

DESIGN OF SECTION

2011

ROD	σ_{DE}	σ_C	σ_{FE}	σ
L	0.3	0.9	0.9	1.6
E	2.2	0.4	1.4	1.3
S	2.1		2.3	4.2
	1.9	1.7	0.5	

$b \times D = 28 \times 150 = 39.3$

$A_{DE} = 2.170 / 39.3 \times 3.0 = 2.12$ $\sigma = 0.13$

ROD	σ_{DE}	σ_C	σ_{FE}	σ
L	0.4	1.5	2.2	2.6
E	1.6	0.4	2.3	2.8
S	4.0	2.7	5.0	9.1
	1.2			

$b \times D = 28 \times 150$

$A_{DE} = 2.170 / 39.3 \times 3.0 = 4.17$

$A_{DE} = 4.0 / 39.3 = 2.0 = 2.4$ $\sigma = 0.19$

$A_{FE} = 1.2 / 39.3 = 4.2$ $\sigma = 0.19$

ROD	σ_{DE}	σ_C	σ_{FE}	σ
L	0.5	0.7	1.2	2.0
E	7.2	1.5	4.3	4.1
S	7.7	2.7	5.6	11.2
	6.7		3.1	

$b \times D = 28 \times 150$

$A_{DE} = 7.2 / 39.3 \times 3.0 = 6.5$

$A_{FE} = 6.7 / 39.3 = 4.7$

$\Delta \sigma = 11.2 - 9.9 = 1.3$

$\Delta \sigma / \sigma_{FE} = 1.13$

$P_{10} = 0.27$

$D_{10} = 1.43 / 28 \times 0.27 = 1.89 \rightarrow 15 \text{ (A)}$

$\sigma = 0.19$

$\sigma = 0.13$

$\sigma = 0.19$

STATE	π_{OE}	π_C	π_{IE}	Θ
L	0.5	0.5	0.5	1.2
E	2.6	0.3	0.3	1.0
D	2.1	0.8	2.9	3.2
	2.1		0.3	

$b \times D = 270 \times 50$

$Q_{OE} = 210 / 29.2 = 7.2 = 2.6$

4-D13 @ 2-D16

$Q_{IE} = 90 / \dots = 0.8$

2-D13

STATE	π_{OE}	π_C	π_{IE}	Θ
L	1.3	1.0	1.6	3.2
E	7.2	3.2	0.3	2.8
D	8.6	4.2	2.4	4.8
	6.9		0.8	

$b \times D = 270 \times 50$

$Q_{OE} = 210 / 29.2 = 7.2$

2-D19
2-D16

$Q_C = 420 / \dots = 3.2$

2-D19

$Q_{IE} = 90 / \dots = 2.0$

2-D19

STATE	π_{OE}	π_C	π_{IE}	Θ	π_{IE}	π_C	π_{OE}	Θ
L	9.2	8.4	4.0	2.4	5.6	1.6	0.2	1.4
E	4.1	1.5	1.1	0.6	1.1	0.3	0.6	0.6

$b \times D = 270 \times 175 \quad \rho = 0.12$

270×50

$Q = 7.5 \quad 7.2 \quad 6.6 \quad 6.9 \quad 2.0 \quad 0.3$

$Q_2 = 1740 / 81.2 \times 12 = 10.1$

n 2-D19
2-D16

2-D19
2-D16

2-D19
2-D13

2-D19
2-D13

2-D19

2-D19

SPAN	π_{EE}	π_{LC}	π_{EF}	α	π_{EE}	π_{LC}	π_{OF}	β
L	11.9	4.4	4.0	9.1	4.9	1.1	0.2	1.6
E	10.6	7.0	2.9	1.6	2.7	0.6	1.5	1.5
B	27.7				7.6	1.7	1.7	4.6
b/d		2.4 x 7.5					2.4 x 5.0	

$LQ_A = 2.4 \times 61.7 \times 6.0 = 10.3^T$

A	12.2	6.7	7.4		6.4	1.4	1.4	
n	2-D19 2-D17	2-D13 2-D19	2-D14 2-D16		2-D19 2-D17		2-D19	

SPAN	π_{OE}	π_{LC}	π_{EF}	α	π_{EE}	π_{LC}	π_{OF}	β
L	14.9	14.0	14.0	12.6	7.5	2.6	0.4	1.6
E	10.4	3.3	2.9	1.6	2.7	0.6	1.5	1.5
B	29.3				10.2	3.2	1.9	4.6
b/d		2.4 x 7.5					2.4 x 5.0	

