

24SF & 6SF units only

<i>Soil Type</i>	Backfill Slope
	Surcharge
	Seismic PGA
	Clay, $\phi = 26^\circ$
	Sand, $\phi = 30^\circ$
Sand/Gravel, $\phi = 34^\circ$	
Crushed Stone, $\phi = 38^\circ$	

Level	Level	Level	3H:1V
0 psf	150 psf	0 psf	0 psf
0g	0g	0.20g	0g
9.0 ft.	7.5 ft.	9.0 ft.	7.5 ft.
10.5 ft.	7.5 ft.	9.0 ft.	7.5 ft.
12.0 ft.	10.5 ft.	10.5 ft.	10.5 ft.
13.5 ft.	10.5 ft.	12.0 ft.	12.0 ft.

Table based on minimum recommended safety factors:
 Overturning FS=1.5 Sliding FS=1.5 Bearing FS=2.0
 Seismic safety factors reduced by 25%
 clay soil includes 150 psf cohesion in foundation soil
 unit weight 120 pcf for clay, 125 pcf for all other soils
 foundation soil limited to $\phi = 30^\circ$

24-62 base unit

<i>Soil Type</i>	Backfill Slope
	Surcharge
	Seismic PGA
	Clay, $\phi = 26^\circ$
	Sand, $\phi = 30^\circ$
Sand/Gravel, $\phi = 34^\circ$	
Crushed Stone, $\phi = 38^\circ$	

Level	Level	Level	3H:1V
0 psf	150 psf	0 psf	0 psf
0g	0g	0.20g	0g
12.0 ft.	10.5 ft.	12.0 ft.	9.0 ft.
13.5 ft.	10.5 ft.	13.5 ft.	10.5 ft.
15.0 ft.	13.5 ft.	13.5 ft.	13.5 ft.
18.0 ft.	16.5 ft.	15.0 ft.	16.5 ft.

24-ME (12" extension) base unit

Level	Level	Level	3H:1V
0 psf	150 psf	0 psf	0 psf
0g	0g	0.20g	0g
12.0 ft.	9.0 ft.	12.0 ft.	9.0 ft.
13.5 ft.	10.5 ft.	12.0 ft.	10.5 ft.
15.0 ft.	13.5 ft.	13.5 ft.	13.5 ft.
16.5 ft.	15.0 ft.	15.0 ft.	15.0 ft.

24-86 & 24-62 base units

<i>Soil Type</i>	Backfill Slope
	Surcharge
	Seismic PGA
	Clay, $\phi = 26^\circ$
	Sand, $\phi = 30^\circ$
Sand/Gravel, $\phi = 34^\circ$	
Crushed Stone, $\phi = 38^\circ$	

Level	Level	Level	3H:1V
0 psf	150 psf	0 psf	0 psf
0g	0g	0.20g	0g
15.0 ft.	12.0 ft.	15.0 ft.	10.5 ft.
16.5 ft.	13.5 ft.	16.5 ft.	12.0 ft.
19.5 ft.	16.5 ft.	18.0 ft.	15.0 ft.
22.5 ft.	19.5 ft.	19.5 ft.	19.5 ft.

24" CIP tail extension

Level	Level	Level	3H:1V
0 psf	150 psf	0 psf	0 psf
0g	0g	0.20g	0g
13.5 ft.	10.5 ft.	13.5 ft.	10.5 ft.
15.0 ft.	13.5 ft.	15.0 ft.	12.0 ft.
18.0 ft.	16.5 ft.	15.0 ft.	15.0 ft.
19.5 ft.	18.0 ft.	16.5 ft.	18.0 ft.

24SF & 6SF units only

<i>Soil Type</i>	Backfill Slope
	Surcharge
	Seismic PGA
	Clay, $\phi = 26^\circ$
	Sand, $\phi = 30^\circ$
Sand/Gravel, $\phi = 34^\circ$	
Crushed Stone, $\phi = 38^\circ$	

Level	Level	Level	3H:1V
0 psf	250 psf	0 psf	0 psf
0g	0g	0.20g	0g
7.5 ft.	4.5 ft.	7.5 ft.	6.0 ft.
9.0 ft.	4.5 ft.	7.5 ft.	7.5 ft.
10.5 ft.	7.5 ft.	10.5 ft.	9.0 ft.
12.0 ft.	9.0 ft.	12.0 ft.	10.5 ft.

