Simple Span Beam --- Uniformly Distrubuted Load : ***Per AISC condition # 1***

HSS 7 x 4 x 1/4"
ASTM A500 Gr. B
Floor Load Only

Variables ----

$L := 20 \cdot ft + 0 \cdot in$ $\quad t_w := 0.25 \cdot in$ $\quad F_y := 42 \cdot ksi$

$x := 0.50 \cdot L$ $\quad d := 7.00 \cdot in$ $\quad E := 29 \cdot 10^6 \cdot psi$

$I := 30.5 \cdot in^4$

$S := 8.72 \cdot in^3$ $\quad \Delta := 360$ $\quad Qty := 1$

Results:

Beam Loading:

$w_{ll} := 160.0 \cdot plf$ ***(30 psf Floor Load - Bedroom Area Only)*** $\quad w_{ll} = 160.0\,plf$

$w_{dl} := 99.47 \cdot plf$ $\quad w_{dl} = 99.5\,plf$

$w := w_{dl} + w_{ll}$ $\quad w = 259.5\,plf$

Allowable Steel Stress:

$F_b := 0.66 \cdot F_y$ $\quad F_b = 27.7\,ksi$

$F_v := 0.40 \cdot F_y$ $\quad F_v = 16.8\,ksi$

Steel Stress:

$Load := w \cdot L$ (Total Equivalent Uniform Load) $\quad Load = 5.19\,kips$

Shear & Reactions:

$R := \frac{w \cdot L}{2}$ $\quad V := R$ $\quad R = 2.59\,kips$

$A_w := 2 \cdot t_w \cdot (d - 2 \cdot t_w)$ $\quad A_w = 3.25\,in^2$

$V_{all} := F_v \cdot A_w$ $\quad V_{all} = 54.60\,kips$

$V_{all} = 54.60\,kips \quad \geq \quad R = 2.59\,kips$ $\quad$ ***CHECK*** = "OK"

Bending:

$M_{max} := \frac{w \cdot L^2}{8}$ (Moment @ center) $\quad M_{max} = 12.97\,ft \cdot kips$

$M_{all} := F_b \cdot (S \cdot Qty)$ $\quad M_{all} = 20.143\,ft \cdot kips$

$M_{all} = 20.143\,ft \cdot kips \quad \geq \quad M_{max} = 12.97\,ft \cdot kips$ $\quad$ ***CHECK*** = "OK"

Deflection:

$\Delta_{max} := \frac{5 w_{ll} \cdot L^4}{384 E \cdot (I \cdot Qty)}$ (Live Load Deflection @ center) $\quad \Delta_{max} = 0.651\,in$

$\Delta_{Allow} := \frac{L}{\Delta}$ $\quad \Delta_{Allow} = 0.667\,in$

$\Delta_{Allow} = 0.667\,in \quad \geq \quad \Delta_{max} = 0.651\,in$ $\quad$ ***CHECK*** = "OK"

SAMPLE CALCULATION