

# TABLE OF CONTENT

<b>INTRODUCTION.....</b>	<b>I-1</b>
The Importance of and Context Good Design .....	I-1
Context Sensitive Design .....	I-2
Bicyclists and Pedestrians: Similarities & Differences.....	I-4
Bicyclists and pedestrians differ in significant ways .....	I-5
Bicyclists .....	I-5
Pedestrians .....	I-5
Design Standards.....	I-6
Standards and Minimums.....	I-7
Innovative Designs .....	I-7
1. Land Use and Site Design .....	I-8
2. Interconnected Streets .....	I-8
3. Access Management (AM) .....	I-10
Problems with Uncontrolled Access .....	I-10
Benefits of AM to Bicyclists and Pedestrians.....	I-10
AM Outcomes That Hinder Walking and Bicycling .....	I-11
AM and Street Connectivity .....	I-12
4. Public Transit.....	I-12
<b>CHAPTER 1: ON-ROAD BIKEWAYS .....</b>	<b>1-1</b>
Types of Bikeways .....	1-1
Design Standards.....	1-2
Shared Roadways .....	1-2
Bicycle Boulevards.....	1-3
Advantages of Bicycle Boulevards .....	1-3
Elements of a Bicycle Boulevard .....	1-3
Potential bicycle boulevard implementation problems .....	1-4
Width .....	1-4
Pavement Design and Construction.....	1-5
Joint between the shoulders and the existing roadway.....	1-6

Gravel Driveways And Approaches .....	1-6
Bike Lanes .....	1-7
Width .....	1-7
Bike Lanes On One-Way Streets .....	1-8
Contra-Flow Bike Lanes.....	1-8
Bike Lanes and Diagonal Parking .....	1-9
Bike Lanes and Bus Lanes .....	1-10
Colored Bike Lanes .....	1-11
Colored Bike Lane “Narrows” Street .....	1-11
Alternatives to Bike Lanes on Main Thoroughfares .....	1-12
Surface Treatments.....	1-12
Surface Types .....	1-12
Chip Seals.....	1-12
Drainage Grates .....	1-12
Railroad Crossings.....	1-13
Crossing Surface.....	1-14
Crossing Angle .....	1-14
Flange Opening .....	1-15
Rumble Strips .....	1-15
Signing and Marking of Bikeways.....	1-16
Introduction .....	1-16
Shared Roadways .....	1-16
Signing.....	1-16
Bike Boulevards .....	1-18
Sharrows .....	1-18
Shoulder Bikeways.....	1-19
Signing.....	1-19
Marking .....	1-19
Bike Lanes .....	1-19
Bike Lane Designation .....	1-19
Stencil Placement .....	1-19

Intersections.....	1-20
Right Turn Lanes at Intersections.....	1-20
Reflectors.....	1-20
Special Use Signs.....	1-20
Railroad Crossing.....	1-20
Sidewalk Users.....	1-21
Bicycle Use of Push-Buttons.....	1-21
Bike Stencils at Intersections.....	1-21
Tunnels and Bridges.....	1-21
Touring Routes.....	1-22
Bicycle Races and Events.....	1-22
Temporary Work Zones.....	1-22
Innovative Designs.....	1-23
Advisory Bike Lanes.....	1-23
Bike Box.....	1-23
Bike Left Turn Lane.....	1-24
Bike Stair Channel.....	1-24
Bike Passing Lane.....	1-24
Bicycle Signal.....	1-24
Bike Friendly Transit Stop.....	1-24
Buffered Bike Lane.....	1-25
Choker/Separator.....	1-25
Cycle Track.....	1-25
Floating Bike Lane.....	1-25
Green Wave.....	1-26
Raised Bike Lanes.....	1-26
Notes.....	1-26
Skinny Street.....	1-26
Woonerf.....	1-27

Practices To Be Avoided .....	1-27
Sidewalk Bikeways .....	1-27
Extruded Curbs .....	1-28
Reflectors and Raised Pavement Markers .....	1-28
Two-way Bike Lane .....	1-28
Continuous Right-Turn Lanes .....	1-28

**CHAPTER 2: RESTRIPIING ROADS WITH BIKES LANES ROAD DIETS..... 2-1**

Reduce Lane Widths .....	2-2
Narrow Travel Lanes.....	2-2
Reduce On-Street Parking .....	2-2
Remove Parking on One Side.....	2-3
Change From Diagonal to Parallel Parking.....	2-3
Narrow Parking Lanes.....	2-4
Replacing Lost Parking .....	2-4
Road Diets: Reduced Number of Travel Lanes .....	2-4
One-Way Couplets.....	2-5
Unbalanced Flow.....	2-6
Pavement Conditions.....	2-6
Width Constraints .....	2-7
Additional Benefits.....	2-7
Bike Lane Widths.....	2-8

**CHAPTER 3: BICYCLE PARKING..... 3-1**

Introduction.....	3-1
Recommended Standards.....	3-2
Dimensions .....	3-2
Covered Parking .....	3-2
Location.....	3-3
Bicycle Parking on Curb Extensions.....	3-4
On-Street Bicycle Parking.....	3-4
Number of Spaces.....	3-5

