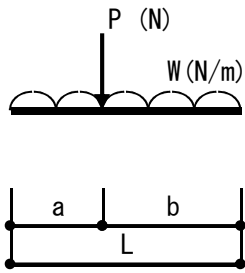


【木造梁の計算】



位置 2階 Y3通り X1-X5間

部材 E120-F330 10.5 × 21.0 cm

$$A = 220.50 \text{ cm}^2$$

$$Z = 771.75 \text{ cm}^3$$

$$I = 8103.37 \text{ cm}^4$$

$$F_b = 33.0 \text{ N/mm}^2$$

$$F_s = 3.6 \text{ N/mm}^2$$

$$E = 12000 \text{ N/mm}^2$$

$$L = 3.640 \text{ m} \quad W = 1950 \text{ N/m} \quad \alpha = 0.64$$

$$P1 = 2178 \text{ N} \quad a1 = 1.820 \text{ m} \quad b1 = 1.820 \text{ m} \quad \alpha1 = 1.00$$

$$P2 = 1632 \text{ N} \quad a2 = 2.730 \text{ m} \quad b2 = 0.910 \text{ m} \quad \alpha2 = 1.00$$

$$P3 = 1588 \text{ N} \quad a3 = 1.820 \text{ m} \quad b3 = 1.820 \text{ m} \quad \alpha3 = 1.00 \quad (\text{短期荷重})$$

$$P4 = 1588 \text{ N} \quad a4 = 2.730 \text{ m} \quad b4 = 0.910 \text{ m} \quad \alpha4 = 1.00 \quad (\text{短期荷重})$$

※ α は告示1459号のたわみ検討用荷重（地震時積載荷重による総荷重）との比率

・ 曲げモーメント

$$\begin{aligned} ML &= 595413 \text{ N}\cdot\text{cm} \\ &= [1/8 \times 19.50 \times 364.0^2 \\ &\quad + 2178 \times 182.0/2 + 1632 \times 91.0/2] \end{aligned}$$

$$\begin{aligned} MS &= 812175 \text{ N}\cdot\text{cm} \\ &= [595413 + 1588 \times 182.0/2 + 1588 \times 91.0/2] \end{aligned}$$

・ せん断力

$$\begin{aligned} QL(\text{左}) &= 5046 \text{ N} \\ &= [1/2 \times 19.50 \times 364.0 + 2178 \times 182.0/364.0 + 1632 \times 91.0/364.0] \end{aligned}$$

$$\begin{aligned} QL(\text{右}) &= 5862 \text{ N} \\ &= [1/2 \times 19.50 \times 364.0 + 2178 \times 182.0/364.0 + 1632 \times 273.0/364.0] \end{aligned}$$

$$\begin{aligned} QS(\text{左}) &= 6237 \text{ N} \\ &= [5046 + 1588 \times 182.0/364.0 + 1588 \times 91.0/364.0] \end{aligned}$$

$$\begin{aligned} QS(\text{右}) &= 7847 \text{ N} \\ &= [5862 + 1588 \times 182.0/364.0 + 1588 \times 273.0/364.0] \end{aligned}$$

・ 曲げ応力度の検定

長期 $f_b = 12.1 \text{ N/mm}^2$
 $\sigma L/f_b = 595413 / 771.75 / 1210$
 $= 0.64 < 1.0 \therefore \text{OK}$

短期 $f_b = 22.0 \text{ N/mm}^2$
 $\sigma S/f_b = 812175 / 771.75 / 2200$
 $= 0.48 < 1.0 \therefore \text{OK}$

・ せん断応力度の検定

長期 $f_s = 1.3 \text{ N/mm}^2$
 $\tau L/f_s = 1.5 \times 5862 / 220.50 / 132$
 $= 0.30 < 1.0 \therefore \text{OK}$

短期 $f_s = 2.4 \text{ N/mm}^2$
 $\tau S/f_s = 1.5 \times 7847 / 220.50 / 240$
 $= 0.22 < 1.0 \therefore \text{OK}$

・ たわみの検討

長期

$$\delta = 0.800 \text{ cm} \quad \delta/L = 1/455 < 1/300 \therefore \text{OK}$$

$$= (5 \times 19.50 \times 364.0^4) / (384 \times 1200000 \times 8103.37)$$

$$+ 2178 \times 364.0^3 / (48 \times 1200000 \times 8103.37) \times \{ 3 \times 182.0/364.0 - 4 \times (182.0/364.0)^3 \}$$

$$+ 1632 \times 364.0^3 / (48 \times 1200000 \times 8103.37) \times \{ 3 \times 91.0/364.0 - 4 \times (91.0/364.0)^3 \}$$