A	15.9	11.4	11.4		4.3	2.7	1.6	
n	4-D22	2-D22 2-D16	2-D22 2-D16		2-D22 2-D16		2-D22	

$\Delta Q = 17.0 \dots = 3.3$

$\Delta Q / \beta = 1.93$

$PW = 0.39$

$\Delta Q / \beta = 1.93, 2.4 \times 0.39 = 1.31 \dots$

1000 AB	π_{OE}	π_L	π_{SE}	\odot
L	14.5	12.3	11.2	10.6
E	8.6	7.1	7.5	1.2
S	23.1			
$b \times D = 23 \times 17.5$				
a	12.6	10.0	9.2	
m	2-022 2-019	2-022 2-016	2-022 2-013	

$AB = 10.6 - 10.3 = 0.3$
 $\Delta D / 100 = 0.13$
 $F_{10} = 0.22$
 $D_{10} \times 14.3 / 23 \times 0.22$
 $= 23 \Rightarrow 15 \text{ (A)}$

1000 AD	π_{OE}	π_L	π_{SE}	\odot
L	6.1	4.9	3.6	3.4
E	6.2	7.5	1.2	0.9
S	12.3			
$b \times D = 23 \times 17.5$				
a	6.7	7.9	7.0	
m	2-019 2-013	2-019 2-016	2-019 2-013	

2000 BC	π_{OE}	π_L	π_{SE}	\odot
L	0	1.2	0.2	1.6
E	4.5	1.5	1.5	2.2
S	4.5	2.3	1.7	0.0
$b \times D = 23 \times 17.5$				
a	2.0	2.4	1.9	
m	2-016	2-016	2-016	

COLUMN

Case	P		H		Q	
	x	y	x	y	x	y
L	4.1		2.0	0.5	0.2	0.1
E	1.3	1.3	2.2	1.3	1.1	1.4
S	5.4	5.4	2.6	2.6	2.4	2.2

$b \times h = 2.6 \times 1.75$ $b/h = 2.6/1.75 = 1/12.4$ $\alpha = 1.00$
 $d_h = 0.8 \times 2.6 / 1.3 = 1.24$

Case	P/bh		H/bh^2		Q/h		A_t	
	x	y	x	y	x	y	x	y
L	2.0		0.6	0.6	-	-		
S	2.6	2.6	1.3	2.4	0.28	0.12	4.2	2.5

$0.7\% = 16.9$ $I_{11} = 6-11.9$ $2-11.9$ $2-11.9$
 $Q_{11x} = 1.75 \times 2.1 \times 6.0 = 11.0$
 $Q_{11y} = 2.6 \times 0.7 \times 6.0 = 10.7$

Case	P		H		Q	
	x	y	x	y	x	y
L	13.0		0.2	0.5	0.1	0.2
E	5.4	4.4	6.2	6.0	2.6	2.3
S	18.4	17.4	6.3	11.5	5.7	6.6

$b \times h = 2.6 \times 1.75$

Case	P/bh		H/bh^2		Q/h		A_t	
	x	y	x	y	x	y	x	y
L	6.2		0.6	0.3	-	-		
S	6.3	6.3	1.3	1.1	0.62	0.33	10.5	4.6

$b/h = 2.6/4.00 = 1/14.3$ $\alpha = 1.00$

HOOP DIA $\pi \times 1.43 / 1.75 \times 0.7 = 9.5$

$4-11.9$ $2-11.9$

Case	P		H		Q	
	X	Y	X	Y	X	Y
L	11.7		0	9.2	0	4.7
E	0.7	0.5	2.4	4.1	1.4	1.9
B	12.0	12.7	2.8	12.3	2.8	11.5
	11.4	11.2				

$b \times D = 2.8 \times 12.5$

Case	P/bD		P/bD'		P _A	Q ₁	Q ₂
	X	Y	X	Y			
L	5.6		0.2	4.9	- 0.26	5.3	2-019
B	5.7	5.4	6.0	8.8	- 1.5	0.25	3.7
	9.4	5.2					2-019

Case	P		H		Q	
	X	Y	X	Y	X	Y
L	27.9		0	4.1	0	1.5
E	1.4	1.9	6.2	7.7	3.1	4.6
B	29.3	29.8	6.2	13.0	6.2	10.7
	26.5	26.0				

$\Delta Q_y = 10.7 - 10.3 = 0.4$
 $\Delta Q_x = 0.23$
 $P_{10} = 0.22$
 $P_{10} = 1.43 / (6 \times 0.22) = 2.72$