Signing.....	3-5
Other Recommendations .....	3-5
<b>CHAPTER 4: WALKWAYS.....</b>	<b>4-1</b>
Types of Walkways .....	4-1
Standards.....	4-2
Sidewalks .....	4-2
The Curb Zone.....	4-2
The Furniture Zone.....	4-2
The Pedestrian Zone .....	4-3
The Frontage Zone .....	4-6
Sidewalks Without Curb and Gutter.....	4-6
Sidewalks Behind the Ditch .....	4-6
Bridges.....	4-7
Surfacing.....	4-7
Thickness.....	4-8
Utility Vaults.....	4-8
Tree Well Grates .....	4-8
Pedestrian Rail.....	4-8
Pervious Sidewalk Surfaces .....	4-8
Railroad Crossings.....	4-9
Paths .....	4-9
Unpaved Paths.....	4-9
Paved Paths.....	4-9
Transit Stop Connections.....	4-10
Sidewalks .....	4-10
Bus Shelters .....	4-10
Bus Pullouts.....	4-11
Bus Curb Extensions .....	4-11
Transit Stop Crossings .....	4-12

Accommodating People with Disabilities .....	4-13
Width .....	4-13
Grades .....	4-13
Cross-Slope.....	4-14
Ramps.....	4-17
Ramp Types .....	4-17
Parallel Ramp .....	4-17
Perpendicular Ramp .....	4-17
Perpendicular Ramp with One Flare .....	4-18
Combination Ramp.....	4-18
Ramp Placement .....	4-19
Separated Sidewalks .....	4-19
Curb Tight Sidewalks .....	4-19
Ramp Elements.....	4-20
Pedestrians with Visual Impairments .....	4-20
Other Pedestrian Facilities .....	4-20
Benches.....	4-21
Shelters .....	4-21
Awnings .....	4-21
Landscaping.....	4-21
Drinking Water Fountains and Public Restrooms .....	4-22
Other Considerations.....	4-22
Driveways.....	4-22
Alleys.....	4-23
Signs.....	4-24
Directional/Wayfinding Signs.....	4-24
Street Signs.....	4-24
Practices to be Avoided.....	4-24
Meandering Sidewalks .....	4-24

**CHAPTER 5: STREET CROSSINGS ..... 5-1**

- Introduction ..... 5-1
- Crosswalks Defined..... 5-2
- Legal Crossings ..... 5-2
- Planning and Design Issues that Affect Crossings ..... 5-3
- Level of Service (LOS), Speed and Appropriate Design Standards ..... 5-3
- Land Use ..... 5-4
- Transit Stops..... 5-4
- Signal Spacing..... 5-4
- Access Management ..... 5-5
- Out-of-Distance Travel ..... 5-6
- Midblock vs. Intersection Crossings ..... 5-6
- Maintenance ..... 5-7
- Crossing Solutions ..... 5-7
- Crosswalks ..... 5-8
- Crosswalk Striping ..... 5-9
- Advance Stop Lines ..... 5-9
- Signs..... 5-10
- Textured and Colored Crosswalks ..... 5-11
- Illumination ..... 5-12
- Raised Medians and Refuge Islands ..... 5-12
- Curb Extensions ..... 5-14
- Pedestrian Signals ..... 5-17
- Two-Step Pedestrian Signal ..... 5-17
- Overcrossings and Undercrossings ..... 5-18
- Other Innovative Designs..... 5-20
- Raised Crosswalks ..... 5-20
- Pedestrian Beacon..... 5-20

**CHAPTER 6: INTERSECTIONS ..... 6-1**

- Introduction ..... 6-1

Bicyclists .....	6-1
Right-Turn Lanes .....	6-2
Other Right-Turn Lane Designs .....	6-3
Exceptions .....	6-4
Heavy Right Turns .....	6-4
Tee Intersections.....	6-4
Signals .....	6-4
Pedestrians .....	6-6
Minimizing Crosswalk Length.....	6-7
Truck Turning.....	6-7
Crosswalk Placement .....	6-8
Crosswalk Markings/Materials .....	6-9
Pedestrian Signal Head Placement.....	6-9
Push Button Placement .....	6-10
Islands and Refuges .....	6-11
Signals .....	6-12
Issues for Pedestrians and Bicyclists .....	6-14
Skewed Intersections.....	6-14
Multi-Leg Intersections.....	6-15
Dual Right-Turn Lanes .....	6-16
Modern Roundabouts.....	6-18
Interchanges .....	6-21
Introduction.....	6-21
Basic Principles.....	6-22
Guidelines .....	6-23
At-Grade Crossings.....	6-23
Grade-Separated Crossings.....	6-23
Single-Point Urban Interchange (SPUI) .....	6-24
Merging and Exit Lanes .....	6-25
Right-Lane Merge.....	6-25

Exit Ramps .....	6-25
Other Innovative Designs.....	6-26
Bike Boxes .....	6-26
Raised Intersections .....	6-26

**CHAPTER 7: SHARED USE PATHS ..... 7-1**

Introduction.....	7-1
Important Considerations.....	7-2
Crossings.....	7-2
Access .....	7-2
Security .....	7-4
Maintenance .....	7-4
On-Street Facilities .....	7-4
Standards.....	7-4
Paths Next to Roadways .....	7-4
Concerns.....	7-4
Guidelines .....	7-5
Design Standards.....	7-5
Width and Clearances.....	7-6
Width.....	7-6
Paths with Heavy Use .....	7-6
Lateral Clearance .....	7-7
Overhead Clearance .....	7-8
Separation from Roadway.....	7-8
Grades and Cross-Slope.....	7-8
Typical Pavement Sections .....	7-8
Drainage.....	7-9
Vegetation.....	7-9
Railings, Fences & Barriers .....	7-9
Illumination.....	7-11
Structures .....	7-12