短期

$$\delta = 1.077 \text{ cm} \quad \delta/L = 1/338 < 1/150 \therefore \text{OK}$$

$$= 0.800$$

$$+ 1588 \times 364.0^3 / (48 \times 1200000 \times 8103.37) \times \{ 3 \times 182.0/364.0 - 4 \times (182.0/364.0)^3 \}$$

$$+ 1588 \times 364.0^3 / (48 \times 1200000 \times 8103.37) \times \{ 3 \times 91.0/364.0 - 4 \times (91.0/364.0)^3 \}$$

クリープ

$$\delta = 1.270 \text{ cm} \quad \delta/L = 1/287 < 1/250 \therefore \text{OK}$$

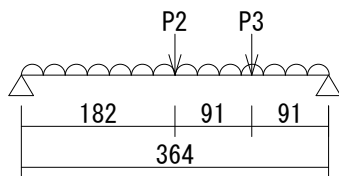
$$= (5 \times 19.50 \times 0.64 \times 364.0^4) / (384 \times 1200000 \times 8103.37)$$

$$+ 2178 \times 1.00 \times 364.0^3 / (48 \times 1200000 \times 8103.37) \times \{ 3 \times 182.0/364.0 - 4 \times (182.0/364.0)^3 \}$$

$$+ 1632 \times 1.00 \times 364.0^3 / (48 \times 1200000 \times 8103.37) \times \{ 3 \times 91.0/364.0 - 4 \times (91.0/364.0)^3 \}$$

【KIZUKURI計算との比較】

3.3.2. 梁・桁・洞差の設計 (個別)
階、位置： 2階梁 Y3通りX1 - X5



ω	=	1950 × 1.000 = 1950 (N/m)	→	19.50 (N/cm) (鉛直)
ω	=	1250 × 1.000 = 1250 (N/m)	→	12.50 (N/cm) (鉛直たわみ)
ω	=	0 (N/m)	→	0.00 (N/cm) (積雪)
P2	=	2178.0 (鉛直)		0.0 (積雪) 2178.0 (鉛直たわみ)
		0.0 (水平w)		1588.1 (水平直交w) →
		0.0 (水平w)		-1588.1 (水平直交w) ←
		0.0 (水平e)		1442.6 (水平直交e) →
		0.0 (水平e)		-1442.6 (水平直交e) ←
		0.0 (水平)m		5292.0 (水平直交)m →
		0.0 (水平)m		-5292.0 (水平直交)m ← (N)
P3	=	1632.0 (鉛直)		0.0 (積雪) 1632.0 (鉛直たわみ)
		0.0 (水平w)		1588.1 (水平直交w) →
		0.0 (水平w)		-1588.1 (水平直交w) ←
		0.0 (水平e)		1442.6 (水平直交e) →
		0.0 (水平e)		-1442.6 (水平直交e) ←
		0.0 (水平)m		5292.0 (水平直交)m →
		0.0 (水平)m		-5292.0 (水平直交)m ← (N)

E120-F330 10.5 × 21 (cm), Cf = 1.0
 I0 = 8103.38 (cm⁴), Z0 = 771.75 (cm³), Ae0 = 220.50 (cm²)
 I = 8103.38 (cm⁴), Z = 771.75 (cm³), Ae = 220.50 (cm²)
 Fb = 33.00 (N/mm²), Fs = 3.60 (N/mm²), Eb = 12000 (N/mm²)

