

Maine Department of Transportation

Highway Program

Design Guidance

Title: Entrance Design

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Discipline: Highway Engineering

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Background:

The MaineDOT Standard Details provide guidance on entrance profile grades. This document is intended to provide additional guidance on entrance design and how to determine the need for Design Exceptions.

Guidance:

Design Vehicle

The appropriate design vehicle should be selected based on expected use. At residential entrances, a passenger vehicle is generally adequate.

Side Slopes

Entrance side slopes should be the same as the main line side slope. Beyond the main line clear zone, side slopes may be steeper.

Drainage

Entrance design should include a hump at the edge of shoulder as shown in the Standard Details when curb is present on the upstream side of an entrance. A hump should also be included at uncurbed entrances if the potential exists for water to flow along snowbanks and down an entrance toward a building.

Entrance Sight Distance

Entrance sight distance does not normally need to be evaluated, and measures to improve sight distance are not generally warranted. Consideration should be given to removal of sight obstructions where practical, and care should be taken to make sure available sight distance is not reduced. If entrance sight distance is evaluated, assume the eye location to be ten feet from the edge of travelway, 3.5 ft. above the pavement and the object height to be 4.25 ft. above the pavement. Use the entrance sight distance values in **Table 1**.

Posted Speed (MPH)	Sight Distance (Feet)
20	155
25	200
30	250
35	305
40	360
45	425
50	495
55	570
60	645

Table 1 - Entrance Sight Distance

Entrance Types

Different types of entrances and their application are presented in **Table 2**. All unpaved entrances shall be designed with a 3-foot wide paved lip. For drainage purposes, all entrances should be designed with a 1% minimum grade.

Entrance Type		Application	Structure	Maximum Grade
Paved Entrance	Residential	A paved entrance shall be specified when the existing entrance is paved or when the proposed grade is 10% or more.	2 in. Pavement 12 in. Gravel	15%
	Commercial		3 in. Pavement 11 in. Gravel	15%
Gravel Entrance	Residential	A gravel entrance shall be specified when the existing entrance is gravel and the proposed grade is less than 10%.	14 in. Gravel	15%
	Commercial			15%
	Woods/Field	A gravel entrance shall be specified for all low volume woods or field entrances regardless of grade.		22%
Grassed Entrance	Lawn	A grassed entrance shall be specified for all low volume lawn entrances.	4 in. Loam 10 in. Gravel	22%
Crushed Stone Entrance		A crushed stone entrance shall be specified when the existing entrance is crushed stone.	2 in. Crushed Stone 12 in. Gravel	15%

Table 2 - Entrance Types

Design Exceptions

Consideration should always be given to designing entrance grades that are flatter than the allowable maximums. Consideration should also be given to extending an entrance by a reasonable distance in order to stay within grade requirements.

Grade changes that alter an entrance by more than 3% and grade changes that reverse the grade of an entrance should be discussed with the Design Team as the potential exists for compensable damages to the property. Careful consideration should also be given to the types of vehicles that are using the entrance.

If any of the following apply, a Design Exception from the Program Manager (or designee) must be obtained.

- Entrances with proposed grades steeper than 6% in either direction and adverse changes to the effective existing grade of more than 3%.
- Entrances (except for Woods, Field, and Lawn entrances) with proposed grades steeper than 15% in either direction.
- Woods, Field, and Lawn entrances with proposed grades steeper than 22% in either direction.

Effective Grade

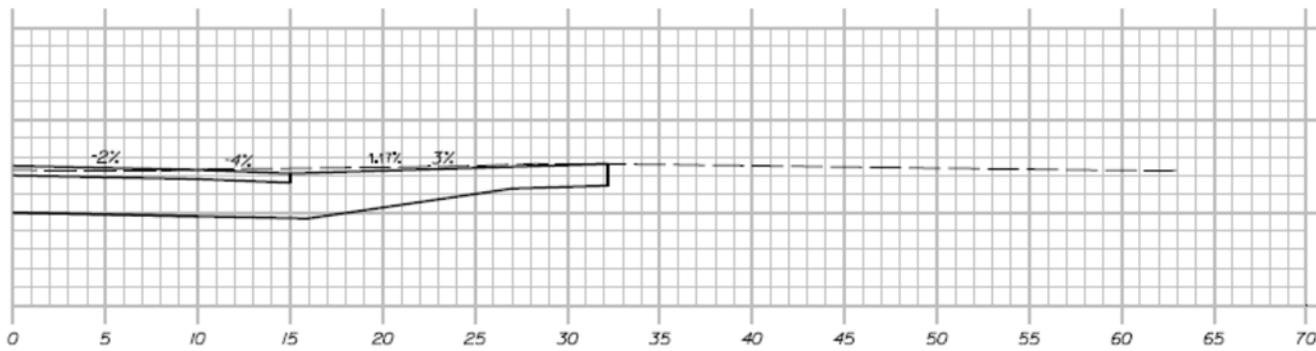
Effective grade is used to determine when a proposed grade change is more than 3%. When entrances have multiple slopes along the length of the entrance, the effective grade is the predominant grade to be used for comparison to proposed grade. This effective grade must be over a significant portion of the impacted section.