Street Crossings.....	7-12
Minor Street Crossings.....	7-12
Major Street Crossings.....	7-13
Rails-to-Trails Crossings.....	7-14
Undercrossings vs. Overcrossings .....	7-14
Undercrossings.....	7-14
Overcrossings.....	7-15
Preventing Motor-Vehicle Access .....	7-17
Geometric Design .....	7-17
Bollards .....	7-17
Offset Fencing.....	7-18
Curb Ramps.....	7-18
Stairways.....	7-19
Signs.....	7-20
Regulatory Signs .....	7-20
Warning Signs .....	7-21
Curves .....	7-21
Intersections .....	7-21
Hill .....	7-21
Height and Width Constraints .....	7-21
Railroad, STOP Ahead, etc .....	7-22
Path Crossing Roadway .....	7-22
Directional, Destination and Street Signs .....	7-22
End of Path.....	7-23
Placement of Signs.....	7-23
Striping.....	7-23

# PHOTOS

## Introduction

<i>A complete street accommodates all travel modes, supports residences and businesses and is a community asset.....</i>	<i>I-1</i>
<i>Context Sensitive Designs.....</i>	<i>I-5</i>
<i>Fast food with direct pedestrian access.....</i>	<i>I-8</i>
<i>Unlimited accesses increase conflict points.....</i>	<i>I-10</i>
<i>Well planned and situated bus stop.....</i>	<i>I-13</i>

## Chapter 1

<i>A high volume urban street with bike lanes.....</i>	<i>1-1</i>
<i>Low volume residential shared roadway.....</i>	<i>1-5</i>
<i>Street too busy for shared roadway.....</i>	<i>1-6</i>
<i>Traffic diverter limits motor vehicle traffic while allowing bicycles to proceed thru.....</i>	<i>1-7</i>
<i>Bicyclist waits at island to cross busy street.....</i>	<i>1-7</i>
<i>Mini circle slows traffic, creating conditions needed for shared roadway.....</i>	<i>1-7</i>
<i>Higher volume rural road with shoulders.....</i>	<i>1-9</i>
<i>Paved driveway apron keeps gravel off shoulder.....</i>	<i>1-10</i>
<i>Typical bike lane on urban higher speed/volume roadway.....</i>	<i>1-10</i>
<i>Bike Lane on one way street.....</i>	<i>1-12</i>
<i>Contra-flow bike lane: One way for cars, two way for bicycles.....</i>	<i>1-12</i>
<i>Bike lane to left of bus lane.....</i>	<i>1-14</i>
<i>Colored bike lane “narrows” street.....</i>	<i>1-15</i>
<i>Concrete bike lane provides contrast with asphalt roadway.....</i>	<i>1-15</i>
<i>Chip seal ends at motor vehicle travel lane.....</i>	<i>1-16</i>
<i>Concrete RR crossing with rubber flanges.....</i>	<i>1-17</i>
<i>Rail crossing S curve.....</i>	<i>1-18</i>
<i>Bicycle unfriendly RR crossing.....</i>	<i>1-18</i>
<i>Profiled edge stripe.....</i>	<i>1-19</i>
<i>Well placed rumble strip leaves room for bicyclists.....</i>	<i>1-19</i>
<i>1st Generation bicycle boulevard pavement marking.....</i>	<i>1-22</i>
<i>2nd Generation bicycle boulevard pavement marking (indicates turn).....</i>	<i>1-22</i>
<i>Sharrows indicate where bicyclists should position themselves in the roadway.....</i>	<i>1-23</i>
<i>Shoulder bikeway on higher volume rural road.....</i>	<i>1-23</i>
<i>Bike lane in temporary work zone.....</i>	<i>1-27</i>
<i>Advisory bike lane.....</i>	<i>1-27</i>
<i>Bike box.....</i>	<i>1-28</i>
<i>Bike left turn lane.....</i>	<i>1-28</i>
<i>Stair channel.....</i>	<i>1-28</i>

<i>Bike passing lane</i> .....	1-28
<i>Bike signal</i> .....	1-29
<i>Bicycle lane to rear of transit stop</i> .....	1-29
<i>Buffered bike lane</i> .....	1-29
<i>Choker/separator</i> .....	1-29
<i>Cycle track</i> .....	1-30
<i>Raised bike lane</i> .....	1-31
<i>Skinny street</i> .....	1-31
<i>Woonerf</i> .....	1-31

## **Chapter 2**

<i>Bike lane restriped by narrowing travel lanes on commercial arterial</i> .....	2-1
<i>5 Lane roadway with wide lanes, no bike lanes</i> .....	2-2
<i>5 Lane roadway with bike lanes, narrowed motor vehicle lanes</i> .....	2-2
<i>Parking removed from one side to add bike lane</i> .....	2-3
<i>Bike lanes added by narrowing parking lane</i> .....	2-4
<i>Parking bay</i> .....	2-4
<i>4 Lane undivided roadway</i> .....	2-5
<i>Restriped with bike lanes, center turn lane and pedestrian crossing</i> .....	2-5
<i>Road diet created room for median pedestrian refuge island</i> .....	2-5
<i>Removing a travel lane created room for a bike lane, curb extension and on street parking</i> .....	2-6
<i>Bike lanes striped on new pavement show up well</i> .....	2-7
<i>Bike lane provides minimal buffer for pedestrians</i> .....	2-8

## **Chapter 3**

<i>Well placed bicycle parking</i> .....	3-1
<i>Upside down u or staple rack accommodates two bicycles</i> .....	3-1
<i>Bike racks can be street art</i> .....	3-2
<i>Covered bike parking</i> .....	3-3
<i>Bike racks placed out of pedestrian zone</i> .....	3-3
<i>Covered bike parking on curb extension</i> .....	3-4
<i>On-street bike parking</i> .....	3-4
<i>Secure bicycle parking in basement room</i> .....	3-5