Table based on AASHTO load and resistance factors
clay soil includes 150 psf cohesion in foundation soil
unit weight 120 pcf for clay, 125 pcf for all other soils

24-62 base unit

<i>Soil Type</i>	Backfill Slope
	Surcharge
	Seismic PGA
	Clay, $\phi = 26^\circ$
	Sand, $\phi = 30^\circ$
Sand/Gravel, $\phi = 34^\circ$	
Crushed Stone, $\phi = 38^\circ$	

Level	Level	Level	3H:1V
0 psf	250 psf	0 psf	0 psf
0g	0g	0.20g	0g
10.5 ft.	7.5 ft.	10.5 ft.	7.5 ft.
12.0 ft.	7.5 ft.	12.0 ft.	9.0 ft.
13.5 ft.	10.5 ft.	13.5 ft.	12.0 ft.
15.0 ft.	13.5 ft.	15.0 ft.	13.5 ft.

24-ME (12" extension) base unit

Level	Level	Level	3H:1V
0 psf	250 psf	0 psf	0 psf
0g	0g	0.20g	0g
10.5 ft.	7.5 ft.	10.5 ft.	7.5 ft.
12.0 ft.	7.5 ft.	12.0 ft.	9.0 ft.
13.5 ft.	10.5 ft.	13.5 ft.	12.0 ft.
15.0 ft.	12.0 ft.	15.0 ft.	13.5 ft.

24-86 & 24-62 base units

<i>Soil Type</i>	Backfill Slope
	Surcharge
	Seismic PGA
	Clay, $\phi = 26^\circ$
	Sand, $\phi = 30^\circ$
Sand/Gravel, $\phi = 34^\circ$	
Crushed Stone, $\phi = 38^\circ$	

Level	Level	Level	3H:1V
0 psf	250 psf	0 psf	0 psf
0g	0g	0.20g	0g
13.5 ft.	10.5 ft.	13.5 ft.	10.5 ft.
16.5 ft.	12.0 ft.	16.5 ft.	12.0 ft.
18.0 ft.	15.0 ft.	18.0 ft.	15.0 ft.
19.5 ft.	16.5 ft.	19.5 ft.	18.0 ft.

24" CIP tail extension

Level	Level	Level	3H:1V
0 psf	250 psf	0 psf	0 psf
0g	0g	0.20g	0g
10.5 ft.	7.5 ft.	10.5 ft.	7.5 ft.
13.5 ft.	10.5 ft.	13.5 ft.	10.5 ft.
15.0 ft.	13.5 ft.	15.0 ft.	13.5 ft.
16.5 ft.	13.5 ft.	16.5 ft.	15.0 ft.

24SF & 6SF units only

<i>Soil Type</i>	Backfill Slope
	Surcharge
	Seismic PGA
	Clay, $\phi = 26^\circ$
	Sand, $\phi = 30^\circ$
Sand/Gravel, $\phi = 34^\circ$	
Crushed Stone, $\phi = 38^\circ$	

Level	Level	Level	3H:1V
0 psf	250 psf	0 psf	0 psf
0g	0g	0.20g	0g
7.5 ft.	4.5 ft.	7.5 ft.	7.5 ft.
7.5 ft.	4.5 ft.	7.5 ft.	7.5 ft.
9.0 ft.	7.5 ft.	9.0 ft.	9.0 ft.
10.5 ft.	7.5 ft.	10.5 ft.	10.5 ft.

Table based on AASHTO load and resistance factors
clay soil includes 150 psf cohesion in foundation soil
unit weight 120 pcf for clay, 125 pcf for all other soils
recess and face adjusted for zero setback

24-62 base unit

<i>Soil Type</i>	Backfill Slope
	Surcharge
	Seismic PGA
	Clay, $\phi = 26^\circ$
	Sand, $\phi = 30^\circ$
Sand/Gravel, $\phi = 34^\circ$	
Crushed Stone, $\phi = 38^\circ$	

Level	Level	Level	3H:1V
0 psf	250 psf	0 psf	0 psf
0g	0g	0.20g	0g
10.5 ft.	7.5 ft.	10.5 ft.	7.5 ft.
12.0 ft.	9.0 ft.	12.0 ft.	9.0 ft.
12.0 ft.	10.5 ft.	12.0 ft.	12.0 ft.
13.5 ft.	10.5 ft.	13.5 ft.	12.0 ft.

24-ME (12" extension) base unit

Level	Level	Level	3H:1V
0 psf	250 psf	0 psf	0 psf
0g	0g	0.20g	0g
10.5 ft.	7.5 ft.	10.5 ft.	7.5 ft.
10.5 ft.	7.5 ft.	10.5 ft.	9.0 ft.
12.0 ft.	9.0 ft.	12.0 ft.	10.5 ft.
12.0 ft.	10.5 ft.	12.0 ft.	12.0 ft.

