

kip \equiv 1000·lbf

$$\begin{pmatrix} D2_{d1} \\ D2_{d2} \\ D2_{l1} \\ D2_{l2} \end{pmatrix} :=$$

Time	LoadRate_	PID_Loop.	..\MainPar	..\MainPar	..\MainPar	..\MainPar	..\MainPar	..\MainPar
10:29:18 AM	0.05831	5.53842	0	-1.81829	2.96049	-0.01641	-0.00939	0
10:29:19 AM	0.06664	6.75851	0	-1.85007	2.92873	-0.01641	-0.00939	0
10:29:20 AM	0.07497	8.07651	0	-1.86597	2.99225	-0.01592	-0.00939	0
10:29:21 AM	0.0833	9.52569	0	-1.8024	2.96049	-0.01641	-0.00939	0

$$\begin{pmatrix} D3_{d1} \\ D3_{d2} \\ D3_{l1} \\ D3_{l2} \end{pmatrix} :=$$

Time	LoadRate_	PID_Loop.	..\MainPar	..\MainPar	..\MainPar	..\MainPar	..\MainPar	..\MainPar
8:39:00 AM	0	0	0	-30.4715	0.18166	-0.00261	0.005876	0
8:39:01 AM	0	0.042542	0	-30.4715	0.18166	-0.00261	0.005876	0
8:39:02 AM	0.00833	0.355182	0	-30.4715	0.134023	-0.00113	0.005876	0
8:39:03 AM	0.01666	1.56653	0	-30.4715	0.149902	-0.00261	0.005876	0