## **Chapter 4**

<i>A successful central business district depends on good sidewalks</i> .....	4-1
<i>Sidewalks serve pedestrians in urban and suburb contexts</i> .....	4-1
<i>Paths serve pedestrians in many contexts</i> .....	4-1
<i>Shoulders serve pedestrians in rural areas</i> .....	4-2
<i>A well organized furniture zone leaves the pedestrian zone clear of obstacles</i> .....	4-3

<i>5-Foot sidewalk is uncomfortably narrow</i> .....	4-4
<i>Sidewalk widened to 6-feet</i> .....	4-4
<i>Furniture zone eliminated at pinch point</i> .....	4-4
<i>Wheel stops prevent sidewalk encroachment</i> .....	4-5
<i>Sidewalk with no buffer</i> .....	4-5
<i>Central business districts require wider sidewalks</i> .....	4-5
<i>A generous frontage zone with seating and bus shelter</i> .....	4-6
<i>Frontage zone used for decorative planters</i> .....	4-6
<i>Sidewalk behind swale</i> .....	4-7
<i>Barrier curb</i> .....	4-7
<i>Pavers require regular maintenance to meet ada requirements</i> .....	4-8
<i>Wheelchair traversable tree grates may extend into pedestrian zone</i> .....	4-8
<i>Concrete mix design is critical in pervious sidewalk to avoid a rough surface</i> .....	4-9
<i>Railroad crossing</i> .....	4-9
<i>Pedestrian crossing paired with transit stop</i> .....	4-10
<i>Bus stop with shelter in furniture zone</i> .....	4-10
<i>Bus shelter improves transit experience</i> .....	4-11
<i>Bus pull out</i> .....	4-11
<i>Curb extension bus stop reduces bus dwell time</i> .....	4-12
<i>Pedestrian crossing to rear of transit stop</i> .....	4-13
<i>Level landing provides resting area</i> .....	4-14
<i>Steep cross slope (4%) is difficult to traverse in a wheelchair</i> .....	4-15
<i>Separated sidewalk stays level at driveways and is free of obstacles</i> .....	4-15
<i>Sidewalk is kept level at driveway</i> .....	4-15
<i>Lowering the entire sidewalk should be a last resort</i> .....	4-16
<i>Wide sidewalk accommodates driveway and keeps pedestrian access route level</i> .....	4-16
<i>Furniture zone accommodates needed grade changes, keeping pedestrian zone level</i> .....	4-17
<i>“Standard” curb ramp</i> .....	4-17
<i>Parallel curb ramp</i> .....	4-17
<i>Perpendicular curb ramp</i> .....	4-18
<i>Curb ramp with one flare</i> .....	4-18
<i>Combination curb ramp</i> .....	4-18
<i>Ramp placement on separated sidewalk, note – outside flares are not required</i> .....	4-19
<i>Bus shelter in furniture zone</i> .....	4-21
<i>Bench in furniture zone</i> .....	4-21
<i>Awning shades sidewalk cafe</i> .....	4-21
<i>Landscaping provides storm water treatment</i> .....	4-22
<i>Dustpan style driveway approach improves pedestrian safety</i> .....	4-22
<i>Commercial right-in, right-out driveway</i> .....	4-23

<i>Commercial driveway with wrapped, level sidewalk and pork chop island</i> .....	4-23
<i>Sidewalk thru alley entrance is kept level</i> .....	4-24
<i>Meandering a sidewalk for no purpose should be avoided.</i> .....	4-25

## **Chapter 5**

<i>A successful pedestrian network requires safe and convenient crossing opportunities</i> .....	5-1
<i>Many crossings occur midblock out of convenience</i> .....	5-1
<i>Pedestrian crossings help shoppers access both sides of the street.</i> .....	5-2
<i>Crossing the street is not a crime</i> .....	5-3
<i>A wide, multi-lane street built for motor vehicle capacity is difficult to cross</i> .....	5-4
<i>It is difficult to determine where pedestrians will cross on auto oriented streets with diffuse destinations</i> .....	5-4
<i>Traffic signal in distance creates adequate gaps for pedestrians to cross street</i> .....	5-4
<i>Painted crosswalk on two lane roadway is appropriate</i> .....	5-8
<i>Good pedestrian crossings on multilane roadways require more than just paint</i> .....	5-8
<i>Staggering markings place stripes out of wheel paths</i> .....	5-9
<i>Pedestrian crossing signs</i> .....	5-10
<i>Textured crosswalk, pedestrian view point</i> .....	5-11
<i>Drivers view of same crosswalk</i> .....	5-11
<i>Textured crosswalk with supplemental white markings</i> .....	5-11
<i>White markings inset into colored pavement</i> .....	5-12
<i>Median island provides mid-street refuge for pedestrians</i> .....	5-13
<i>Pedestrians waiting where curb extension could be</i> .....	5-14
<i>Motorist yields to pedestrians at curb extension</i> .....	5-15
<i>Curb extension provides room for bike parking</i> .....	5-15
<i>Slotted drain at retrofit curb extension</i> .....	5-16
<i>Rapid rectangular flashing beacon</i> .....	5-17
<i>Pedestrian undercrossing is open and inviting</i> .....	5-19
<i>Raised crosswalk</i> .....	5-19
<i>Pedestrian hybrid beacon or HAWK</i> .....	5-20

## **Chapter 6**

<i>Large multi-lane intersections pose particular challenges for pedestrians and bicyclists, but solutions exist</i> .....	6-1
<i>Combined right turn lane and thru bike lane</i> .....	6-3
<i>Stencil indicates where to position bicycle over loop detector to trip signal</i> .....	6-4
<i>Truck negotiating turn</i> .....	6-7
<i>Pedestrian signal head in line with crosswalk</i> .....	6-8
<i>Pushbutton placed and aligned for the visually impaired</i> .....	6-9
<i>Tactile pedestrian push button</i> .....	6-9

