
F. Design Resource Summary and FHWA Bicycle and Pedestrian Design Resource

DESIGN APPROACH AND TREATMENTS

Design Resources

There are many local and national design guidance documents that can be a resource to the City of Beaverton in implementing the facility types and treatments described above. Local resources include guidance from Washington County via their Bicycle Design Toolkit, Neighborhood Bikeway Treatments, and Mid-block Crossing Policy. A description of the Washington County resources as well as national resources is included below.

Local Design Resources

Table 6 summarizes the Washington County and ODOT design guidance documents that can be a resource to the City of Beaverton. Renderings and typical cross-sections from the Washington County design guidance documents for facility types and design treatments included in this memorandum are provided in *Attachment 2* (Bicycle Design Toolkit) and *Attachment 3* (Neighborhood Bikeway Treatments).

Table 6 - Washington County & ODOT Design Guidance

	<i>What's In it?</i>	<i>How can Beaverton Use it?</i>
<p>Washington County Bicycle Design Toolkit (2012) http://www.co.washington.or.us/LUT/Divisions/CPM/upload/WaCo_Toolkit_Dec2012.pdf</p>	<p>Guidance on innovative bikeway facilities that are not currently addressed in the Washington County Road Design Standards.</p>	<p>Plan and design bicycle facilities along City or County roads.</p>
<p>Washington County Neighborhood Bikeway Treatments (2015) http://www.co.washington.or.us/LUT/Divisions/TrafficEngineering/Design-Information/upload/Appendix-F-Toolkit-Treatments.pdf</p>	<p>Guidance for treatments that may be used on designated Neighborhood Bikeway routes</p>	<p>Plan and design signs, pavement markings, intersections and traffic calming treatments along designated Neighborhood Bikeway routes.</p>
<p>Washington County Mid-block Crossing Policy http://www.co.washington.or.us/LUT/upload/Mid-block-crossing-policy-and-agenda.pdf</p>	<p>Policy allowing new pedestrian crossings to be established at mid-block locations and uncontrolled intersections on roads under county jurisdiction, based upon engineering study and approval by the County Engineer.</p>	<p>Ensure reasonably safe crossings for trail users at mid-block locations and uncontrolled intersections to improve the safety of all road users.</p>
<p>Oregon Department of Transportation Highway Design Manual http://www.oregon.gov/ODOT/Engineering/Pages/Hwy-Design-Manual.aspx</p>	<p>Guidance and standards for designing ODOT facilities</p>	<p>The ODOT Highway Design Manual provides guidance for the design of new construction of State owned roadways.</p>
<p><u>ODOT Bicycle and Pedestrian Plan (OBPP)</u> http://www.oregon.gov/ODOT/Planning/Documents/OBPP.pdf</p>	<p>Provides a decision making framework for walking and bicycling efforts in the State within the context of the overall transportation system</p>	<p>Planning consideration for bicycle and pedestrian networks along State owned facilities.</p>

DESIGN APPROACH AND TREATMENTS

National Design Resources

The Federal Highway Administration (FHWA) developed an index of bicycle and pedestrian design resources. The FHWA Bicycle and Pedestrian Design Resource Index is provided in Attachment 4. Since publication, several additional resources have been developed. Descriptions of the newest resources not included in the Index as well as descriptions of the documents included in the Index are described below in Table 7.