Case	P/bD		P/bD'		P _A	Q ₁	Q ₂
	X	Y	X	Y			
L	13.3		0	7.6	-	-	
B	14.9	14.2	13.2	11.5	0.25	0.16	7.4
	12.6	12.2					3.019 2-019

Case	P		H		Q	
	X	Y	X	Y	X	Y
L	12.5		0	9.9	0	5.9
E	0	0.5	2.6	4.1	1.4	1.6
B	12.5	13.0	2.8	12.4	2.8	11.5
		12.0				

$b \times D = 2.8 \times 12.5$

Case	P/bD		P/bD'		P _A	Q ₁	Q ₂
	X	Y	X	Y			
L	6.0		0	7.1	- 0.26	5.3	2-019
B	6.0	6.2	6.0	8.9	0.15	0.20	3.2
		5.7					2-019

	x	P	y	x	P	y	x	P	y
L		24.1		0	0	77	2.4	0	2.9
B	0		1.9	6	0.2	11.8	2.1	3.6	
S	24.1	36.0	22.2	6		12.4	6.2	12.1	

$\Delta P = 12.1 - 10.3 - 1.3$
 $\Delta P_{\text{eff}} = 1.05$
 $P_{\text{eff}} = 0.27$
 $\Delta P_{\text{eff}} = \frac{1.49}{2.4 \times 0.27}$
 $= 12.4 \rightarrow 10.1$

$b \times D = 2.4 \times 75$

	x	P/bD	y	x	P/bD	y	x	P	y	u	y
L		16.2		0	0	2.4					
B	16.2	17.1	15.3	12.2	0.9	11.8	0.22	0.17	6.7	3.6	3-11.9

	x	P	y	x	P	y	x	P	y
L		9.7		0	0	6.2		0	1.2
B	0	0.4	0.6	1.0	0.7	6.4	0.6		1.4
S	9.7	10.6	8.9	1.0		12.0	1.0		4.4

$b \times D = 2.4 \times 9.7$

	x	P/bD	y	x	P/bD	y	x	P	y	u	y
L		4.6		0	0	2.4		0.12			
B	4.6	5.0	4.2	2.1	0.6	7.6	0.1	0.24	2.1	1.0	2-11.9

	x	P	y	x	P	y	x	P	y
L		2.5		0	0			0	
B			1.1	0.4	0.5			0.2	
S		4.1	2.4		0.6			0.6	

$b \times D = 2.3 \times 2.4$

	x	P/bD	y	x	P/bD	y	x	P	y	u	y
L		4.5		0							
B		5.9	2.1		2.4		0.1	0.4		2-11.9	

$1.0\% = 6.7$ $I_m = 10.1$

	P	π	σ	ρ		
L	12.0		0	0		
E	7.1		0.5	0.5		
S	15.0	2.2	1.0	1.0		
		$b \times D = 2.2 \times 12.0$			$\rho = 1.0$	
	P/bD	π/bD^2	P/π	ρ	ρ	ρ
L	16.0	-	-	-	-	-
S	20.1	10.6	5.6	20.0	0.3	2-D16

	P	π	σ	ρ	ρ	ρ
L	4.0	0.2	0.2	0.1	0.1	0
E	12	0.1	1.2	1.0	0.5	0.5
S	17.2	4.1	1.4	0.6	1.3	0.6
		$b \times D = 2.2 \times 12.0$				

	P/bD	π/bD^2	P/π	ρ	ρ	ρ
L	13.1	1.1	0.6	-	-	2-D16
S	6.7	0.2	0.2	0.5	0.6	2-D16
	2.6	5.0				

	P	π	σ	ρ	ρ	ρ
L	11.3	0.2	0.1	0.1	0.1	0
E	4.7	0.4	2.1	1.0	1.3	0.5
S	16.0	11.0	2.4	1.0	2.7	1.0
	6.6	10.9				

$b \times D = 2.2 \times 12.0$

	P/bD	π/bD^2	P/π	ρ	ρ	ρ
L	14.5	1.1	-	-	-	-
S	20.5	15.0	15.6	5.6	2.5	2-D19
	8.5	14.0				

Code	X	P ₁	Y	X	P ₂	Y	X	P ₃	Y
L		11.4		0	2.0	2.6	0	1.5	
E	0.6	0.1		1.8	1.5	2.2	1.8	0.9	1.1
S	12.0	11.5		1.2	4.9		1.8	3.0	
	10.0	11.2							

$b \times D = 2.8 \times 4.5$

Code	X	P/bD	Y	X	P/bD ²	Y	X	P ₁	Y	X	P ₂	Y	X	P ₃	Y
L		0.0		-	4.9		-	0.12							
S	0.5	0.1		0.2	0.3		0.12	0.22		1.5	2.4		2.0	1.6	
	0.5	0.9													