<i>Cut thru pedestrian island</i> .....	6-11
<i>Countdown pedestrian signal head</i> .....	6-12
<i>LPI: Pedestrian phase precedes motor vehicle green phase by a few seconds</i> .....	6-12
<i>Skewed intersection results in long crosswalk and increased pedestrian exposure</i> .....	6-13
<i>Formerly skewed intersection realigned to right-angle</i> .....	6-14
<i>Blue bike lane thru skewed intersection</i> .....	6-14
<i>Modern roundabout in suburban context</i> .....	6-19
<i>Pedestrian crossing to splitter island at roundabout</i> .....	6-19
<i>Bicyclist in circulating roadway at roundabout</i> .....	6-19
<i>Bicyclist using exit ramp to access sidewalk</i> .....	6-20
<i>Bike box (bicyclists may continue straight)</i> .....	6-26
<i>Raised intersection keeps crossing level with sidewalk</i> .....	6-26

## **Chapter 7**

<i>Paths accommodate many users</i> .....	7-1
<i>Paths are used by many non-motorized modes</i> .....	7-2
<i>Path connection to local street</i> .....	7-4
<i>Popular paths quickly become crowded</i> .....	7-6
<i>Gravel shoulders prevent raveling of path edges</i> .....	7-6
<i>Path striped to separate users</i> .....	7-7
<i>Double fencing makes users feel trapped</i> .....	7-9
<i>Gentle grassy slope eliminates the need for railing</i> .....	7-10
<i>Pedestrians stop to admire the view in widened area without impeding thru traffic</i> .....	7-11
<i>Path crossing a minor street should have been given priority right of way</i> .....	7-12
<i>Path is fully separated with an undercrossing</i> .....	7-13
<i>Undercrossing with good sight lines</i> .....	7-14
<i>Bollards are overused and can cause injury</i> .....	7-16
<i>Split path entry eliminates need for bollards</i> .....	7-16
<i>Offset fencing</i> .....	7-16
<i>Metal channel (in yellow) provided for bicycle access</i> .....	7-17

## **TABLES**

<i>Table 1-1: Separation Context matrix</i> .....	1-4
<i>Table 1-2: Rural road shoulder widths</i> .....	1-8

# FIGURES

## Introduction

<i>Figure I-1: Sample illustration from Main Street Handbook.....</i>	<i>I-2</i>
<i>Figure I-2: The Transect (Congress of New Urbanism).....</i>	<i>I-3</i>
<i>Figure I-3: Streets can be made pleasant for all users.....</i>	<i>I-6</i>
<i>Figure I-4: Segregated land uses increase travel distances .....</i>	<i>I-7</i>
<i>Figure I-5: Mixed land use fosters walking and bicycling .....</i>	<i>I-8</i>
<i>Figure I-6: Disconnected streets increase travel distances .....</i>	<i>I-9</i>
<i>Figure I-7: Connected streets reduce travel distances, reduce traffic and increase mode choices ...</i>	<i>I-9</i>
<i>Figure I-8: Discontinuous streets linked with paths .....</i>	<i>I-9</i>
<i>Figure I-9: Consolidating accesses reduces conflict points, benefitting pedestrians, bicyclists and drivers.....</i>	<i>I-10</i>
<i>Figure I-10: Allowable movements at an intersection.....</i>	<i>I-11</i>
<i>Figure I-11: Severed connection eliminates conflicts. ....</i>	<i>I-11</i>
<i>Figure I-12: Pedestrian and bicycle connections can be preserved.....</i>	<i>I-11</i>

## Chapter 1

<i>Figure 1-1: Shared roadway.....</i>	<i>1-5</i>
<i>Figure 1-2: Wide curb lane.....</i>	<i>1-6</i>
<i>Figure 1-3: Elements of a bicycle boulevard.....</i>	<i>1-7</i>
<i>Figure 1-4: Shoulder bikeway.....</i>	<i>1-8</i>
<i>Figure 1-5: Saw cut before adding shoulder .....</i>	<i>1-9</i>
<i>Figure 1-6: Feathering a shoulder .....</i>	<i>1-9</i>
<i>Figure 1-7: Grinding and inlaying a shoulder .....</i>	<i>1-10</i>
<i>Figure 1-8: Gravel driveway paved to limit gravel on shoulders.....</i>	<i>1-10</i>
<i>Figure 1-9: Typical bike lane dimensions.....</i>	<i>1-11</i>
<i>Figure 1-10: Contra-flow bike lane reduces out of direction travel.....</i>	<i>1-12</i>
<i>Figure 1-11: Bike lane next to diagonal parking.....</i>	<i>1-13</i>
<i>Figure 1-12: Back in diagonal parking and bike lane.....</i>	<i>1-13</i>
<i>Figure 1-13: Bike lane to the left of bus lane .....</i>	<i>1-14</i>
<i>Figure 1-14: Colored bike lanes “narrow” roadway.....</i>	<i>1-14</i>
<i>Figure 1-15: Bicycle safe drainage grates .....</i>	<i>1-17</i>
<i>Figure 1-16: Curb inlet drainage grate.....</i>	<i>1-17</i>
<i>Figure 1-17: Bulged RR crossing.....</i>	<i>1-18</i>
<i>Figure 1-18: Bicycle friendlier rumble strips.....</i>	<i>1-19</i>
<i>Figure 1-19: W11-1 with riders .....</i>	<i>1-20</i>
<i>Figure 1-20: W16-1P .....</i>	<i>1-20</i>
<i>Figure 1-21: CW11-1 .....</i>	<i>1-20</i>
<i>Figure 1-22: R4-11.....</i>	<i>1-21</i>

