IOWA DOT

Design Bureau

3F-2

Foreslopes at Drainage Structures

Design Manual
Chapter 3
Cross Sections
Originally Issued: 02-10-12
Revised: 06-25-19

New Construction or Reconstruction

In areas of new construction or reconstruction, the foreslope transition point (also called the hinge point) through the area containing the culvert should match that of the remainder of the project.

Isolated Drainage Structure Construction

For isolated drainage structure construction which does not involve future reconstruction, maintain the hinge point (defined by dimension 'X' in Typicals 4311 and 4312), as follows:

- 'X' should meet or exceed the preferred design clear zone distance (see Section 8A-2). Review right-of-way and cultural impacts for feasibility.
- For shallow culverts, the 6:1 foreslope may be flattened, but must extend, at minimum, to the preferred design clear zone. Ensure foreslope is sloped properly to maintain drainage away from the roadway.
- To mitigate impacts in constrained areas, consider the following and document variances per Section 1C-8:
    - 'X' may be, at minimum, equivalent to the acceptable design clear zone distance (see Section 8A-2).

      Note: If use of the acceptable design clear zone distance will cause right-of-way impacts, go ahead and extend 'X' to the preferred design clear zone distance.
    - Using apron guards or shielding culverts with barrier are other options if major impacts restrict the ability to maintain adequate clear zone distances.
        - See Section 8B-2 for information on culvert safety treatments.
        - See Section 8A-4 for information on warrants for shielding obstacles.
    - 4:1 foreslopes are traversable and recoverable, so may be used within the design clear zone. 3:1 foreslopes are traversable, but not recoverable, so should be used only beyond the design clear zone. Modify Typicals 4311 and 4312 accordingly (see Section 1E-4).

'L' and 'W' in Typicals 4311 and 4312 are determined as follows:

- W is the pipe or RCB opening width (measured from outside to outside of apron or wing) plus 20 feet on each side.
- $L = \frac{(X - \text{Design Shoulder width} - \text{width of 10:1 slope})}{\tan 15°}$

Chronology of Changes to Design Manual Section:

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6/25/2019	Revised Updated hyperlinks. Updated header logo and text.
5/26/2017	Revised Modified formula for determining L. Added references to Typical 4312.
8/17/2016	Revised Added in information regarding W and L in 4311.
2/10/2012	NEW New.