24-86 & 24-62 base units

<i>Soil Type</i>	Backfill Slope
	Surcharge
	Seismic PGA
	Clay, $\phi = 26^\circ$
	Sand, $\phi = 30^\circ$
Sand/Gravel, $\phi = 34^\circ$	
Crushed Stone, $\phi = 38^\circ$	

Level	Level	Level	3H:1V
0 psf	250 psf	0 psf	0 psf
0g	0g	0.20g	0g
13.5 ft.	10.5 ft.	13.5 ft.	10.5 ft.
15.0 ft.	12.0 ft.	15.0 ft.	12.0 ft.
15.0 ft.	13.5 ft.	15.0 ft.	13.5 ft.
16.5 ft.	13.5 ft.	16.5 ft.	15.0 ft.

24" CIP tail extension

Level	Level	Level	3H:1V
0 psf	250 psf	0 psf	0 psf
0g	0g	0.20g	0g
12.0 ft.	9.0 ft.	12.0 ft.	9.0 ft.
13.5 ft.	10.5 ft.	13.5 ft.	12.0 ft.
13.5 ft.	12.0 ft.	13.5 ft.	13.5 ft.
15.0 ft.	13.5 ft.	15.0 ft.	13.5 ft.

24SF & 6SF units only

Soil Type	Backfill Slope	Level	Level	Level	3H:1V
	Surcharge	0 kPa	7.5 kPa	0 kPa	0 kPa
	Seismic PGA	0g	0g	0.20g	0g
	Clay, $\phi = 26^\circ$	2.7 m	2.3 m	2.7 m	2.3 m
Sand, $\phi = 30^\circ$	3.2 m	2.3 m	3.2 m	2.3 m	
Sand/Gravel, $\phi = 34^\circ$	3.7 m	3.2 m	3.7 m	3.2 m	
Crushed Stone, $\phi = 38^\circ$	4.1 m	3.7 m	4.1 m	3.7 m	

Table based on minimum recommended safety factors:
 Overturning FS=1.5 Sliding FS=1.5 Bearing FS=2.0
 Seismic safety factors reduced by 25%
 clay soil includes 7.5 kPa cohesion in foundation soil
 unit weight 19 kN/m³ for clay, 20 kN/m³ for all other soils

24-62 base unit

Soil Type	Backfill Slope	Level	Level	Level	3H:1V
	Surcharge	0 kPa	7.5 kPa	0 kPa	0 kPa
	Seismic PGA	0g	0g	0.20g	0g
	Clay, $\phi = 26^\circ$	3.7 m	2.7 m	3.7 m	2.7 m
Sand, $\phi = 30^\circ$	4.1 m	3.2 m	4.1 m	3.2 m	
Sand/Gravel, $\phi = 34^\circ$	4.6 m	4.1 m	4.6 m	4.1 m	
Crushed Stone, $\phi = 38^\circ$	5.0 m	4.6 m	5.0 m	4.6 m	

24-ME (300 mm extension) base unit

Soil Type	Backfill Slope	Level	Level	Level	3H:1V
	Surcharge	0 kPa	7.5 kPa	0 kPa	0 kPa
	Seismic PGA	0g	0g	0.20g	0g
	Clay, $\phi = 26^\circ$	3.7 m	2.7 m	3.7 m	2.7 m
Sand, $\phi = 30^\circ$	4.1 m	3.2 m	4.1 m	2.7 m	
Sand/Gravel, $\phi = 34^\circ$	4.6 m	4.1 m	4.6 m	3.7 m	
Crushed Stone, $\phi = 38^\circ$	5.0 m	4.6 m	5.0 m	4.6 m	

24-86 & 24-62 base units

Soil Type	Backfill Slope	Level	Level	Level	3H:1V
	Surcharge	0 kPa	7.5 kPa	0 kPa	0 kPa
	Seismic PGA	0g	0g	0.20g	0g
	Clay, $\phi = 26^\circ$	4.6 m	3.7 m	4.6 m	3.2 m
Sand, $\phi = 30^\circ$	5.0 m	4.1 m	5.0 m	3.7 m	
Sand/Gravel, $\phi = 34^\circ$	5.9 m	5.0 m	5.9 m	4.6 m	
Crushed Stone, $\phi = 38^\circ$	6.4 m	5.9 m	6.4 m	5.9 m	