<i>Figure 1-23: D11-1</i> .....	1-21
<i>Figure 1-24 Bicycle route guide sign OBD1-3c</i> .....	1-21
<i>Figure 1-25: MUTCD Figure 9B-6 with Oregon Supplement OBD1 signs</i> .....	1-22
<i>Figure 1-26: Oregon standard bike lane marking</i> .....	1-23
<i>Figure 1-27: OBW1-9</i> .....	1-24
<i>Figure 1-28: Standard bike stencil</i> .....	1-24
<i>Figure 1-29 : Bike stencil placed out of wheel path</i> .....	1-24
<i>Figure 1-30: R4-4</i> .....	1-25
<i>Figure 1-31: OBW8-19L</i> .....	1-25
<i>Figure 1-32: OBR10-13</i> .....	1-25
<i>Figure 1-33: R10-26</i> .....	1-25
<i>Figure 1-34: Bike symbol for loop detection placement</i> .....	1-26
<i>Figure 1-35: OBR 10-10 and OBW 1-8</i> .....	1-26
<i>Figure 1-36: OBD 11-3</i> .....	1-26
<i>Figure 1-37: OBM 1-8</i> .....	1-26
<i>Figure 1-38: Raised bike lane</i> .....	1-30
<i>Figure 1-39: Conflicts with sidewalk riding</i> .....	1-32
<i>Figure 1-40: Ramp allows bicycle to access sidewalk on bridge</i> .....	1-32
<i>Figure 1-41: Problems with two-way bike lanes</i> .....	1-33
<i>Figure 1-42: Widening one side and moving center line results in proper bike lane placement</i> .....	1-33
<i>Figure 1-43: Continuous right turn lane reconfigured</i> .....	1-34

## **Chapter 2**

<i>Figure 2-1: Bike lanes added by narrowing travel lanes</i> .....	2-2
<i>Figure 2-2: Parking removed from one side</i> .....	2-3
<i>Figure 2-3: Restripe from diagonal to parallel parking</i> .....	2-3
<i>Figure 2-4: Bike lane added by narrowing parking</i> .....	2-4
<i>Figure 2-5: Parking bays</i> .....	2-4
<i>Figure 2-6: Road Diet – 4 motor vehicle lanes becomes 2 bike lanes and 3 motor vehicle lanes</i> ....	2-5
<i>Figure 2-7: Motor vehicle travel lane removed from 4-lane, one way street</i> .....	2-6
<i>Figure 2-8: 4-lane, two way street restriped with 2 lanes in one direction, 1 in the other and bike lanes</i> .....	2-6
<i>Figure 2-9: Motor vehicle travel lane offset by bike lane results in larger effective turn radius</i> .....	2-7
<i>Figure 2-10: Restriping offsets travel lanes reducing wear and tear</i> .....	2-7

## **Chapter 3**

<i>Figure 3-1: Recommended bicycle parking dimensions</i> .....	3-2
<i>Figure 2-2: Bike parking in furniture zone in central business district</i> .....	3-3
<i>Figure 3-3: Bike parking on curb extension</i> .....	3-4
<i>Figure 3-4: Protected on street bike corral</i> .....	3-4

## Chapter 4

<i>Figure 4-1: The sidewalk zone system, urban context</i> .....	4-2
<i>Figure 4-2: The curb zones transitions from the street to the sidewalk</i> .....	4-2
<i>Figure 4-3: Separated sidewalks facilitate ramp and crosswalk alignment</i> .....	4-3
<i>Figure 4-4: Separated sidewalk is free of obstructions</i> .....	4-3
<i>Figure 4-5: Sidewalk clearances</i> .....	4-4
<i>Figure 4-6: The furniture zone may be eliminated or reduced at pinch points</i> .....	4-4
<i>Figure 4-7: Wheel stops reduce sidewalk encroachment</i> .....	4-4
<i>Figure 4-8: Recommended curb side sidewalk dimensions</i> .....	4-5
<i>Figure 4-9: Recommended Central Business District sidewalk dimensions</i> .....	4-5
<i>Figure 4-10: Sidewalk behind ditch or swale</i> .....	4-7
<i>Figure 4-11: Minimum bridge sidewalk width</i> .....	4-7
<i>Figure 4-12: Pedestrian rail should be used when a sidewalk abuts a serious hazard</i> .....	4-8
<i>Figure 4-13: Pervious sidewalk</i> .....	4-8
<i>Figure 4-14: Bus stop pad dimensions</i> .....	4-10
<i>Figure 4-15: Bus pullout at corner adversely impacts traffic</i> .....	4-11
<i>Figure 4-16: Bus pullout with curb extension</i> .....	4-11
<i>Figure 4-17: Curb extension bus stop</i> .....	4-12
<i>Figure 4-18: One crossing serves bus stop in both directions</i> .....	4-12
<i>Figure 4-19: Grade guideline for building access ramps and separated pathways</i> .....	4-14
<i>Figure 4-20: Crosswalks maintained at 2% cross slope in steep terrain</i> .....	4-14
<i>Figure 4-21: Furniture zone maintains sidewalk continuity</i> .....	4-15
<i>Figure 4-22: Curb tight sidewalk wraps to the back of driveway</i> .....	4-15
<i>Figure 4-23: Entire sidewalk dips at driveway, but beware the roller coaster effect</i> .....	4-15
<i>Figure 4-24: Partially lowered sidewalk at driveway</i> .....	4-16
<i>Figure 4-25: Minimum pedestrian access route maintained level at driveway</i> .....	4-16
<i>Figure 4-26: Steeper cross slopes in furniture and frontage zones keep pedestrian zone level</i> .....	4-16
<i>Figure 4-27: “Standard” ramp</i> .....	4-17
<i>Figure 4-28: Parallel curb ramp</i> .....	4-17
<i>Figure 4-29: Perpendicular ramp</i> .....	4-18
<i>Figure 4-30: Perpendicular ramp with one flare</i> .....	4-18
<i>Figure 4-31: Combination curb ramp</i> .....	4-18
<i>Figure 4-32: Ramp placement, sidewalk with furniture zone</i> .....	4-19
<i>Figure 4-33: Ramp placement on wide curbside sidewalk</i> .....	4-19
<i>Figure 4-34: Ramp placement on narrow curb tight sidewalk</i> .....	4-20
<i>Figure 4-35: Single ramp placement on constrained sidewalk</i> .....	4-20
<i>Figure 4-36: Blind pedestrian with clearances</i> .....	4-20
<i>Figure 4-37: Conventional driveway design</i> .....	4-22
<i>Figure 4-38: Intersection style driveway</i> .....	4-23