$$\text{DispD2} := \frac{D2_{d1} + D2_{d2}}{2}$$

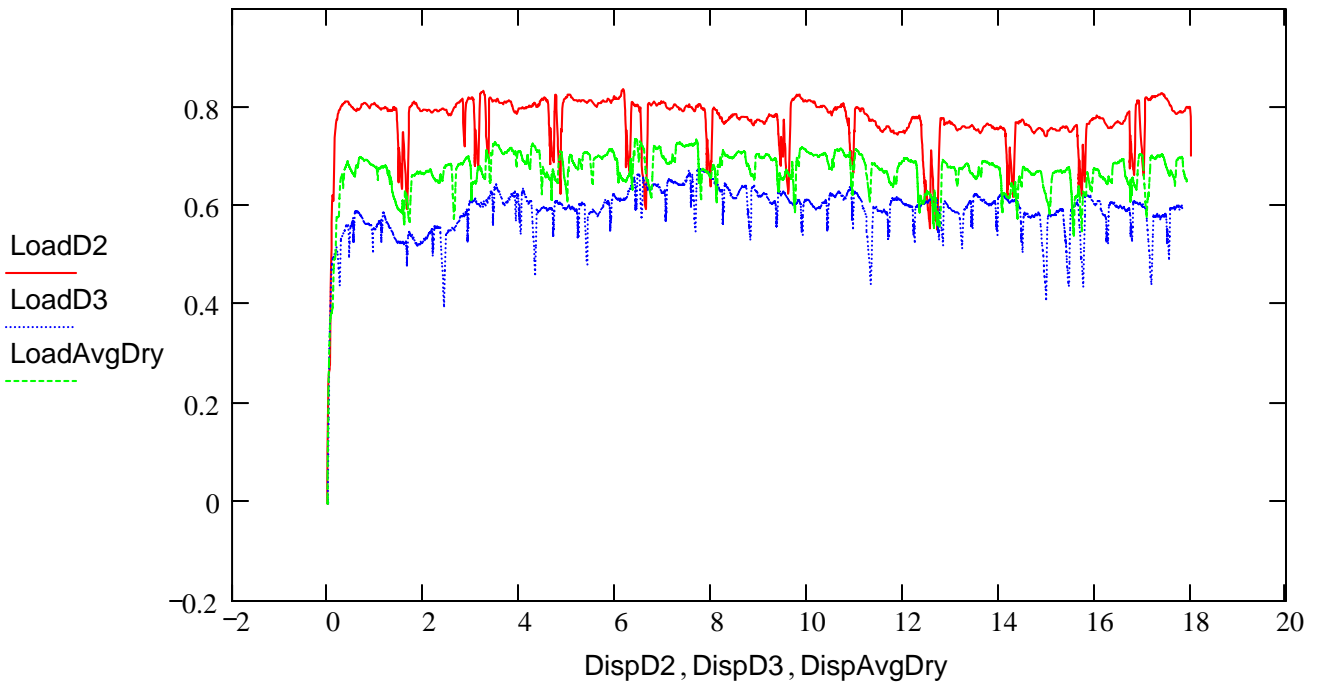
$$\text{LoadD2} := D2_{l1} + D2_{l2}$$

$$\text{DispD3} := \frac{D3_{d1} + D3_{d2}}{2}$$

$$\text{LoadD3} := D3_{l1} + D3_{l2}$$

$$\text{DispAvgDry} := \frac{\text{DispD2} + \text{DispD3}}{2}$$

$$\text{LoadAvgDry} := \frac{\text{LoadD2} + \text{LoadD3}}{2}$$



$$\text{PeakD2} := \max(\text{LoadD2}) \cdot \text{kip}$$

$$\text{PeakD2} = 0.837 \text{ kip}$$

$$\text{PeakD3} := \max(\text{LoadD3}) \cdot \text{kip}$$

$$\text{PeakD3} = 0.675 \text{ kip}$$

$$\text{AvgPeakDryRun} := \frac{\text{PeakD2} + \text{PeakD3}}{2}$$

$$\text{AvgPeakDryRun} = 0.756 \text{ kip}$$

$$\begin{pmatrix} A3_{d1} \\ A3_{d2} \\ A3_{I1} \\ A3_{I2} \end{pmatrix} :=$$

Time	LVDT1	LVDT2	Loadcell1	Loadcell2
11:31:45 AM	-0.00063	0.004892	0	0
11:31:46 AM	-0.00063	0.004892	0	0
11:31:47 AM	-0.00063	0.005876	0	0

$$\begin{pmatrix} A4_{d1} \\ A4_{d2} \\ A4_{I1} \\ A4_{I2} \end{pmatrix} :=$$

Time	LVDT1	LVDT2	Loadcell1	Loadcell2
1:15:46 PM	0.081227	0.082698	0.140051	-0.03419
1:15:47 PM	0.081227	0.083191	0.140051	-0.03134
1:15:48 PM	0.081227	0.083191	0.140051	-0.03134

$$\begin{pmatrix} S1_{d1} \\ S1_{d2} \\ S1_{I1} \\ S1_{I2} \end{pmatrix} :=$$

Time	LVDT1	LVDT2	Loadcell1	Loadcell2
8:56:00 AM	-0.00014	0.006861	0.002801	0
8:56:00 AM	-0.00014	0.007846	0.002801	0
8:56:00 AM	-0.00014	0.006861	0.002801	0

$$\begin{pmatrix} S2_{d1} \\ S2_{d2} \\ S2_{I1} \\ S2_{I2} \end{pmatrix} :=$$

Time	LVDT1	LVDT2	Loadcell1	Loadcell2
9:55:00 AM	-0.00261	0.005876	0	0
9:55:00 AM	-0.00261	0.006369	-0.0028	0
9:55:00 AM	-0.00113	0.005876	0	0

$$\begin{pmatrix} S3_{d1} \\ S3_{d2} \\ S3_{I1} \\ S3_{I2} \end{pmatrix} :=$$

Time	LoadRate_	PID_Loop.	..\MainPar	..\MainPar	..\MainPar	..\MainPar	..\MainPar	..\MainPar
2:58:08 PM	0	2.8631	0	-30.4715	0.149902	-0.00113	0.006861	-0.0028
2:58:09 PM	0.00833	3.45173	0	-30.4715	0.102265	-0.00113	0.006861	-0.0028
2:58:10 PM	0.01666	5.13993	0	-30.4715	0.134023	-0.00113	0.006861	-0.0028