$DB\% = 10.1 \quad Z_{11} = 6 - 0.16$

$SQ_{AX} = 4.5 \times 2.0 \times 9 = 8.1$

$SQ_{AY} = 2.8 \times 3.6 \times 9 = 8.8$

Code	X	P	Y	X	P	Y	X	P	Y
L		29.2		0	15.0	0.6	0	0.6	
E	2.2	0.2		4.0	3.8	3.8	3.0	1.9	
S	21.4	29.6		4.0	5.2		4.0	4.5	
	17.0	29.0							

$b \times D = 2.8 \times 4.5$

Code	X	P/bD	Y	X	P/bD ²	Y	X	P ₁	Y	X	P ₂	Y	X	P ₃	Y
L		0.0		-	2.0		-	-							
S	2.2	0.2		1.4	0.6		0.27	0.25		4.0	0.6		3.0	1.6	
	2.2	2.8													

Code	X	P	Y	X	P	Y	X	P	Y
L		32.3		0	2.6	1.3	0	1.0	
E	0	0.2		4.0	3.8	3.8	2.0	1.9	
S	22.7	32.3		4.0	6.4		4.0	4.8	
		32.1							

$b \times D = 20 \times 4.5$

	$x \frac{F}{bD} y$	$x \frac{M}{bD^2} y$	$x P_A y$	$x A_A y$	$x n y$
L	25.6	-	4.5	-	-
B	25.6 25.5	14.1 11.6	0.35 0.21	1.1 2.6	3-D16 2-D16

	$x P y$	$x M y$	$x Q y$
L	2.6	0.1 0.1	0.1 0.1
B	0.6 0.3	1.2 1.0	0.6 0.5
B	2.9 2.7	1.7 0.7	1.3 0.7

$b \times D = 20 \times 2.8$

	$x \frac{F}{bD} y$	$x \frac{M}{bD^2} y$	$x P_A y$	$x A_A y$	$x n y$
L	2.7	0.6 0.6	-	-	-
B	4.1 2.5	2.3 4.0	0.26 0.12	2.0 0.9	2-D16 2-D16

	$x P y$	$x M y$	$x Q y$
L	6.5	0 0	0 0
B	2.4 1.1	2.4 2.4	1.0 1.0
B	2.4 2.4	2.4 1.0	2.4 1.0

$b \times D = 20 \times 2.3$

	$x \frac{F}{bD} y$	$x \frac{M}{bD^2} y$	$x P_A y$	$x A_A y$	$x n y$
L	4.7	-	-	-	-
B	11.2 11.2	9.7 6.9	1.36 0.46	5.6 0.12	3.7 0.9

	$x P y$	$x M y$	$x Q y$
L	4.0	0 0	0.2 0.2
B	0.6 0.6	1.2 1.0	0.6 0.5
B	4.6 2.4	1.2 0.9	1.2 0.7

$b \times b = 2.0 \times 2.3$

	$\frac{P}{bD} \times$	$\frac{P}{bD} \times$	$\frac{P}{bD} \times$	$\frac{P}{bD} \times$	$\frac{P}{bD} \times$	$\frac{P}{bD} \times$	$\frac{P}{bD} \times$	$\frac{P}{bD} \times$
L	5.1	0	1.1					
S	4.4 4.1	5.9 4.3	0.4 4.4	0.2 0.1	0.2 0.1	1.6	0.9	2.0 2.0

	$\frac{P}{bD} \times$	$\frac{P}{bD} \times$	$\frac{P}{bD} \times$	$\frac{P}{bD} \times$	$\frac{P}{bD} \times$	$\frac{P}{bD} \times$
L	9.1	0	0	0	0	0
D	2.1	2.6 2.6	1.0 1.0	1.3	0.5	
B	4.1	11.2 7.0	2.6	1.0	2.6	1.0

$b \times b = 2.0 \times 2.3$

	$\frac{P}{bD} \times$	$\frac{P}{bD} \times$	$\frac{P}{bD} \times$	$\frac{P}{bD} \times$	$\frac{P}{bD} \times$	$\frac{P}{bD} \times$
L	11.7	-	-	-	-	-
S	11.7 14.4 A.0	14.7	13.6	0.44	0.08	3.4 0.6

