



TOPIC <i>Curb Ramp Gutter Flow Slope Design and Design Exceptions</i>	NUMBER <i>RD21-01(A)</i>	SUPERCEDES OR RESCINDS <i>New</i>
APPROVAL <i>Original signed by Heidi Shoblom, PE State Traffic Roadway Engineer</i>	EFFECTIVE DATE <i>06/01/2021</i>	VALIDATION DATE <i>N/A</i>

Topic

This advisory clarifies how ODOT design standards for gutter flow slope and cross slope apply differently, based on the street slope and traffic control conditions. This advisory also provides guidance and best practices for achieving the applicable gutter flow slope requirements for curb ramps. The advisory provides clarification of which design exceptions and codes are required when applicable standards are not met for gutter flow slope and cross slope. Strategies for warping (transitioning) the cross slope at the street entrance are discussed to assist engineers performing curb ramp work. Gutter flow slope and cross slope of the ramp run are interdependent attributes of the curb ramp.

Advisory Information

DEFINITIONS & ACRONYMS

ADA – Americans with Disabilities Act

ADAAG – The 2010 ADA Standards for Accessible Design

FHWA – Federal Highway Administration

HDM – Highway Design Manual

MUTCD – Manual on Uniform Traffic Control Devices

ODOT – Oregon Department of Transportation

PROWAG – Public Rights of Way Accessibility Guidelines from the US Access Board

Cross Slope – The grade (slope) that is perpendicular to the running slope in the direction of pedestrian travel.

Cross Slope 1 – The ODOT inspection position numbering for the cross slope at the portion of the curb ramp that leads to the street crossing.

Gutter Flow Slope – The grade (slope) at the gutter flow line immediately parallel to the curb or street edge where water is conveyed to a drainage system.

Any changes/updates in Technical Services Directives or Bulletins (Manuals, Standard Specifications and Drawings) take precedence over information in Advisories.

BACKGROUND

ODOT standards for curb ramps are developed based on applicable standards and best practices. The “applicable standards” means the standards in the following relating to curb ramps and pedestrian signals: ADA and its implementing regulations, PROWAG, ADAAG, Section 504 of the Rehabilitation Act of 1973, Part 4 & Part 6 of the MUTCD, and includes Oregon Statutes. The existing legal requirement in the 2010 ADA Standards Section 403.3 Walking Surfaces Slope requires the cross slope of an accessible route to be less than 1:48 (slope) relative to a horizontal plane (zero). National guidance prohibits cross slopes on an accessible route greater than 2.0% except under certain conditions based on the street conditions that are constrained by the operation of vehicular traffic. The applicable standards for ODOT account for these street conditions and permit the gutter flow slope at certain street crossing to have a slope exceeding 2.0%.

When the gutter flow slope exceeds 2.0%, ODOT employs the practice of warping along the pedestrian access route as mitigation to achieve a compliant cross slope. Warping allows the cross slope to transition gently rather than create an abrupt vertical discontinuity (lip) at the bottom of the curb ramp where it meets the gutter flow slope. ODOT’s standard transition rate for warping cross slope is 0.5% per foot in the pedestrian access route. Instability occurs for people navigating the cross slope when the transition rate exceeds 1.0% per foot and requires additional justification for use. Transition rates exceeding 1.0% per foot require approval with a design exception. In addition, ODOT’s best practice is to adjust some of the pavement in front of the curb ramp to table some of the street intersection in combination with cross slope warping to meet the gutter flow slope requirements.

Design Exceptions

When applicable standards are not achieved, ODOT documents the inability to meet applicable standards with an ADA Curb Ramp Design Exception. The ADA Curb Ramp Design Exception Request is prepared on the ODOT Form 734-5112. The ODOT ADA Curb Ramp Design Checklist (ODOT Form 734-5184) is a companion document for filling out the ADA Curb Ramp Design Exception Request. The ADA Curb Ramp Exception Form User Guide is available to assist you with filling out the electronic form and signatures. All three documents can be found on the ODOT webpage for design exceptions below: <https://www.oregon.gov/odot/Engineering/Pages/Design-Exceptions.aspx>.

Refer to the ODOT ADA Curb Ramp Design Checklist and the Table 1 below for determining when design exceptions are required for gutter flow slope and cross slope. Table 1 is further clarification of the cross slope (Criteria C) and the gutter flow slope (Criteria D) stated on the ODOT ADA Curb Ramp Design Checklist. Cross slope and gutter flow slope measurements are recorded on the curb ramp inspection forms. An approved ADA Curb Ramp Design Exception Request is required to complete the curb ramp inspection form when the applicable standards are not achieved.