$$\begin{pmatrix} S4_{d1} \\ S4_{d2} \\ S4_{I1} \\ S4_{I2} \end{pmatrix} := \begin{array}{|c|c|c|c|c|c|c|c|c|c|} \hline 17.8179 & 48.3358 & 143.051 & -27.9923 & 10.8524 & 17.963 & 18.0059 & 5.44797 & 5.16278 \\ \hline 17.8262 & 34.0342 & 116.229 & -28.2625 & 10.8047 & 17.9748 & 18.0059 & 5.45357 & 5.13713 \\ \hline 17.8345 & 19.2542 & 62.5849 & -28.4691 & 10.8047 & 17.9748 & 18.0059 & 5.45637 & 5.11719 \\ \hline 17.8429 & 4.72434 & 0 & -28.4691 & 10.8047 & 17.9827 & 18.0068 & 5.45077 & 5.10579 \\ \hline \end{array}$$

$$\text{DispA3} := \frac{A3_{d1} + A3_{d2}}{2}$$

$$\text{LoadA3} := A3_{I1} + A3_{I2}$$

$$\text{DispA4} := \frac{A4_{d1} + A4_{d2}}{2}$$

$$\text{LoadA4} := A4_{I1} + A4_{I2}$$

$$\text{DispS1} := \frac{S1_{d1} + S1_{d2}}{2}$$

$$\text{LoadS1} := S1_{I1} + S1_{I2}$$

$$\text{DispS2} := \frac{S2_{d1} + S2_{d2}}{2}$$

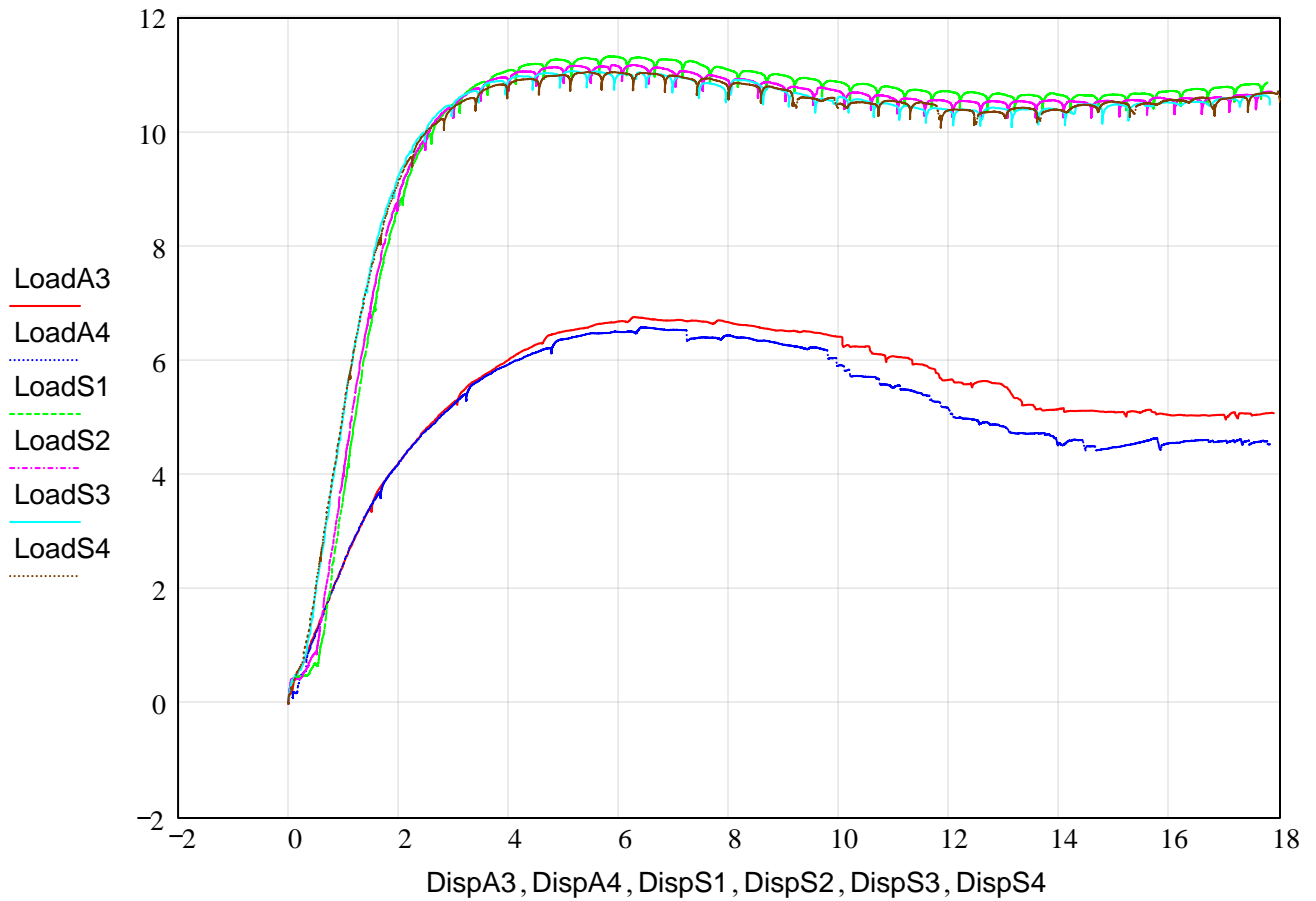
$$\text{LoadS2} := S2_{I1} + S2_{I2}$$

$$\text{DispS3} := \frac{S3_{d1} + S3_{d2}}{2}$$

$$\text{LoadS3} := S3_{I1} + S3_{I2}$$

$$\text{DispS4} := \frac{S4_{d1} + S4_{d2}}{2}$$

$$\text{LoadS4} := S4_{I1} + S4_{I2}$$



$$\text{TOL} = 1 \times 10^{-3}$$

$$\text{TOL} := 0.01$$

$$\text{A3IndexAt75X} := \text{match}(0.75, \text{DispA3})_0$$

$$\text{A3LoadAt75X} := \text{LoadA3}_{\text{A3IndexAt75X}}$$

$$\text{A3DispAt75X} := \text{DispA3}_{\text{A3IndexAt75X}}$$

$$\text{A3IndexAt125X} := \text{match}(1.25, \text{DispA3})_0$$

