3.2.2.4 Regression Equations for Modeling Parameters

It is understood that the trends alone do not provide sufficient information to fully quantify modeling parameters. Empirical equations based on multi-variate regression analysis that account for combinations of geometric and material parameters in the quantification of modeling parameters are suggested.

Data were exploited to derive regression equations for the modeling parameters θ_p, θ_{pc}, and Λ. The equations have been derived from the full RBS and non-RBS data sets, using the full range of beam depths available in each set (4 in. $\leq d \leq$ 36 in. for non-RBS connections, and 18 in. $\leq d \leq$ 36 in. for RBS connections). The following equations are suggested to estimate modeling parameters as a function of geometric and material parameters that were found to be statistically significant.

Pre-capping plastic rotation, θ_p, for beams with non-RBS connections:

$$\theta_p = 0.087 \cdot \left(\frac{h}{t_w}\right)^{-0.365} \cdot \left(\frac{b_f}{2 \cdot t_f}\right)^{-0.14} \cdot \left(\frac{L}{d}\right)^{0.34} \cdot \left(\frac{d}{c^1_{unit} \cdot 21"}\right)^{-0.721} \cdot \left(\frac{c^2_{unit} \cdot F_y}{50}\right)^{-0.23} \quad (3\text{-}1)$$

Pre-capping plastic rotation, θ_p, for beams with RBS connections:

$$\theta_p = 0.19 \cdot \left(\frac{h}{t_w}\right)^{-0.314} \cdot \left(\frac{b_f}{2 \cdot t_f}\right)^{-0.10} \cdot \left(\frac{L_b}{r_y}\right)^{-0.185} \cdot \left(\frac{L}{d}\right)^{0.113} \cdot \left(\frac{d}{c^1_{unit} \cdot 21"}\right)^{-0.76} \cdot \left(\frac{c^2_{unit} \cdot F_y}{50}\right)^{-0.07} \quad (3\text{-}2)$$

Post-capping rotation, θ_{pc}, for beams with non-RBS connections:

$$\theta_{pc} = 5.70 \cdot \left(\frac{h}{t_w}\right)^{-0.565} \cdot \left(\frac{b_f}{2 \cdot t_f}\right)^{-0.80} \cdot \left(\frac{d}{c^1_{unit} \cdot 21"}\right)^{-0.28} \cdot \left(\frac{c^2_{unit} \cdot F_y}{50}\right)^{-0.43} \quad (3\text{-}3)$$

Post-capping rotation, θ_{pc}, for beams with RBS connections:

$$\theta_{pc} = 9.62 \cdot \left(\frac{h}{t_w}\right)^{-0.513} \cdot \left(\frac{b_f}{2 \cdot t_f}\right)^{-0.863} \cdot \left(\frac{L_b}{r_y}\right)^{-0.108} \cdot \left(\frac{c^2_{unit} \cdot F_y}{50}\right)^{-0.36} \quad (3\text{-}4)$$

Reference cumulative plastic rotation, Λ, for beams with non-RBS connections:

$$\Lambda = \frac{\mathrm{E}_t}{M_y} = 500 \left(\frac{h}{t_w}\right)^{-1.34} \cdot \left(\frac{b_f}{2 \cdot t_f}\right)^{-0.595} \cdot \left(\frac{c^2_{unit} \cdot F_y}{50}\right)^{-0.36} \quad (3\text{-}5)$$