Figure 4-39: Right-in, right out driveway .....	4-23
Figure 4-40: Alley clearly crosses a sidewalk .....	4-24
Figure 4-41: D1-3b.....	4-24

## Chapter 5

Figure 5-1: All legs of all street intersections are crosswalks, regardless of the presence of sidewalks, shoulder or other “pedestrian” facility .....	5-2
Figure 5-2: Crosswalks defined for T-Intersection .....	5-2
Figure 5-3: Access management techniques such as raised medians and consolidated driveways reduce conflict points .....	5-5
Figure 5-4: Driver and pedestrian waiting for same gap are in conflict when the gap opens up .....	5-5
Figure 5-5: Intersection with all turn and crossing movements .....	5-5
Figure 5-6: Severed streets and non-traversable barrier reduce pedestrian travel options .....	5-6
Figure 5-7: Most pedestrians will cross midblock rather than walk to a signalized intersection .....	5-6
Figure 5-8: Conflicts at intersections are many.....	5-7
Figure 5-9: Conflicts at midblock crossings may be fewer.....	5-7
Figure 5-10: Staggered continental crosswalk markings .....	5-9
Figure 5-11: Multiple threat crash occurs when Car B does not yield to pedestrian.....	5-9
Figure 5-12: An advance stop bar allows a pedestrian to see that Car B has not stopped.....	5-10
Figure 5-13: Sign R1-5c are placed adjacent to the stop bar.....	5-10
Figure 5-14: Signs W11-2 and W16-7p .....	5-10
Figure 5-15: Textured crosswalk supplemented with white lines .....	5-11
Figure 5-16: White crosswalk inset into colored pavement.....	5-11
Figure 5-17: Proper illumination makes pedestrians crossing the street more visible .....	5-12
Figure 5-18: Median allows pedestrian to cross one half of the roadway at a time .....	5-12
Figure 5-19: Midblock island with high visibility crosswalks, advanced stop lines, illumination and angles cut through .....	5-13
Figure 5-20: Crossing distance without curb extensions.....	5-14
Figure 5-21: Crossing distance with curb extensions.....	5-14
Figure 5-22: Curb extensions improve visibility of and by the pedestrian.....	5-15
Figure 5-23: Curb extension retrofit issues .....	5-15
Figure 5-24: Roadway designed with curb extensions and integrated parking lanes .....	5-16
Figure 5-25: 2-step signal: pedestrian activates signal to stop near side traffic .....	5-17
Figure 5-26: 2-step signal: pedestrian proceeds to far side crossing facing traffic .....	5-17
Figure 5-27: 2-step signal: pedestrian activates push button to stop far side traffic.....	5-18
Figure 5-28: Pedestrian overcrossing adds a lot of travel distance when raised above a roadway .....	5-18
Figure 5-29: Pedestrian overcrossing reduces travel distance when roadway is lowered .....	5-18
Figure 5-30: Undercrossing of elevated roadway .....	5-18
Figure 5-31: Raised crosswalk acts as speed hump .....	5-19