$$\text{A3LoadAt125X} := \text{LoadA3}_{\text{A3IndexAt125X}}$$

$$\text{A3DispAt125X} := \text{DispA3}_{\text{A3IndexAt125X}}$$

$$\text{A4IndexAt75X} := \text{match}(0.75, \text{DispA4})_0$$

$$\text{A4LoadAt75X} := \text{LoadA4}_{\text{A4IndexAt75X}}$$

$$\text{A4DispAt75X} := \text{DispA4}_{\text{A4IndexAt75X}}$$

A4IndexAt125X := match(1.25 ,DispA4) ₀	A4LoadAt125X := LoadA4 _{A4IndexAt125X}
	A4DispAt125X := DispA4 _{A4IndexAt125X}
S1IndexAt75X := match(0.75 ,DispS1) ₀	S1LoadAt75X := LoadS1 _{S1IndexAt75X}
	S1DispAt75X := DispS1 _{S1IndexAt75X}
S1IndexAt125X := match(1.25 ,DispS1) ₀	S1LoadAt125X := LoadS1 _{S1IndexAt125X}
	S1DispAt125X := DispS1 _{S1IndexAt125X}
S2IndexAt75X := match(0.75 ,DispS2) ₀	S2LoadAt75X := LoadS2 _{S2IndexAt75X}
	S2DispAt75X := DispS2 _{S2IndexAt75X}
S2IndexAt125X := match(1.25 ,DispS2) ₀	S2LoadAt125X := LoadS2 _{S2IndexAt125X}
	S2DispAt125X := DispS2 _{S2IndexAt125X}
S3IndexAt75X := match(0.75 ,DispS3) ₀	S3LoadAt75X := LoadS3 _{S3IndexAt75X}
	S3DispAt75X := DispS3 _{S3IndexAt75X}
S3IndexAt127X := match(1.27 ,DispS3) ₀	S3LoadAt125X := LoadS3 _{S3IndexAt127X}
	S3DispAt125X := DispS3 _{S3IndexAt127X}
S4IndexAt75X := match(0.75 ,DispS4) ₀	S4LoadAt75X := LoadS4 _{S4IndexAt75X}
	S4DispAt75X := DispS4 _{S4IndexAt75X}
S4IndexAt125X := match(1.25 ,DispS4) ₀	S4LoadAt125X := LoadS4 _{S4IndexAt125X}
	S4DispAt125X := DispS4 _{S4IndexAt125X}