Table 7 - National Design Resources

	<i>What's In it?</i>	<i>How can Beaverton Use it?</i>
<p>Federal Highway Administration (FHWA) Separated Bike Lane Planning and Design Guide (2015) https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/separated_bikelane_pdg/page00.cfm#notice</p>	<p>Guidance for the implementation of separated bicycle lanes as well as a menu of design options based on site context.</p>	<p>Planning considerations and design options for separated bicycle lanes and intersection treatments suitable for the “interested but concerned” type of bicyclists.</p>
<p>FHWA Revisions to Controlling Criteria (2016) https://www.fhwa.dot.gov/design/standards/160505.cfm</p>	<p>Controlling criteria for the design of projects on the Nation Highway System.</p>	<p>Planning considerations and resources for taking flexible approaches to designing highways under constrained conditions.</p>
<p>National Cooperative Highway Research Program (NCHRP) Report 562 – Improving Pedestrian Safety at Unsignalized Crossings https://www.deldot.gov/information/business/drc/manuals/nchrp_rpt_562.pdf</p>	<p>Guidance on crossing treatments to improve safety at unsignalized crossings.</p>	<p>Plan and design appropriate treatments for unsignalized crossings.</p>
<p>FHWA Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations Study https://www.fhwa.dot.gov/publications/research/safety/04100/04100.pdf</p>	<p>Guidance on determining the effects of marked versus unmarked crosswalks at uncontrolled locations.</p>	<p>Determine design treatment for uncontrolled crossings.</p>
<p>Re:Streets Website http://www.restreets.org/</p>	<p>Guidance and best practices for the planning, design and construction of streets to enhance the built environment.</p>	<p>Plan and design innovative solutions for streets beyond the current standards.</p>

DESIGN APPROACH AND TREATMENTS

	<i>What's In it?</i>	<i>How can Beaverton Use it?</i>
<p>MassDOT Separated Bike Lane Planning and Design Guide https://www.massdot.state.ma.us/highway/DoingBusinessWithUs/Manuals-PublicationsForms/SeparatedBikeLane-PlanningDesignGuide.aspx</p>	<p>Guidance for the implementation of separated bicycle lanes as well as a menu of design options based on site context.</p>	<p>Planning considerations and design options for separated bicycle lanes and intersection treatments suitable for the “interested but concerned” type of bicyclists.</p>
<p>FHWA Small Town and Rural Multimodal Networks http://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/small_townsNACTO</p>	<p>Guidance to support rural communities in providing safe, accessible and comfortable transportation options for all.</p>	<p>Plan and design multimodal networks specific to rural and small town contexts.</p>
<p>American Association of State Highway and Transportation Officials (AASHTO) Roadside Design Guide (2011) https://safety.fhwa.dot.gov/roadway_dept/countermeasures/reduce_crash_severity/policy_memo/aash-to_rdg_120626/</p>	<p>Design guidance on operating practices as they relate to roadside safety.</p>	<p>Plan and design for safety treatments to minimize likelihood of injury when a motorist leaves the road.</p>
<p>AASHTO A Policy on Geometric Design of Highways and Streets (2011, pending update) https://www.fhwa.dot.gov/design/standards/151112.cfm</p>	<p>Guidance on current design research and practices for highway and street geometric design.</p>	<p>Plan and design unique solutions to meet the needs of roadway users while giving strong consideration to the surrounding environment.</p>
<p>AASHTO Guide for Development of Bicycle Facilities (2012, pending 2018 update) http://nacto.org/wp-content/uploads/2011/03/AASHTO-Guide-for-the-Development-of-Bicycle-Facilities-1999.pdf</p>	<p>Guidance on best practices in accommodating bicycle travel and operations.</p>	<p>Plan and design for bicycle facilities to enhance and encourage safe bicycle travel.</p>

