Appendix D – Catwalk Calculations

Steel Catwalk Load Calculations:

Assumptions:
- Considering HSS 5x5x5/16 hangers and W8x28 girders are the critical members
- The catwalk is 1’ wide, with largest spans of 25’
- Load requirements are 40 PSF LL and 20 PSF DL

HSS 5x5x5/16 hanger –

Tributary Area = 25’ x 1’ = 25 ft^2

1.2(20 PSF) + 1.6(40 PSF) = 88 PSF

25 ft^2 x 88 PSF = 2,000 lb

Stress = P/A = 2.2 kips / 8.42 in^2 = 0.27 ksi < 50 ksi

W8x28 girder –

W = 88 PSF x 1’ = 88 PLF

V_u = (wl)/2 = (88 PLF x 25 ft)/2 = 1,100 lbs

M_u = (wl^2)/8 = [8 PLF x (25ft)^2]/8 = 6,875 ft-lbs

*DL & LL: Δ = (5wl^4)/384EI

= [5 x 88 PLF x (25ft)^4 x 1728 in^3] / (384 x 29e3 ksi x 98 in^4 x 1,000 lbs) = 0.272 in

0.272 in < 0.625 = (25 ft x 12 in/ft) / 480

*LL: Δ = (5wl^4)/384EI

= 5 x 64 PLF x (25ft)^4 x 1728 in^3] / (384 x 29e3 ksi x 98 in^4 x 1,000 lbs) = 0.198 in

0.198 in < 0.833 = (25 ft x 12 in/ft) / 360

Z_required = M_u / Φ_bF_y = (6,875 ft-lbs x 12 in) / (0.9 x 50 ksi x 1,000lbs) = 1.83 in^3
Aluminum Catwalk Load Calculations:

Assumptions:
- Considering HSS 4x4x3/16 hangers and W10x210 girders are the critical members
- The catwalk is 1’ wide, with largest spans of 25’
- Load requirements are 40 PSF LL and 20 PSF DL
- $F_y = 35$ ksi and $E = 10e3$ ksi for alloy 6061-T6
- Additional material characteristics are to be that of steel, allowing for the same equations

HSS 4x4x3/16 hanger –
Stress $= \frac{P}{A} = \frac{2.2 \text{ kips}}{2.87 \text{ in}^2} = 0.77 \text{ ksi} < 35 \text{ ksi}$

W8x28 girder –
$W = 88$ PSF x 1’ = 88 PLF
$V_u = \frac{(wl)}{2} = \frac{(88 \text{ PLF} \times 25 \text{ ft})}{2} = 1,100 \text{ lbs}$
$M_u = \frac{(wl^2)}{8} = \frac{[8 \text{ PLF} \times (25 \text{ ft})^2]}{8} = 6,875 \text{ ft-lbs}$
*DL & LL: $\Delta = \frac{(5wl^4)}{384EI}$
\[\Delta = \frac{5 \times 88 \text{ PLF} \times (25 \text{ ft})^4 \times 1728 \text{ in}^3}{(384 \times 10e3 \text{ ksi} \times 155.8 \text{ in}^4 \times 1,000 \text{ lbs})} = 0.496 \text{ in} < 0.625 = (25 \text{ ft} \times 12 \text{ in/ft}) / 480 \]
*LL: $\Delta = \frac{(5wl^4)}{384EI}$
\[\Delta = \frac{5 \times 64 \text{ PLF} \times (25 \text{ ft})^4 \times 1728 \text{ in}^3}{(384 \times 10e3 \text{ ksi} \times 155.8\text{in}^4 \times 1,000 \text{ lbs})} = 0.198 \text{ in} < 0.833 = (25 \text{ ft} \times 12 \text{ in/ft}) / 360 \]

FRP Catwalk Load Calculations:
No calculations were evaluated for this section. E.T. Techtonics estimator considered the 40 PSF live load and 20 PSF deal load.

Wood Catwalk Load Calculations:
No calculations were evaluated for this section. The steel hangers remained in this design and have already been checked. Manufactured I-beams were recommended by a Georgia-Pacific Product Guide.