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Gutter flow slope and cross slope are interdependent design criteria for the street entrance/exit. The gutter flow slope has three applicable intersection control types based on traffic operation including stop/yield, signalized/uncontrolled, or midblock operations. This corresponds to Criteria D lines D1, D2, and D3 on the ODOT ADA Curb Ramp Design Checklist. For curb ramps, the street entrance/exit is ramp run position 1 when following ODOT curb ramp inspection numbering conventions. In some cases, both the gutter flow slope and cross slope need design exceptions to be documented for a given design.

ODOT ADA Curb Ramp Design Checklist criterion C1 states that the cross slope of each ramp run shall be designed to a maximum of 1.5% in order to achieve a constructed slope not greater than 2.0%. It adds the following note. “At an intersection crossing where the roadway is not controlled by a stop or a yield sign, perpendicular style ramp-runs shall be allowed to transition cross-slope at an appropriate rate between the 1.5% max turning space to the street or highway grade up to a maximum of 4.5%. 0.5%/ft is a suggested appropriate cross-slope transition rate.” Anytime cross slopes exceed 2.0% on the other ramp run positions (ramp run 2 and/or ramp run 3) a design exception is required under Criteria C1. For some parallel curb ramps, turn space slope is also interdependent with gutter flow slope and cross slope and will require Criteria J1.

Refer to ODOT’s Engineering for Accessibility webpage to find “Exhibit A: Curb Ramp Location and Numbering” for details about ODOT’s curb ramp numbering convention: <https://www.oregon.gov/odot/Engineering/Pages/Accessibility.aspx>.

TABLE 1 – Cross Slope 1 and Gutter Flow Slope Interdependencies, Ramp Run 1

Gutter Flow Slope (Criteria D)	Ramp Run 1 Cross Slope (Criteria C1)	Mitigation	ADA DE Needed & Criteria
D1 - Stop Yield (1.5%)	0-1.5%		No
	1.5% - 4.5%	Warping of Cross Slope Up to 4.5%	Need DE D1 and C1 >1.5%
	greater than 4.5%	Warping of Cross Slope > 4.5%	Need DE D1 and C1 >1.5%
D2 - Signalized & Uncontrolled (4.5%)	0-1.5%		No
	1.5% - 4.5%	Warping of Cross Slope Up to 4.5%	No
	greater than 4.5%	Warping of Cross Slope > 4.5%	Need DE D2 > 4.5% and C1 >4.5%
D3 - Midblock, Grade of Road 0% - 1.5%	0- 1.5%		No
	>1.5%		Need DE D3 and C1 >1.5%
D3- Midblock, Grade of Road 1.5% - 4.5%	0- 1.5%		No
	Exceeds 1.5% & Less Than Grade of Road	Warping of Cross Slope Up to 4.5%	No
	Exceeds 1.5% & Exceeds Grade of Road	Warping of Cross Slope > 4.5%	Need DE D3 > 4.5% and C1 >4.5%
D3 - Midblock, Grade of Road greater than 4.5%	0- 1.5%		No
	Exceeds 1.5% & Less Than Grade of Road	Warping of Cross Slope Up to 4.5%	No
	Exceeds 1.5% & Less Than Grade of Road	Warping of Cross Slope > 4.5%	Need DE C1 only > 4.5%
	Exceeds 1.5% & Exceeds Grade of Road	Warping of Cross Slope > 4.5%	Need DE D3 & C1 >4.5%

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As an example, a perpendicular curb ramp run has a gutter flow slope that is designed at 6.0% for a stop/yield condition, which is warped at a rate of 0.5% per foot over a length of 9.0 feet, would require a design exception code for both codes D1 and C1. The gutter flow slope requirement is exceeded and the cross slope is warped over the ramp run exceeding the 2.0% ADA requirement. The warping of the ramp run is ODOT's mitigation to create a smooth transition to the gutter flow slope.

In some circumstances an additional design exception criteria for the turn space (Criteria J1) is also required on parallel style curb ramps, as it does not maintain 2.0% slopes in both directions noted as Slope X and Slope Y on the curb ramp inspection forms. An example of this condition occurs when a parallel curb ramp is designed with a gutter flow slope of 4.0% for a stop/yield condition and no warping occurs in the turn space/landing. The result and desired affect is to keep the turn space/landing planar during construction (maintaining the front and back of the turn space/landing at 4.0% slope). A design exception is required for three codes including D1, C1, and J1 as the ramp run exceeds the applicable standards for the given design.