$$A3Offset := A3DispAt75X - \frac{A3LoadAt75X}{\left(\frac{A3LoadAt125X - A3LoadAt75X}{A3DispAt125X - A3DispAt75X} \right)}$$

$$A4Offset := A4DispAt75X - \frac{A4LoadAt75X}{\left(\frac{A4LoadAt125X - A4LoadAt75X}{A4DispAt125X - A4DispAt75X} \right)}$$

$$S1Offset := S1DispAt75X - \frac{S1LoadAt75X}{\left(\frac{S1LoadAt125X - S1LoadAt75X}{S1DispAt125X - S1DispAt75X} \right)}$$

$$S2Offset := S2DispAt75X - \frac{S2LoadAt75X}{\left(\frac{S2LoadAt125X - S2LoadAt75X}{S2DispAt125X - S2DispAt75X} \right)}$$

$$S3Offset := S3DispAt75X - \frac{S3LoadAt75X}{\left(\frac{S3LoadAt125X - S3LoadAt75X}{S3DispAt125X - S3DispAt75X} \right)}$$

$$S4Offset := S4DispAt75X - \frac{S4LoadAt75X}{\left(\frac{S4LoadAt125X - S4LoadAt75X}{S4DispAt125X - S4DispAt75X} \right)}$$

$$DispA3 := DispA3 - A3Offset$$

$$DispA4 := DispA4 - A4Offset$$

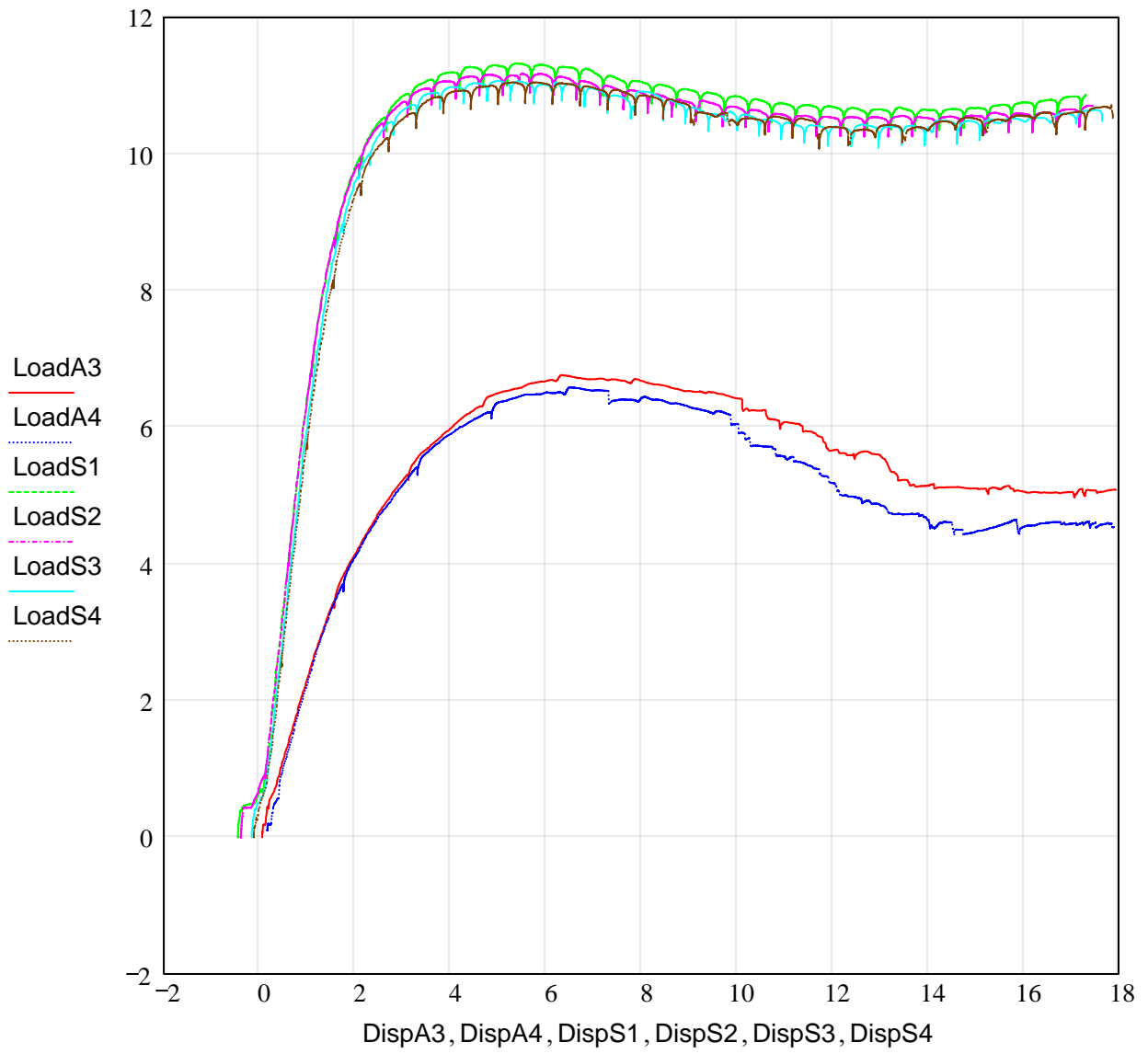
$$DispS1 := DispS1 - S1Offset$$

$$DispS2 := DispS2 - S2Offset$$

$$DispS3 := DispS3 - S3Offset$$

$$DispS4 := DispS4 - S4Offset$$

TOL := 0.001



$$\text{PeakA3} := \max(\text{LoadA3}) \cdot \text{kip}$$