DESIGN APPROACH AND TREATMENTS

	<i>What's In it?</i>	<i>How can Beaverton Use it?</i>
<p><i>AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities (2004)</i> http://www.transportationops.org/research/update-aashto-guide-planning-design-and-operation-pedestrian-facilities</p>	<p>Guidance on planning, design and operations of pedestrian facilities along streets and highways.</p>	<p>Plan and design resource in identifying effective measures of accommodating pedestrians on public right-of-way with consideration of land-use planning and site design.</p>
<p><i>FHWA Manual on Uniform Traffic Control Devices (2012)</i> https://mutcd.fhwa.dot.gov/</p>	<p>Guidance on standards used to install and maintain traffic control devices on public roadways, highways, bicycle facilities and private streets.</p>	<p>Plan and design for the operations of traffic control devices as well as maintenance.</p>
<p><i>Institute of Transportation Engineers (ITE)/Congress for New Urbanism (CNU) Designing Walkable Urban Thoroughfares (2010)</i> http://library.ite.org/pub/e1cff43c-2354-d714-51d9-d82b39d4dbad</p>	<p>Guidance on context sensitive solutions (CSS) in the planning and design of urban thoroughfares.</p>	<p>Plan and design solutions for transportation facilities that integrate community objectives and values around walking.</p>
<p><i>ITE Recommended Design Guidelines to Accommodate Pedestrians and Bicycles at Interchanges (2014)</i> http://www.worldcat.org/title/recommended-design-guidelines-to-accommodate-pedestrians-and-bicycles-at-interchanges-a-proposed-recommended-practice-of-the-institute-of-transportation-engineers/oclc/884577810</p>	<p>Specific dimensions, safety features, signing, and design geometries to improve the safety of pedestrians and bicycles at interchanges.</p>	<p>Plan and design pedestrian and bicycle facilities at interchanges to accommodate these modes in the larger transportation network.</p>
<p><i>ITE Traffic Control Devices Handbook (2013)</i> http://ecommerce.ite.org/IMIS/ItemDetail?iProductCode=IR-112A</p>	<p>Guidance and information to implement the provisions of the MUTCD.</p>	<p>Assist in determining the appropriate traffic control device(s) for a specific condition based on judgment and/or study.</p>

DESIGN APPROACH AND TREATMENTS

	<i>What's In it?</i>	<i>How can Beaverton Use it?</i>
<p>National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide (2014) http://nacto.org/publication/urban-bikeway-design-guide/</p>	<p>Guidance on solutions that encourage and help create “complete streets” that are safe and enjoyable for bicyclists.</p>	<p>Plan and design bicycle facilities specific to the urban context including a menu of design options dependent upon site context.</p>
<p>NACTO Urban Streets Design Guide (2013) http://nacto.org/publication/urban-street-design-guide/</p>	<p>Guidance on the tools and tactics cities can implement to make their streets safer, more livable and economically vibrant.</p>	<p>Plan and design resource to set a vision for complete streets and strategies for their implementation.</p>
<p>NACTO Transit Street Design Guide http://nacto.org/publication/transit-street-design-guide/</p>	<p>Guidance for the development of transit facilities on city streets and the prioritization of transit improvements as well as service quality.</p>	<p>Plan, design and enhance transit facilities to create active and efficient streets in neighborhoods and downtown areas.</p>
<p>US Access Board Draft Guidelines: Public Right-of-Way Accessibility Guidelines (PROWAG), Shared-Use Path Guidelines (2014) https://www.access-board.gov/guidelines-and-standards</p>	<p>Guidance on shared-use path accommodations for all modes including pedestrians, bicyclists, and people with disabilities.</p>	<p>Plan and design accommodations to meet the needs of all users including people with disabilities.</p>

Pedestrian Facility Design Treatments

3/2/2015

Note: Page numbers refer to printed version of design guideline.