ODOT implemented a requirement for constructing concrete curb and gutter as the applicable standard on or along state highways to facilitate construction of a flush connection at the curb ramp opening. A general design exception is required if curb and gutter is not installed on or along the state highway on curb ramps. Use the Roadway General Design Exception Request Form found on the ODOT webpage for design exceptions when requesting a deviation from installation of curb and gutter for your project site. Mark the request as "Other – Curb and Gutter" for the design exception when requesting a deviation from installation of curb and gutter at the curb ramp. The Roadway General Exception Form is located at:
<https://www.oregon.gov/odot/Engineering/Pages/Design-Exceptions.aspx>.

Design Strategies for ADA Curb Ramp Retrofit Projects

Cross slope and gutter flow slope design requirements can be achieved using the following guidelines. This guidance can be utilized on curb ramp retrofit projects currently in construction or design. The need to implement this guidance on brand new facilities should be rare. Each site location will need to be evaluated. At the discretion of the Engineer of Record, the designer may choose to apply the cross slope warping in the asphalt concrete pavement (ACP) in front of the ramp, in the curb ramp run position 1, the concrete gutter pan, or a combination thereof.

The asphalt concrete pavement is a transitional segment for ADA curb ramp retrofit projects. Under the ADA, transitional segments are to meet applicable standards to the extent practical within the scope of the project. The design and useful life of Portland Cement structures exposed to pedestrian use compared to Asphalt Concrete structures under traffic loading is significantly different. As such, the useful service life of a newly constructed curb ramp is expected to be longer and therefore the priority for curb ramps meeting applicable standards take priority.

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Asphalt in the roadway will be resurfaced potentially many times before the Portland Cement curb ramp is required to be reconstructed due to structural failure of the material. Therefore, it is recommended that the cross slope/gutter flow slope warping occur in the asphalt concrete pavement (ACP) first. Followed by warping in the concrete ramp run position 1 or concrete gutter pan. Excessive warping in the gutter pan is not constructible. Portland Cement Concrete (PCC) roadbeds typically involve other structural elements including rebar that cannot be easily modified in small areas of reconstruction. PCC roadways are not required to be warped where the work is limited to only curb ramp reconstruction and warping should occur in the ramp run position 1 and gutter pan first. The warping rate for cross slope transitions is limited to 0.5% per foot on the ACP, ramp run, and gutter pan as described in the background section above.

Reconstructed and patched asphalt concrete pavement cannot reduce accessibility and surface slopes shall be equal to or better than the existing conditions. The limit for asphalt concrete pavement reconstruction is to the edge of the travel lane line. When an exclusive bike lane is present, the asphalt concrete pavement modification needs to consider the functionality for bicyclists in addition to ADA accessibility (refer to the AASHTO Guide for the Development of Bicycle Facilities). Modifications within the vehicular travel lanes are not required. ACP joints should not occur on the vehicle wheel path in the travel lane even when a dedicated shoulder is not present. Provide at least 4 foot of useable surface for bicyclists without seams in the exclusive bike lane. If a gutter pan is added where it did not exist before, consider the distance between the edge of the gutter pan and the lane line. If that distance is less than 4-feet, consider widening the gutter pan to extend the entire width of the bike lane.

Profile adjustments at the gutter flow line can also be used to achieve the applicable standard for gutter flow slope. The gutter flow slope may be adjusted by raising or lowering the edge of the ramp throat. Maintain positive drainage conveyance at the gutter flow line to reduce sediment and debris collection, avoiding standing water and ponding. Additional inlets may be required when a storm sewer system exists in the roadway. ODOT's hydraulics manual requires 0.3% minimum longitudinal slope for drainage conveyance; however some sites do not require any gutter flow slope (e.g. at the top of a crest or super curve) to provide drainage conveyance.

Profile adjustments shall not present an obstruction or barrier to vehicular travel, and some tabling of the intersection can be utilized to achieve the applicable standards. For example, when intersection corners are constructed with existing curb tight sidewalks predominately along the highway, which does not extend along the side street, profile adjustments and tabling of the street crossing on the side street is feasible in many circumstances to obtain standards. The Engineer will determine the length of the asphalt concrete pavement transition along the gutter line profile.

Sufficient information shall be included in the contract plans to detail where the ACP profile adjustments and warping occurs. This includes, but is not limited to match points, the length of transition and transition rate of warping for the applicable segments or components of the curb ramp designed.

*T*arget Audience

This advisory is targeted to assist engineering professionals and staff when performing curb ramp design and construction work.

*C*ontact Information

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