$$\text{PeakIndexA3} := \text{match}\left(\frac{\text{PeakA3}}{\text{kip}}, \text{LoadA3}\right)_0$$

$$\text{DispPeakA3} := \text{DispA3}_{\text{PeakIndexA3}}$$

$$\text{DispPeakA3} = 6.33$$

$$\text{PeakA4} := \max(\text{LoadA4}) \cdot \text{kip}$$

$$\text{PeakIndexA4} := \text{match}\left(\frac{\text{PeakA4}}{\text{kip}}, \text{LoadA4}\right)_0$$

$$\text{DispPeakA4} := \text{DispA4}_{\text{PeakIndexA4}}$$

$$\text{DispPeakA4} = 6.488$$

$$\text{PeakS1} := \max(\text{LoadS1}) \cdot \text{kip}$$

$$\text{PeakIndexS1} := \text{match}\left(\frac{\text{PeakS1}}{\text{kip}}, \text{LoadS1}\right)_0$$

$$\text{DispPeakS1} := \text{DispS1}_{\text{PeakIndexS1}}$$

$$\text{DispPeakS1} = 5.374$$

$$\text{PeakS2} := \max(\text{LoadS2}) \cdot \text{kip}$$

$$\text{PeakIndexS2} := \text{match}\left(\frac{\text{PeakS2}}{\text{kip}}, \text{LoadS2}\right)_0$$

$$\text{DispPeakS2} := \text{DispS2}_{\text{PeakIndexS2}}$$

$$\text{DispPeakS2} = 5.503$$

$$\text{PeakS3} := \max(\text{LoadS3}) \cdot \text{kip}$$

$$\text{PeakIndexS3} := \text{match}\left(\frac{\text{PeakS3}}{\text{kip}}, \text{LoadS3}\right)_0$$