## Chapter 6

<i>Figure 6-1: Dashing bike lane prior to intersection warns motorists and bicyclists of potential conflict</i> .....	6-2
<i>Figure 6-2: Standard right turn lane with through bike lane</i> .....	6-2
<i>Figure 6-3: Right-turn lane developed by dropping parking lane</i> .....	6-2
<i>Figure 6-4: Right turn lane developed by dropping a lane</i> .....	6-3
<i>Figure 6-5: Combined right turn lane and thru bike lane</i> .....	6-3
<i>Figure 6-6: Right bike lane follows traffic flow</i> .....	6-3
<i>Figure 6-7: Bike lane at T-intersection</i> .....	6-4
<i>Figure 6-8: Intersection sensitive to bicycles</i> .....	6-5
<i>Figure 6-9: Closed crosswalk forces pedestrians to cross three streets instead of one</i> .....	6-6
<i>Figure 6-10: Effective vs. actual corner radius</i> .....	6-6
<i>Figure 6-11: Corner with no turns can have tight radius</i> .....	6-7
<i>Figure 6-12: Large curb radius design impacts crossing distances, crosswalk alignment and facilitates high speed motor vehicle turns</i> .....	6-7
<i>Figure 6-13: Large vehicles can be accommodated</i> .....	6-7
<i>Figure 6-14: Crosswalk placed at most direct route</i> .....	6-8
<i>Figure 6-15: Crosswalk placed at shortest crossing point</i> .....	6-8
<i>Figure 6-16: Crosswalk placed midway between direct and shortest routes</i> .....	6-8
<i>Figure 6-17: Proper pedestrian push button placement</i> .....	6-9
<i>Figure 6-18: Pedestrian refuge island and medians helps separate conflicts and assists pedestrian crossings at large intersections</i> .....	6-10
<i>Figure 6-19: Pedestrian refuge island at right turn slip lane</i> .....	6-11
<i>Figure 6-20: Skewed intersection increases crossing distances</i> .....	6-13
<i>Figure 6-21: Squared intersection improves visibility</i> .....	6-14
<i>Figure 6-22: Muti-legged intersection reconfigured</i> .....	6-14
<i>Figure 6-23: Option 1 – Drop bike lane prior to intersection</i> .....	6-15
<i>Figure 6-24: Option 2 – Encourages bicyclist to take thru-right lane</i> .....	6-16
<i>Figure 6-25: Option 3 – Preserves dedicated bike lane</i> .....	6-16
<i>Figure 6-26: Option 4 – Addition of pedestrian island</i> .....	6-17
<i>Figure 6-27: Modern roundabout</i> .....	6-18
<i>Figure 6-28: Bicyclist exit ramp detail</i> .....	6-20
<i>Figure 6-29: Pedestrian and bicyclist accessible urban freeway interchange with right angle approaches</i> .....	6-21
<i>Figure 6-30: Freeway interchange with separated pedestrian and bicyclist path to avoid high speed conflicts</i> .....	6-23
<i>Figure 6-31: Single Point Urban Interchange (SPUI) with pedestrian and bicyclist access</i> .....	6-24
<i>Figure 6-32: Bicyclist crossing at high speed entrance ramp</i> .....	6-24
<i>Figure 6-33: Pedestrian and bicyclist crossing at high speed exit ramp</i> .....	6-25

<i>Figure 6-34: Bike box</i> .....	6-25
<i>Figure 6-35: Raised intersection</i> .....	6-26

## **Chapter 7**

<i>Figure 7-1: Shared-Use path siting considerations</i> .....	7-3
<i>Figure 7-2: Intersection and driveway conflicts at path</i> .....	7-5
<i>Figure 7-3: Suggested shared use path dimensions</i> .....	7-6
<i>Figure 7-4: Paved path with separate soft surface trail</i> .....	7-6
<i>Figure 7-5: Wide path striped to separate modes</i> .....	7-7
<i>Figure 7-6: Sample pavement designs</i> .....	7-8
<i>Figure 7-7: Barrier prevents roots from upheaving path</i> .....	7-8
<i>Figure 7-8: Railing added to concrete barrier</i> .....	7-9
<i>Figure 7-9: Rub rail added to railing</i> .....	7-9
<i>Figure 7-10: High fencing at path edges creates cattle chute effect</i> .....	7-9
<i>Figure 7-11: Railing needed on left, not needed on right</i> .....	7-10
<i>Figure 7-12: Offsetting path reduces need for railing</i> .....	7-10
<i>Figure 7-13: 14 feet wide bridge serves a 10 feet wide path</i> .....	7-11
<i>Figure 7-14: Bridge widened at view point</i> .....	7-11
<i>Figure 7-15: Midblock crossing with island and advance stop bar</i> .....	7-12
<i>Figure 7-16: Path is curved to align with crosswalk</i> .....	7-12
<i>Figure 7-17: Undercrossing</i> .....	7-13
<i>Figure 7-18: Path undercrossings, various configurations</i> .....	7-14
<i>Figure 7-19: Path overcrossings, various configurations</i> .....	7-15
<i>Figure 7-20: Path splits to prevent it appearing like a driveway</i> .....	7-15
<i>Figure 7-21: Tight curb radii prevent motor vehicle access</i> .....	7-15
<i>Figure 7-22: Offset gates prevent motor vehicle access</i> .....	7-16
<i>Figure 7-23: Stairway with channel for bicycle tires</i> .....	7-17
<i>Figure 7-24: Signs R1-1</i> .....	7-18
<i>Figure 7-25: Signs OBR1-1 and OBR1-2</i> .....	7-18
<i>Figure 7-26: Appropriate use of sign OBR1-1 (or OBR1-2)</i> .....	7-18
<i>Figure 7-27: Sign R9-6</i> .....	7-18
<i>Figure 7-28: Signs R5-3 and OBR10-14</i> .....	7-18
<i>Figure 7-29: Sign R9-5</i> .....	7-19
<i>Figure 7-30: Signs W1-1 and W1-2 (18"x18")</i> .....	7-19
<i>Figure 7-31: Signs W2-1 and W2-2 (18"x18")</i> .....	7-19
<i>Figure 7-32: Sign W7-5</i> .....	7-19
<i>Figure 7-33: Signs OBW12-2 and OBW12-3 (18"x18")</i> .....	7-19
<i>Figure 7-34: Signs W10-1 and W3-1 (18"x18")</i> .....	7-19
<i>Figure 7-35: Railroad crossing ahead markings</i> .....	7-20

<i>Figure 7-36: Sign W11-15 with rider W11-15P .....</i>	<i>7-20</i>
<i>Figure 7-37: Directional and street signs.....</i>	<i>7-20</i>
<i>Figure 7-38: Bicycle route sign examples.....</i>	<i>7-21</i>
<i>Figure 7-39: Beginning and end of path signing.....</i>	<i>7-22</i>
<i>Figure 7-40: Sign mounting clearances.....</i>	<i>7-23</i>
<i>Figure 7-41: Skip stripe followed by solid stripe in a curve.....</i>	<i>7-23</i>