When determining whether a grade change of more than 3% may be warranted, consider other site specific characteristics, such as the overall length of the entrance, the grade of the remaining entrance and the length of remaining entrance not being impacted.

The following cross sections give examples of effective grade and whether a Design Exception is required.

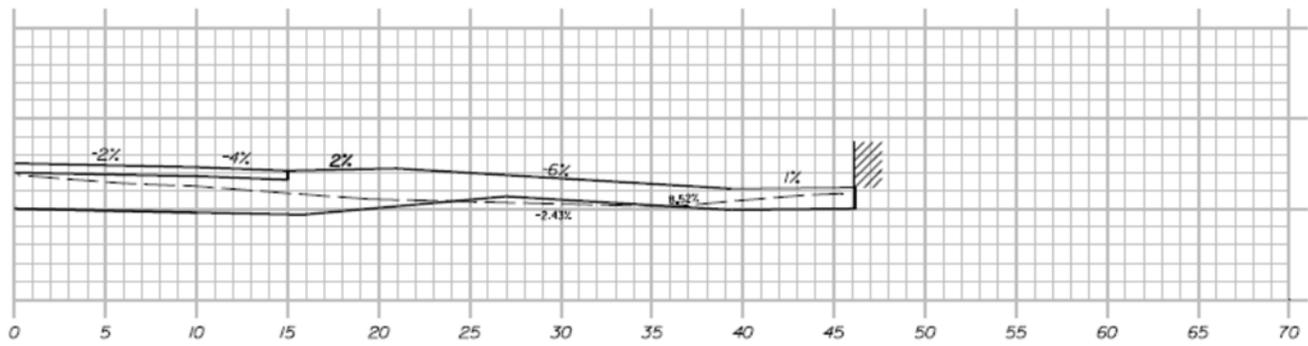
EXAMPLE: FLAT ENTRANCE (+/- 6% OR LESS) WITH ADVERSE GRADE CHANGE LESS THAN 3%

STATION	EFFECTIVE EXISTING GRADE	PROPOSED GRADE	NOTES:	DESIGN EXCEPTION REQUIRED?
XX-XX.XX	1.17%	3%	THE EFFECTIVE GRADE IS 1.17%. THE PROPOSED GRADE IS LESS THAN 6% AND LESS THAN 3% STEEPER THAN THE EFFECTIVE GRADE. NO DISCUSSION IS REQUIRED.	NO



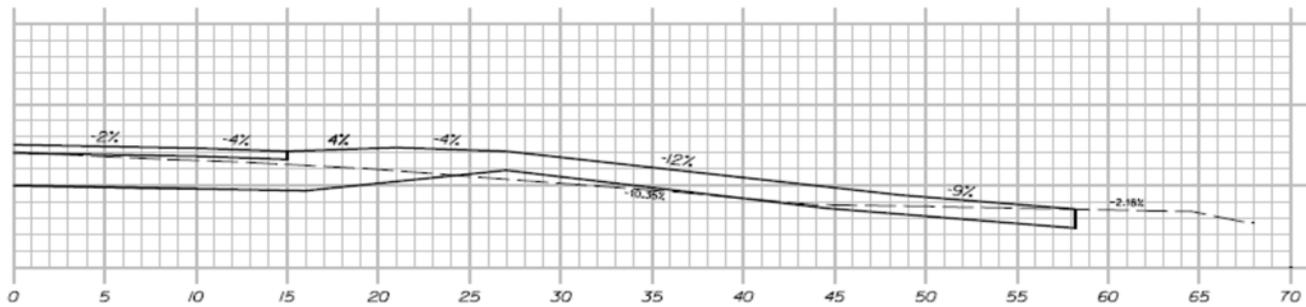
EXAMPLE: FLAT ENTRANCE (+/- 6% OR LESS) WITH ADVERSE GRADE CHANGE GREATER THAN 3%

