*Reviewers,*

*Below is a total rewrite of DM Section 1220.02(2) about minimum Length Vertical Curves. And a modification to DM Section 1260.03(7) removing the comment about continuous illumination.*

*These changes are small like sometimes only a sentence, so to streamline the review, we have combined these Design Manual Chapters.*

*Keep in mind that in combining these sections into one file shows that the formatting is different for some chapters, but section numbers are precise. Do not worry about the formatting or the section numbers. We will fix all formatting and section numbers before we publish in September.*

*Please set your MS Word to “Review”, “All Markup” to see all track changes and comments. And do not worry if your changes/comments go into new pages. We will take care of it.*

*Please review the changes below as you would any other Design Manual review using MS Word’s Track Changes and please add a comment about each of your changes to help us understand why you are suggesting your changes.*

*Every chapter starts on a new page.*

***Thank you*** *for helping us improve the Design Manual for users like yourself.*

***Chapter 1220 Geometric Profile Elements***

**1220.02 Vertical Alignment**

***1220.02(2) Minimum Length of Vertical Curves***

The minimum length of a vertical curve is controlled by design speed, stopping sight distance, and the change in grade.

**1220.02(2)(a) New Construction Projects**

For new construction (building a street where one does not currently exist), the minimum length of the vertical curve must meet stopping sight distance (see Chapter 1260) or have a length at least three times the design speed, whichever is greater. For aesthetics, the desirable length of a vertical curve is two to three times the length needed for stopping sight distance.

**1220.02(2)(b) Reconstruction Projects**

On reconstruction projects, a zero-length vertical curve may be used as follows:

* Intermediate and Low Speeds: Algebraic difference of 1.0% or less
* High Speeds: Algebraic Difference of 0.5% or less

Zero-length vertical curves are meant for spot locations to accommodate small profile changes that match into existing profiles. For example, modifying the existing profile for an overlay or adjusting the profile to accommodate a fish passage structure. Do not use a series of zero-length vertical curves as a replacement for a properly designed vertical curve.

The minimum length of crest vertical curves shall be the same as new construction. The minimum length of sag vertical curves is determined using Exhibit 1220-X. A spreadsheet is available to calculate the controlling values shown in Exhibit 1220-X.

Exhibit 1220-X: Minimum Length of Sag Vertical Curves

|  |  |  |
| --- | --- | --- |
| **Sag Vertical Curve Minimum Length \*\*\***  **(Reconstruction Only)** | | |
| **Design Speed** | **Minimum** | **Desired Minimum** |
| ≤ 30 mph | Use the equations for L in Exhibit 1260-7 with S equal to the SSD from Exhibit 1260-1. \* | Same as Minimum. \* |
| 35 to 45 mph | Use the equations for L in Exhibit 1260-7 with S equal to 230’. \* | Use the equations for L in  Exhibit 1260-7 with S equal to the SSD from Exhibit 1260-1. \* |
| ≥ 50 mph | Use the equation for comfort: \*\*  *L* = Curve length (ft)  *A* = Change in grade (%)  *V* = Design speed (mph) | Use the equations for L in  Exhibit 1260-7 with S equal to the SSD from Exhibit 1260-1. \* |
| \* The calculated value of L cannot be less than what is required for comfort. Use the formula for comfort shown above. In this case, the comfort equation may be used within pedestrian crossings or intersections because sight distance is not restricted by the sag vertical curve.  \*\* The comfort equation cannot be applied when the curve is within an intersection or a pedestrian crossing. In these situations, the minimum sag vertical curve must meet stopping sight distance.  \*\*\* All values for SSD used in this table must be adjusted for grade per 1260.03(2). | | |

***Chapter 1260 Sight Distance***

**1260.03 Stopping Sight Distance (Eye height – 3.5 ft, Object height – 2.0 ft)**

***1260.03(7) Existing Stopping Sight Distance***

*Sag Vertical Curves* – The minimum length of an existing sag vertical curve may be found using the equations in Exhibit 1260-7 or using the *KS* values from Exhibit 1260-11.