3.6.1.4.2 Fatigue Load – Frequency

Steel design requires the $ADTT_{SL}$ averaged over the design life of the bridge to determine which fatigue limit state applies. However, traffic growth is usually not predicted for the design life of the bridge. In lieu of project-specific information from the Roadway Data Group, determine $ADTT_{SL}$ as follows:

$$ADTT_{SL} = p\ ADTT_n$$

$$ADTT_n = \alpha\ (CAADT_0)\left(\frac{CAADT_{20}}{CAADT_0}\right)^{\frac{n\ years}{20\ years}}$$

Where:

p = Fraction of truck traffic in a single-lane. Use AASHTO Table 3.6.1.4.2-1.
α = Conversion factor from two-way traffic to one-way traffic.
= 0.60 when two-directional traffic data is provided
= 1.00 when one-directional traffic data is provided
n = 45 years

ADTT = **A**verage **D**aily **T**ruck **T**raffic
$ADTT_{SL}$ = *ADTT* in a single-lane in one direction
$ADTT_n$ = Estimated one-directional *ADTT* over the bridge's design life (construction + n years)

CAADT = **C**ommercial **A**verage **A**nnual **D**aily **T**raffic
$CAADT_0$ = *CAADT* at construction (i.e., 0 years)
$CAADT_{20}$ = *CAADT* at construction + 20 years

Commentary:

The 9th Edition of AASHTO LRFD has a design life of 75 years. As design data is a projection, the above method was adopted to avoid determining the $AADT_{SL}$ following a curve-fit and integral approach. The formula is based on the future value equation using simple interest, $FV = PV(1 + r)^n$.

The true value of *n* should fall between a linear average (1/2 x 75 years = 37.5 years) and a parabolic average (2/3 x 75 years = 50 years) but depends on the assumed curve-fit and traffic rate of change, *r*. The value of *n* selected provides a conservative $AADT_{SL}$ with the presumed curve-fit equation.

The higher α was selected (compared to 0.55 in the code) as it better reflects historical data trends submitted from traffic engineers.

Revisions:
Oct 2023 Added new article.