Key	Color
Design Treatment Addressed	
Interim Approval	
Experimental Status	

	Roadside Design Guide (2011)	A Policy on Geometric Design of Highways and Streets (2011)	Guide for the Development of Bicycle Facilities (2012)	Guide for the Planning, Design, and Operation of Pedestrian Facilities (2004)	Manual on Uniform Traffic Control Devices (2012)	Designing Walkable Urban Thoroughfares (2010)	Recommended Design Guidelines to Accommodate Pedestrians and Bicycles at Interchanges (2014)	Traffic Control Devices Handbook (2013)	Urban Bikeway Design Guide (2014)	Urban Street Design Guide (2013)	Draft Guidelines: PROWAG, Shared Use Path Guidelines (as of 2014)	
	AASHTO	AASHTO	AASHTO	AASHTO	FHWA	ITE/CNU	ITE	ITE	NACTO	NACTO	US Access Board	
A. General Roadway												
A1 Paved shoulders		Section 4.4		Section 3.2.2						Page 41		
A2 Pedestrian accommodations on bridges/tunnels		Sections 4.10.3, 4.17.1, 4.17.2		Section 3.2.9							R302.3, R302.5, R408	
A3 Driveway management and design		Sections 2.6.6, 4.15.2		Section 3.2.6		Pages 125-126		Page 640				
A4 Medians		Section 4.11		Section 3.3.2, 3.4.1	Section 3i	Pages 138-140		Pages 539-540		Page 116	R302.3.1, R305.2.4	
A5 On-street parking design		Section 4.20		Section 2.6.2		Pages 145-148					R309	
A6 Lighting and illumination		Section 3.6.3		Sections 3.2.11, 3.3.6		Page 168 and throughout				Pages 40-41		
A7 Shared streets				Section 3.2.13						Pages 26-30		
A8 Travel lane width		Section 4.3		Section 2.6		Pages 136-138				Pages 33-36		
A9 Lane narrowing			N/A	Section 2.6				Page 217	N/A	Pages 33-36		
A10 Lane reduction						Pages 149 - 150				Pages 5-15, 33-36		
A11 Chicanes				Section 2.6.2						Pages 49, 142		
A12 Speed humps, tables, and cushions				Section 2.6.2	Sections 2C.29, 3B.25, 3B.26			Pages 202-203		Pages 51-56, 142		
A13 Diverters				Section 2.6.1						Page 142		
A14 Sight distance and sight lines		Section 3.2		Section 3.1.4, 3.3.5						Pages 121-124		
A15 Railroad grade crossings				Section 3.2.12	Sections 8C.01, 8C.02, 8C.03, 8C.10, 8C.11, 8C.13			Pages 545, 208-214, 463, 471-472			R302.7.4, R305.2.5, R208	
A16 Curb ramps		Section 4.17.3		Section 3.3.5	Section 3B.18 (Line 18)			Pages 212-214		Page 113	R208, R304, R305, R407	
A17 Sidewalks												
A17.1 Surface treatments				Section 3.2.10, 3.3.4							R302.7	
A17.2 Buffer zones	Sections 10.2.1.6, 10.2.2	Section 4.17.1		Sections 3.2.4, 3.2.13		Chapter 8				Pages 38-44		
A17.3 Obstacles and protruding objects	Section 10.2.2.2			Section 3.2.12		Pages 122, 126				Pages 38-44	R210, R402, R404	
A17.4 Maintenance				Section 4.3		Pages 171-172 (snow removal)		Pages 185-188, 504	N/A			
A17.5 Maintenance of facility during construction				Section 4.4	Section 6D.01			Pages 561-562		Page 41	R205	
A17.6 ADA compliant access routes				Section 3.2							R302, R204	
A17.7 Grade and cross slope				Section 3.2.7							R302.5, R302.6	
A17.8 Sidewalk widths and geometry		Section 4.17.1		Section 3.2.3				Page 504		Pages 38-44	R302.3	
A17.9 Stairs				Section 3.2.8							R408, R409	
A18 Pedestrians and transit												
A18.1 Siting bus stops		Section 4.19				Pages 163-165, 200					Pages 60-64	R308
A18.2 Bus bulbs and boarding islands						Pages 200-202					Pages 8-13, 45-47, 50, 58-59, 62-63	
A18.3 Pedestrian accommodations at median transit						Page 141 (Table 9.1)					Pages 22-23, 60	R208, R308, R408
A18.4 Transit stop improvements											Pages 22-23, 62-64	R208, R308, R308.2, R404
A18.5 Transit stop design		Section 4.19		Section 3.2.5							Pages 62-64	