$$\text{DispPeakS3} := \text{DispS3}_{\text{PeakIndexS3}}$$

$$\text{DispPeakS3} = 4.979$$

$$\text{PeakS4} := \max(\text{LoadS4}) \cdot \text{kip}$$

$$\text{PeakIndexS4} := \text{match}\left(\frac{\text{PeakS4}}{\text{kip}}, \text{LoadS4}\right)_0$$

$$\text{DispPeakS4} := \text{DispS4}_{\text{PeakIndexS4}}$$

$$\text{DispPeakS4} = 5.315$$

$$\text{AvgAlumPeakLoad} := \frac{\text{PeakA3} + \text{PeakA4}}{2} \quad \text{AvgAlumPeakLoad} = 6.676 \text{ kip}$$

$$\text{AvgSteelPeakLoad} := \frac{\text{PeakS1} + \text{PeakS2} + \text{PeakS3} + \text{PeakS4}}{4}$$
$$\text{AvgSteelPeakLoad} = 11.157 \text{ kip}$$

$$\text{AvgAlumPeakLoadAdj} := \text{AvgAlumPeakLoad} - \text{AvgPeakDryRun}$$

$$\text{AvgSteelPeakLoadAdj} := \text{AvgSteelPeakLoad} - \text{AvgPeakDryRun}$$

$$\text{AvgAlumPeakLoadAdj} = 5.92 \text{ kip}$$

$$\text{AvgSteelPeakLoadAdj} = 10.4 \text{ kip}$$

$$\text{AvgDispPeakAlum} := \frac{\text{DispPeakA3} + \text{DispPeakA4}}{2} \cdot \text{in}$$

$$\text{AvgDispPeakSteel} := \frac{\text{DispPeakS1} + \text{DispPeakS2} + \text{DispPeakS3} + \text{DispPeakS4}}{4} \cdot \text{in}$$

$$\text{AvgDispPeakAlum} = 6.409 \text{ in}$$

$$\text{AvgDispPeakSteel} = 5.293 \text{ in}$$

$$\text{AvgAlumThk} := \frac{0.0735 + 0.075 + 0.074 + 0.076}{4} \quad \text{AvgAlumThk} = 0.075$$

$$\text{AvgSteelThk} := \frac{0.0785 + 0.075 + 0.0745 + 0.0745}{4} \quad \text{AvgSteelThk} = 0.076$$