	Mmax (N·cm)	Md2	Md3	QL (N)	QR (N)	$\delta, \delta' \times 2.0$ (cm)
ω (鉛直)	322959	322959	322959	3549	3549	0.458 0.588
P2 (鉛直)	198198	198198	99099	1089	1089	0.225 0.450
P3 (鉛直)	111384	74256	111384	408	1224	0.118 0.236
P2 (直交w→)	144513	144513	72256	794	794	0.164
P3 (直交w→)	108384	72256	108384	397	1191	0.115
P2 (直交w←)	-144513	-144513	-72256	-794	-794	-0.164
P3 (直交w←)	-108384	-72256	-108384	-397	-1191	-0.115
P2 (直交e→)	131276	131276	65638	721	721	0.149
P3 (直交e→)	98457	65638	98457	361	1082	0.104
P2 (直交e←)	-131276	-131276	-65638	-721	-721	-0.149
P3 (直交e←)	-98457	-65638	-98457	-361	-1082	-0.104
P2 (直交m→)	481572	481572	240786	2646	2646	0.547
P3 (直交m→)	361179	240786	361179	1323	3969	0.382
P2 (直交m←)	-481572	-481572	-240786	-2646	-2646	-0.547
P3 (直交m←)	-361179	-240786	-361179	-1323	-3969	-0.382
(鉛直) 合計		595413	533442	5046	5862	0.801 1.273
(積雪) 合計		0	0	0	0	0.000 0.000
(水平w→) 合計		0	0	0	0	0.000
(直交w→) 合計		216769	180641	1191	1985	0.279
(水平w←) 合計		0	0	0	0	0.000
(直交w←) 合計		-216769	-180641	-1191	-1985	0.000
(水平e→) 合計		0	0	0	0	0.000
(直交e→) 合計		196914	164095	1082	1803	0.253
(水平e←) 合計		0	0	0	0	0.000
(直交e←) 合計		-196914	-164095	-1082	-1803	0.000
(水平m→) 合計		0	0			
(直交m→) 合計		722358	601965			
(水平m←) 合計		0	0			
(直交m←) 合計		-722358	-601965			
鉛直+0.00積雪		595413	533442	5046	5862	0.801 1.273
鉛直+1.00積雪		595413	533442	5046	5862	0.801
鉛直+0.00積雪+水平w→		595413	533442	5046	5862	0.801
鉛直+0.00積雪+水平w←		595413	533442	5046	5862	0.801
鉛直+0.00積雪+直交w→		812182	714083	6237	7847	1.080
鉛直+0.00積雪+直交w←		378644	352801	3855	3877	0.801
鉛直+0.00積雪+水平e→		595413	533442	5046	5862	0.801
鉛直+0.00積雪+水平e←		595413	533442	5046	5862	0.801
鉛直+0.00積雪+直交e→		792327	697537	6128	7665	1.054
鉛直+0.00積雪+直交e←		398499	369347	3964	4059	0.801
鉛直+0.00積雪+水平m→		595413	533442			
鉛直+0.00積雪+水平m←		595413	533442			
鉛直+0.00積雪+直交m→		1317771	1135407			
鉛直+0.00積雪+直交m←		-126945	-68523			

長期 fb = 1.1 × Fb / 3 = 12.100, fs = 1.1 × Fs / 3 = 1.320 (N/mm²)
 Mmax / (Z × fb × Cf) = 595413 / (771.8 × 12.100 × 1.0) = 0.64 ≤ 1.0 OK
 (α × Qmax) / (Ae × fs) = (1.5 × 5862) / (220.5 × 1.320) = 0.30 ≤ 1.0 OK
 δ = 0.801 (cm) ≤ 2.00 OK
 = 1/454 ≤ 1/300 OK
 $\delta' \times 2.0$ = 1.273 (cm) = 1/286 ≤ 1/250 OK

風圧時 fb = 2.0 × Fb / 3 = 22.000, fs = 2.0 × Fs / 3 = 2.400 (N/mm²)
 Mmax / (Z × fb × Cf) = 812182 / (771.8 × 22.000 × 1.0) = 0.48 ≤ 1.0 OK

$$\begin{aligned}
 (\alpha \times Q_{\max}) / (A_e \times f_s) &= (1.5 \times 7847) / (220.5 \times 2.400) = 0.22 \leq 1.0 \text{ OK} \\
 \delta &= 1.080 \text{ (cm)} \leq 4.00 \text{ OK} \\
 &= 1/337 \leq 1/150 \text{ OK}
 \end{aligned}$$

地震時 $f_b = 2.0 \times F_b / 3 = 22.000$, $f_s = 2.0 \times F_s / 3 = 2.400 \text{ (N/mm}^2\text{)}$

$$\begin{aligned}
 M_{\max} / (Z \times f_b \times C_f) &= 792327 / (771.8 \times 22.000 \times 1.0) = 0.47 \leq 1.0 \text{ OK} \\
 (\alpha \times Q_{\max}) / (A_e \times f_s) &= (1.5 \times 7665) / (220.5 \times 2.400) = 0.22 \leq 1.0 \text{ OK} \\
 \delta &= 1.054 \text{ (cm)} \leq 4.00 \text{ OK} \\
 &= 1/345 \leq 1/150 \text{ OK}
 \end{aligned}$$

積雪時 $f_b = 0.8 \times 2.0 \times F_b / 3 = 17.600$, $f_s = 0.8 \times 2.0 \times F_s / 3 = 1.920 \text{ (N/mm}^2\text{)}$

$$\begin{aligned}
 M_{\max} / (Z \times f_b \times C_f) &= 595413 / (771.8 \times 17.600 \times 1.0) = 0.44 \leq 1.0 \text{ OK} \\
 (\alpha \times Q_{\max}) / (A_e \times f_s) &= (1.5 \times 5862) / (220.5 \times 1.920) = 0.21 \leq 1.0 \text{ OK} \\
 \delta &= 0.801 \text{ (cm)} \leq 4.00 \text{ OK} \\
 &= 1/454 \leq 1/150 \text{ OK}
 \end{aligned}$$

梁上曲げ

$$M_{\max} / (Z \times f_b \times C_f) = 1317771 / (771.8 \times 22.000 \times 1.0) = 0.78 \leq 1.0 \text{ OK}$$