 45 miles per hour or greater.

N/A: Not Applicable

Comparison of Minimum Width for Two-Lane Roadways

Roadway Type	1997 Manual	2006 Guidebook
Arterial	40 ft	30 ft
Collector	40 ft	28 ft

Addenda provided some flexibility at the low end of the speed and volume range - minimum width of 30 feet for arterials (<55 mph and <400 vpd), and 20 feet for collector roads (<35 mph and <400 vpd), but these conditions rarely exist.

Intersections

Multimodal LOS Balance

Exhibit 6-11
Level-of-Service Targets

	Target Level-of-Service Ranges		
	Pedestrian	Bicycle	Motor Vehicle
Urban Center	A-C	C-E	D-F or NA
Urban Residential	A-C	B-D	C-E
Suburban Commercial	C-E	C-E	C-F or NA
Suburban Residential	B-B	A-C	C-D
Small Town, Village Center	A-C	A-C	C-D
Small Town, Village Residential	A-C	A-C	B-C
Rural Settlement (Crossroads, Residential)	A-B	A-C	A-C
Rural Open Space	A-B	A-C	A-C

NA: Level-of-service criteria may not apply in dense urban or suburban commercial centers.

Design Exceptions



Results



Thomas A. DiPaolo, P.E.

Assistant Chief Engineer

Massachusetts Highway Department

thomas.dipaolo@mhd.state.ma.us

(617) 973-7516