STATION	EFFECTIVE EXISTING GRADE	PROPOSED GRADE	NOTES:	DESIGN EXCEPTION REQUIRED?
XX-XX.XX	-2.43%	6%	THE EFFECTIVE GRADE IS -2.43% SINCE IT COVERS THE SIGNIFICANT PORTION OF THE ENTRANCE. THE PROPOSED GRADE IS ONLY 6% BUT GREATER THAN 3% STEEPER THAN THE EFFECTIVE GRADE. THIS SHOULD BE DISCUSSED WITH APPROPRIATE TEAM MEMBERS TO ENSURE THERE ARE NO ADVERSE EFFECTS.	NO



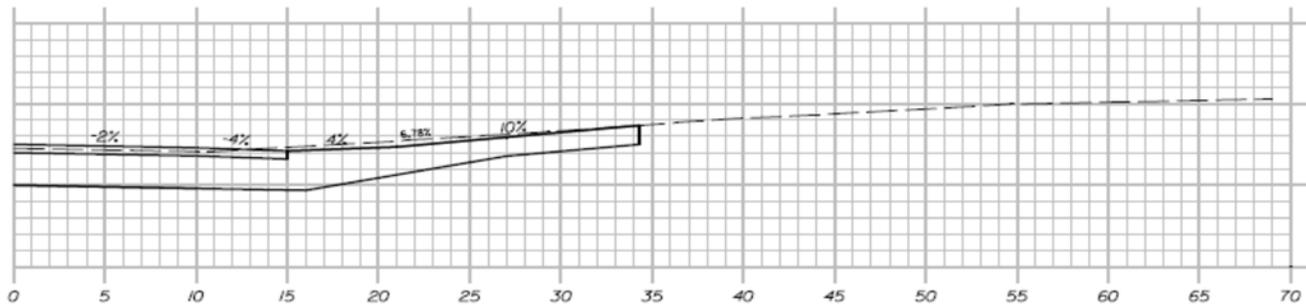
EXAMPLE: STEEP ENTRANCE (STEEPER THAN 6%) WITH ADVERSE CHANGE LESS THAN 3%

STATION	EFFECTIVE EXISTING GRADE	PROPOSED GRADE	NOTES:	DESIGN EXCEPTION REQUIRED?
XX-XX.XX	-10.35%	12%	THE EFFECTIVE GRADE IS -10.35%. THE PROPOSED GRADE IS LESS THAN 3% STEEPER THAN THE EFFECTIVE GRADE.	NO



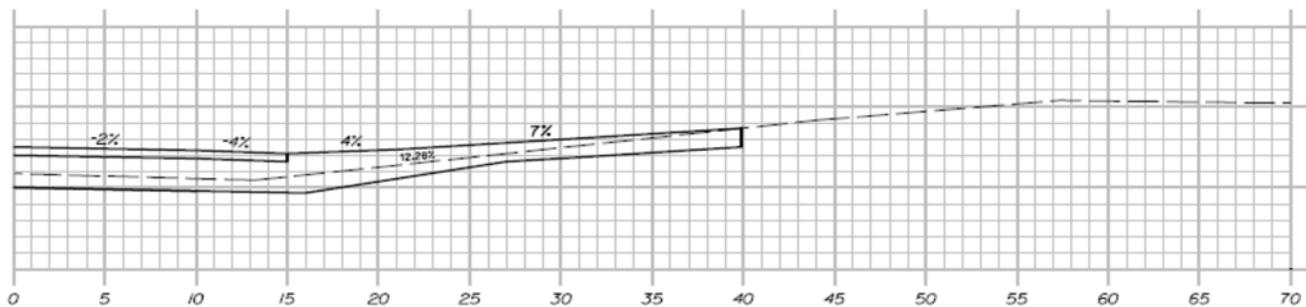
EXAMPLE: STEEP ENTRANCE (STEEPER THAN 6%) WITH ADVERSE CHANGE GREATER THAN 3%

STATION	EFFECTIVE EXISTING GRADE	PROPOSED GRADE	NOTES:	DESIGN EXCEPTION REQUIRED?
XX-XX.XX	6.78%	10%	THE EFFECTIVE GRADE IS 6.78%. THE PROPOSED GRADE IS GREATER THAN 3% STEEPER THAN THE EFFECTIVE GRADE.	YES