SLAB

$l_x = 2.97$ $l_y = 2.97$ $\gamma = 2.97$
 $M_{x1} = 0.04 \times W \times 2.97^2 = 0.651W$
 $M_{x2} = 0.055 \times \dots = 0.490W$
 $M_{y1} = 0.14 \times \dots = 0.326W$
 $M_{y2} = 0.020 \times \dots = 0.224W$

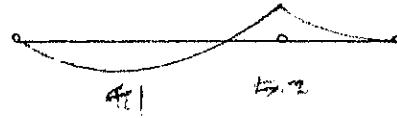
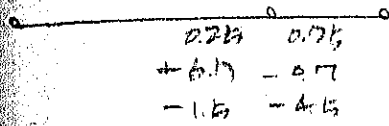
$W_R = 0.66$	$W_L = 0.66$	$W_C = 0.66$
0.37	0.43	0.57
0.25	0.29	0.38
0.19	0.22	0.29
0.13	0.15	0.19

	$D = 10$	$\bar{D} = 6.1$	$\bar{D} = 5.2$			
$A_{R1} = 3.0$	$\begin{matrix} R \\ \square 10 \end{matrix} 20 \text{ (A)}$	3.5	$\begin{matrix} Z \\ \square 10 \end{matrix} 20 \text{ (A)}$	4.6	$\begin{matrix} L \\ \square 10 \end{matrix}$	15 (A)
$A_{R2} = 2.0$	"	2.4	"	3.1	"	"
$A_{L1} = 1.8$	$\square 10$	2.1	$\square 10$	2.8	$\square 10$	25 (A)
$A_{L2} = 1.2$	"	1.4	"	1.8	"	"

NON WALL W = 0.52

$$C = 2176 \times 0.52^2 / 100 = 45$$

$$TLO = \quad \quad \quad / 8 = 6.1$$



$$Z_{TLE} = \quad \quad \quad 0.6 - 5.2 = 4.6$$

$$Q_C = 41 / 0.726 \times 2.0 = 28 \quad \quad \quad 2 \rightarrow 19$$

$$Q_{SE} = 50 / \quad \quad \quad = 40 \quad \quad \quad 2 \rightarrow 19$$

FOOTING

$f_p \ 35\phi = 30^T$

$f_p = 30 - 2.0 = 28.0$

$W = 1.05^2 \times 2.5 \times 2.5 = 2.0$

P	WALL	THE WEIGHT	ΣP	φ × n	l × l"
130	0.54 × 1.17 2.69 1.10 × 1.17 1.45	2.15	17.8	35φ × 1	105 × 105
278	0.54 × 2.55 1.38 0.54 × 2.55 1.38	5.35	34.6	35φ × 2	105 × 210
361	1.31 × 4.07 5.33 0.54 × 1.17 0.69	5.35	46.2	35φ × 3	105 × 315
290	1.31 × 4.07 5.33	5.35	41.1	"	"
163		5.35	21.7	35φ × 2	105 × 210
306	0.54 × 2.55 1.38	5.35	34.7	"	"
120	1.10 × 2.55 4.25	2.15	18.4	35φ × 1	105 × 105
113	1.10 × 1.17 2.17	2.15	16.6	"	"
292	1.10 × 2.55 4.25 1.10 × 1.10 1.23	4.25	39.9	35φ × 2	105 × 210
323	1.31 × 4.07 5.33 1.10 × 1.10 1.23	6.50	47.1	35φ × 3	105 × 315
292	1.31 × 4.07 5.33	6.50	42.3	"	"
168		6.50	23.2	35φ × 2	105 × 210
45	0.17 × 1.17 0.22 0.47 × 1.17 0.56	2.15	9.4	35φ × 1	105 × 105
91	0.17 × 2.55 0.43	2.15	12.7	"	"
103	0.17 × 2.55 0.43 0.47 × 2.55 1.20	2.15	15.1	"	"

F1 750 x 1 105 x 105 D = 75 $\lambda = 59.5$
 $n = 5-D16$

F2 750 x 2 105 x 210
 $\sigma_p = 300.0 / 2 = 150 = 15$
 $\tau_s = 20.0 \times 10^3 / 105 \times 59.5 = 3.2 < 5$
 $\mu = 20.0 \times 10^3 / 59.5 \times 15 = 22.4$
 $\alpha = 20.0 \times 52.5 / 59.5 \times 2.0 = 8.6$ } 5-D16

F3 750 x 3 105 x 315
 $\sigma_p = 400.0 / 3 = 133.3$
 $\mu = 15.0 \times 10^3 / 59.5 \times 15 = 17.6$
 $\alpha = 15.0 \times 105 / 59.5 \times 2.0 = 12.9$ } 5-D19