$$\text{AvgOD} := 35.625$$

$$\text{AvgID} := \text{AvgOD} - 0.075 \cdot 2 \quad \text{AvgID} = 35.475$$

$$\text{OnePercentVal} := \frac{\text{AvgID}}{100}$$

$$\text{OnePercentVal} = 0.355$$

$$\text{FivePercentVal} := \frac{\text{AvgID} \cdot 5}{100}$$

$$\text{FivePercentVal} = 1.774$$

$$\text{TOL} = 1 \times 10^{-3}$$

$$\text{TOL} := 0.01$$

$$\text{A3IndexAt1} := \text{match}(\text{OnePercentVal}, \text{DispA3})_0$$

$$\text{A3IndexAt5} := \text{match}(\text{FivePercentVal}, \text{DispA3})_0$$

$$\text{A4IndexAt1} := \text{match}(\text{OnePercentVal}, \text{DispA4})_0$$

$$\text{A4IndexAt5} := \text{match}(\text{FivePercentVal}, \text{DispA4})_0$$

$$\text{TOL} := 0.02$$

$$\text{S1IndexAt1} := \text{match}(\text{OnePercentVal}, \text{DispS1})_0$$

$$\text{S1IndexAt5} := \text{match}(\text{FivePercentVal}, \text{DispS1})_0$$

$$\text{TOL} := 0.01$$

$$\text{S2IndexAt1} := \text{match}(\text{OnePercentVal}, \text{DispS2})_0$$

$$\text{S2IndexAt5} := \text{match}(\text{FivePercentVal}, \text{DispS2})_0$$

$$\text{S3IndexAt1} := \text{match}(\text{OnePercentVal}, \text{DispS3})_0$$

$$\text{S3IndexAt5} := \text{match}(\text{FivePercentVal}, \text{DispS3})_0$$

$$\text{S4IndexAt1} := \text{match}(\text{OnePercentVal}, \text{DispS4})_0$$

$$\text{S4IndexAt5} := \text{match}(\text{FivePercentVal}, \text{DispS4})_0$$

$$\text{A3LoadAt1} := \text{LoadA3}_{\text{A3IndexAt1}}$$

$$\text{A3LoadAt1} = 0.758$$

$$\text{A3LoadAt5} := \text{LoadA3}_{\text{A3IndexAt5}}$$

$$\text{A3LoadAt5} = 3.844$$

$$\text{A4LoadAt1} := \text{LoadA4}_{\text{A4IndexAt1}}$$

$$\text{A4LoadAt1} = 0.52$$

$$\text{A4LoadAt5} := \text{LoadA4}_{\text{A4IndexAt5}}$$

$$\text{A4LoadAt5} = 3.68$$

$$\text{S1LoadAt1} := \text{LoadS1}_{\text{S1IndexAt1}}$$

$$\text{S1LoadAt1} = 2.287$$

$$\text{S1LoadAt5} := \text{LoadS1}_{\text{S1IndexAt5}}$$

$$\text{S1LoadAt5} = 9.339$$

$$\text{S2LoadAt1} := \text{LoadS2}_{\text{S2IndexAt1}}$$

$$\text{S2LoadAt1} = 2.33$$

$$\text{S2LoadAt5} := \text{LoadS2}_{\text{S2IndexAt5}}$$

$$\text{S2LoadAt5} = 9.311$$

$$S3LoadAt1 := LoadS3S3IndexAt1$$

$$S3LoadAt1 = 1.985$$

$$S3LoadAt5 := LoadS3S3IndexAt5$$

$$S3LoadAt5 = 8.95$$

$$S4LoadAt1 := LoadS4S4IndexAt1$$

$$S4LoadAt1 = 1.788$$

$$S4LoadAt5 := LoadS4S4IndexAt5$$

$$S4LoadAt5 = 8.837$$

$$AvgAlumLoadAt1 := \frac{A3LoadAt1 + A4LoadAt1}{2} \cdot \text{kip} \quad AvgAlumLoadAt1 = 0.639 \text{ kip}$$

$$AvgAlumLoadAt5 := \frac{A3LoadAt5 + A4LoadAt5}{2} \cdot \text{kip} \quad AvgAlumLoadAt5 = 3.762 \text{ kip}$$

$$AvgStlLoadAt1 := \frac{S1LoadAt1 + S2LoadAt1 + S3LoadAt1 + S4LoadAt1}{4} \cdot \text{kip}$$

$$AvgStlLoadAt1 = 2.097 \text{ kip}$$

$$AvgStlLoadAt5 := \frac{S1LoadAt5 + S2LoadAt5 + S3LoadAt5 + S4LoadAt5}{4} \cdot \text{kip}$$

$$AvgStlLoadAt5 = 9.109 \text{ kip}$$

$$AlumPSAt1 := \frac{\frac{AvgAlumLoadAt1}{OnePercentVal \cdot \text{in}}}{8 \cdot \text{ft}}$$

$$AlumPSAt1 = 18.761 \frac{\text{lbf}}{\text{in}}$$

$$AlumPSAt5 := \frac{\frac{AvgAlumLoadAt5}{FivePercentVal \cdot \text{in}}}{8 \cdot \text{ft}}$$

$$AlumPSAt5 = 22.093 \frac{\text{lbf}}{\text{in}}$$

$$SteelPSAt1 := \frac{\frac{AvgStlLoadAt1}{OnePercentVal \cdot \text{in}}}{8 \cdot \text{ft}}$$

$$SteelPSAt1 = 61.587 \frac{\text{lbf}}{\text{in}}$$

$$SteelPSAt5 := \frac{\frac{AvgStlLoadAt5}{FivePercentVal \cdot \text{in}}}{8 \cdot \text{ft}}$$

$$SteelPSAt5 = 53.496 \frac{\text{lbf}}{\text{in}}$$