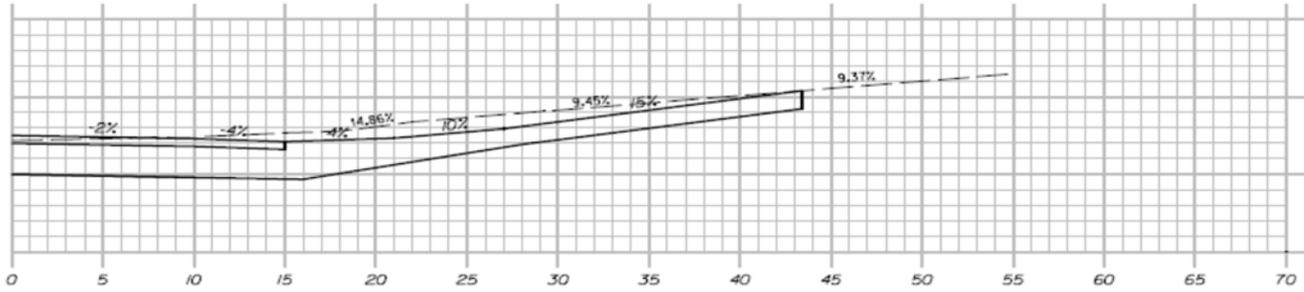
EXAMPLE: STEEP ENTRANCE (STEEPER THAN 6%) WITH NON-ADVERSE CHANGE GREATER THAN 3%

STATION	EFFECTIVE EXISTING GRADE	PROPOSED GRADE	NOTES:	DESIGN EXCEPTION REQUIRED?
XX-XX.XX	12.28%	7%	THE EFFECTIVE GRADE IS 12.28%. THE PROPOSED GRADE CHANGE IS GREATER THAN 3%, HOWEVER, A PROPOSED FLATTER GRADE WOULD NOT BE CONSIDERED AN ADVERSE EFFECT.	NO



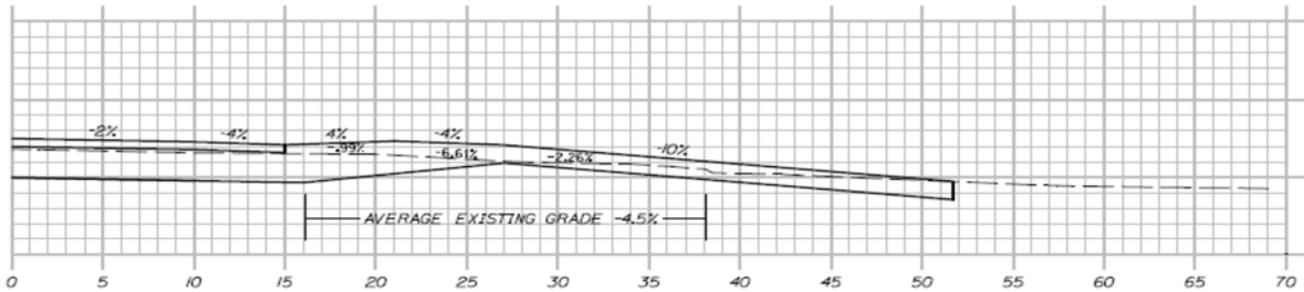
EXAMPLE: STEEPEST GRADE NOT NECESSARILY THE EFFECTIVE GRADE

STATION	EFFECTIVE EXISTING GRADE	PROPOSED GRADE	NOTES:	DESIGN EXCEPTION REQUIRED?
XX-XX.XX	9.45%	15%	THE EFFECTIVE GRADE IS 9.45% BECAUSE THE 14.86% GRADE IS TOO SHORT TO BE CONSIDERED A SIGNIFICANT PORTION OF THE EXISTING ENTRANCE GRADE.	YES



EXAMPLE: MULTIPLE EXISTING GRADE CHANGES

STATION	EFFECTIVE EXISTING GRADE	PROPOSED GRADE	NOTES:	DESIGN EXCEPTION REQUIRED?
XX-XX.XX	-4.5%	10%	THE EXISTING ENTRANCE GRADE CHANGES FREQUENTLY AND NONE COVERS A SIGNIFICANT PORTION OF THE ENTRANCE. AN AVERAGE GRADE TAKEN OVER A SIGNIFICANT PORTION SHOULD BE TAKEN AS THE EFFECTIVE GRADE.	YES



EXAMPLE: COMPARING GRADES AT DIFFERENT OFFSETS

STATION	EFFECTIVE EXISTING GRADE	PROPOSED GRADE	NOTES:	DESIGN EXCEPTION REQUIRED?
XX-XX.XX	12.31%	15%	THE PROPOSED GRADE OF 15% SHOULD NOT BE COMPARED TO THE EXISTING 6.26% GRADE. A SIGNIFICANT PORTION OF THIS ENTRANCE IS AT 12.31%. THE PROPOSED ENTRANCE IS IMPROVED BECAUSE IT MOVES THE STEEP GRADE AWAY FROM THE ROAD AND PROVIDES SMOOTH TRANSITION TO A CONCRETE PAD.	NO

