**Voltage Drop Study – Cable Sizing Calculation Notes**

**Note**: This illustrative procedure uses HPS luminaires, but it is valid for LED luminaires as well, except that LED luminaires have no ballast loss.

1. Voltage drop on circuit not to exceed 5% nominal circuit voltage in steady state since equipment can generally tolerate a voltage variance of 10%.

Because of the small wire sizes involved and the high power factor of the lighting load, the reactance is considered to be negligible in this computation. (**AIEE** publication No. 952 dated October, 1956)

1. Operating current for typical luminaires in **ODOT** HPS Highway Lighting Systems:

Line Amperes Operating = (Lamp watt + Ballast watts)/Line voltage

Ballast watts may be as much as 30% lamp watts for tertiary winding ballast.

|  |  |  |  |
| --- | --- | --- | --- |
| Lamp Wattage | Line Amps. Operating | | |
| 480 Volts | 240 Volts | 120 Volts |
| 100 | 0.27 | 0.54 | 1.1 |
| 150 | 0.41 | 0.81 | 1.6 |
| 200 | 0.54 | 1.1 | 2.2 |
| 250 | 0.68 | 1.4 | 2.7 |
| 310 | 0.84 | 1.7 | 3.4 |
| 400 | 1.1 | 2.2 | 4.3 |
| 1000 | 2.7 | 5.4 | 11 |

1. Obtain wire resistance from published data (engineering handbooks, manufacturers’ data sheets, etc. The following values are taken from **NEC** (2011) Chapter 9, Table 9:

|  |  |
| --- | --- |
| Wire Size | Ohms per 1000 feet |
| 14 | 3.1 |
| 12 | 2.0 |
| 10 | 1.2 |
| 8 | 0.78 |
| 6 | 0.49 |
| 4 | 0.31 |
| 2 | 0.19 |
| 1/0 | 0.12 |
| 2/0 | 0.10 |
| 4/0 | 0.079 |

1. Voltage drop in a Lighting Circuit Section = Amperes in and beyond the Section x [(Length of the Section in feet x 2 wires)/1000] x Resistance wire per 1000.

Include in length of a section an allowance for connection at each end and slack. Frequently this is done by allowing 5-10 feet at each end and rounding up section lengths in increments of 5 feet.

1. To simplify calculations ***(see Figure 1198-12c)***: Lighting unit lead and voltage drop is computed only to the base of the support; underpass lighting load and voltage drop is computed only to the disconnect switch; and the sign lighting load and voltage drop are computed only to point of connection to the lighting circuit.