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: $\Delta = (5wl^4)/384EI$

= [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: $\Delta = (5wl^4)/384EI$

= 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

$Z_{required} = M_u / \Phi_b F_y$ = (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 = P/A = 2.2 kips / 2.87 in2 = 0.77 ksi < 35 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: $\Delta = (5wl^4)/384EI$

= [5 x 88 PLF x $(25\text{ ft})^4$ x 1728 in^3] / (384 x 10e3 ksi x 155.8 in^4 x 1,000 lbs) = 0.496 in

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

*LL: $\Delta = (5wl^4)/384EI$

= [5 x 64 PLF x $(25\text{ ft})^4$ x 1728 in^3] / (384 x 10e3 ksi x 155.8in^4 x 1,000 lbs) = 0.198 in

0.37 in < 0.833 = (25 ft x 12 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.