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	AASHTO	AASHTO	AASHTO	AASHTO	FHWA	ITE/CNU	ITE	ITE	NACTO	NACTO	US Access Board
B. Intersections and Crossing Locations											
B1 Raised crossings				Section 3.4.2			Page 7			Pages 98,115	
B2 Curb extensions (bulb outs)				Sections 2.6.2, 3.3.2		Pages 195-197				Pages 45-50	R304, R305
B3 Corner radii				Section 3.3.1		Pages 184-187				Pages 117-120	
B4 Crossing Islands				Sections 3.3.2, 3.4.1		Pages 156-157				Page 116	R208, R302.3.1, R305.2.4
B5 Pedestrian design treatments at roundabouts				Section 3.3.3	Sections 2B.45, 3C.05	Pages 190-192					R306.3
B6 Pedestrian accommodation at complex interchanges/ intersections				Section 3.3.3			Page 9-25			Pages 100-106	
B7 Traffic circles		Section 9.3.4		Section 2.6.2						Page 99	
B8 Overpasses/underpasses	Section 7.7.2.3	Section 4.17.2		Section 3.5							R302.3, R302.5, R408
B9 Right-turn slip-lane design				Section 3.3.3		Pages 187-189	Page 5				
B10 Skewed Intersections				Section 3.2.12						Pages 100-106	
B13 Marked crosswalks and enhancements											
B13.1 Striping				Section 3.3.4	Section 3B.18	Pages 193-195	Page 4	Pages 521-522, 540-543		Pages 110-113	
B13.2 Signing at crosswalks				Section 4.2	Sections 2B.11, 2B.12		Page 4	Pages 522-524			
B13.3 Advance yield/stop lines at uncontrolled locations				Section 3.3.4	Section 3B.16		Page 7	Pages 543-544		Page 113	
B13.4 Advance stop lines at traffic signals				Section 3.3.4	Section 3B.16					Page 113	
B13.5 Other crosswalk features								Pages 640-645, 541-543		Pages 109-116	
B14 Signalization											
B14.1 Pedestrian detection				Section 4.1.4	Sections 4E.08, 4E.09			Pages 214-215, 402, 553		Pages 132-133	R209
B14.2 Signal timing for pedestrians				Sections 4.1.2, 4.1.6	Section 4E.06			Pages 553-554, 381-382		Pages 130-131	R306.2
B14.3 Pedestrian signalheads	Section 4.6			Section 4.1.3	Section 4E			Pages 551-553, 334-338, 412			R209
B14.4 Leading pedestrian intervals				Section 4.1.1	Section 4E.06			Page 359		Page 128-129	
B14.5 Exclusive pedestrian phase				Section 4.1.1	Sections 4E.09 (line 3), 4E.11 (line 19)			Page 359			
B14.6 Pedestrian Hybrid Beacon (HAWK Signal)					Section 4F		Page 7	Pages 556-558, 225-226, 338			
B14.7 Rectangular Rapid Flash Beacon					Interim approval (July 2008)		Page 8	Pages 560, 226			
B14.8 Warrants				Section 4.1.3	Sections 4E.09-4E.13		Page 7				
B14.9 Accessibility				Section 4.1.4				Pages 546-549			R403, R404, R406, R209
B15 Pedestrian related signs											
B15.1 Sign location and assembly	Section 4.3.3				Section 2A						R402
B15.2 Sign sizing					Sections 2A.06, 2B.13, 2C.04						R410, R211
B15.3 Sign types				Section 4.2.1, 4.2.2	Section 2A.05						
B15.4 Wayfinding				Section 4.2.3, 4.2.4							R410, R211
B16 School Areas											
B16.1 Pavement markings				Section 3.3.4, 4.2.2	Section 7C						
B16.2 Crosswalks					Sections 7B.11, 7B.12, 7C			Pages 520-522			
B16.3 School-related signs				Section 4.2.2	Section 7B			Pages 224-226, 512-525			
B16.4 Signals					Section 4C.06			Pages 525-526			
B16.5 Speed limits				Section 2.5.4	Sections 7B.15, 7B.16			Pages 508-512			
B16.6 Crossing Guards				Section 2.5.4							
B17 Midblock Crossings											
B17.1 Crossing distance considerations				Section 3.4.1						Pages 114-115	
B17.2 Signs and pavement markings				Section 3.4.1	Sections 3B.16, 3B.18, 2B.11, 2B.12	Pages 150-155				Pages 114-116	
B17.3 Traffic calming				Section 3.4.2						Pages 114-117	
B17.4 Signals				Section 3.4.3						Pages 114-118	