600 mm CIP tail extension

Soil Type	Backfill Slope	Level	Level	Level	3H:1V
	Surcharge	0 kPa	7.5 kPa	0 kPa	0 kPa
	Seismic PGA	0g	0g	0.20g	0g
	Clay, $\phi = 26^\circ$	4.1 m	3.2 m	4.1 m	3.2 m
Sand, $\phi = 30^\circ$	4.6 m	3.7 m	4.6 m	3.2 m	
Sand/Gravel, $\phi = 34^\circ$	5.5 m	5.0 m	5.5 m	4.1 m	
Crushed Stone, $\phi = 38^\circ$	5.9 m	5.5 m	5.9 m	5.5 m	

Gravity Height Calculations

CAN/CSA-S6-06, Canadian Highway Bridge Design Code (metric)

24SF & 6SF units only

Soil Type	Backfill Slope
	Surcharge
	Seismic PGA
	Clay, $\phi = 26^\circ$
	Sand, $\phi = 30^\circ$
Sand/Gravel, $\phi = 34^\circ$	
Crushed Stone, $\phi = 38^\circ$	

Level	Level	Level	3H:1V
0 kPa	12 kPa	0 kPa	0 kPa
0g	0g	0.20g	0g
2.3 m	1.4 m	2.3 m	1.8 m
2.7 m	1.4 m	2.3 m	1.8 m
3.2 m	1.8 m	2.7 m	2.7 m
3.7 m	2.3 m	2.7 m	3.2 m

Table based on CAN/CSA-S6-06 load and resistance factors
clay soil includes 7.5 kPa cohesion in foundation soil
unit weight 19 kN/m³ for clay, 20 kN/m³ for all other soils

Soil Type	Backfill Slope
	Surcharge
	Seismic PGA
	Clay, $\phi = 26^\circ$
	Sand, $\phi = 30^\circ$
Sand/Gravel, $\phi = 34^\circ$	
Crushed Stone, $\phi = 38^\circ$	

24-62 base unit

Level	Level	Level	3H:1V
0 kPa	12 kPa	0 kPa	0 kPa
0g	0g	0.20g	0g
3.2 m	2.3 m	3.2 m	2.3 m
3.7 m	2.3 m	3.2 m	2.7 m
4.1 m	2.7 m	3.7 m	3.2 m
4.6 m	3.7 m	4.1 m	4.1 m

24-ME (300 mm extension) base unit

Level	Level	Level	3H:1V
0 kPa	12 kPa	0 kPa	0 kPa
0g	0g	0.20g	0g
3.2 m	1.8 m	3.2 m	2.3 m
3.7 m	1.8 m	3.2 m	2.7 m
4.1 m	2.3 m	3.7 m	3.2 m
4.6 m	3.7 m	3.7 m	4.1 m

Soil Type	Backfill Slope
	Surcharge
	Seismic PGA
	Clay, $\phi = 26^\circ$
	Sand, $\phi = 30^\circ$
Sand/Gravel, $\phi = 34^\circ$	
Crushed Stone, $\phi = 38^\circ$	

24-86 & 24-62 base units

Level	Level	Level	3H:1V
0 kPa	12 kPa	0 kPa	0 kPa
0g	0g	0.20g	0g
4.1 m	2.7 m	4.1 m	2.7 m
4.1 m	3.2 m	4.1 m	3.2 m
5.0 m	3.7 m	4.6 m	4.1 m
5.9 m	5.0 m	5.0 m	5.0 m

600 mm CIP tail extension

Level	Level	Level	3H:1V
0 kPa	12 kPa	0 kPa	0 kPa
0g	0g	0.20g	0g
3.7 m	2.7 m	3.7 m	2.7 m
4.1 m	2.7 m	4.1 m	3.2 m
5.0 m	3.7 m	4.1 m	4.1 m
5.5 m	4.6 m	4.6 m	5.0 m

CAN/CSA-S6-06, Canadian Highway Bridge Design Code - Vertical Face (metric)
24SF & 6SF units only

Soil Type	Backfill Slope	Level	Level	Level	3H:1V
	Surcharge	0 kPa	12 kPa	0 kPa	0 kPa
	Seismic PGA	0g	0g	0.20g	0g
	Clay, $\phi = 26^\circ$	2.3 m	0.9 m	1.8 m	1.8 m
Sand, $\phi = 30^\circ$	2.3 m	0.9 m	2.3 m	1.8 m	
Sand/Gravel, $\phi = 34^\circ$	2.7 m	1.4 m	2.3 m	2.3 m	
Crushed Stone, $\phi = 38^\circ$	2.7 m	1.8 m	2.3 m	2.7 m	

Table based on CAN/CSA-S6-06 load and resistance factors
 clay soil includes 7.5 kPa cohesion in foundation soil
 unit weight 19 kN/m³ for clay, 20 kN/m³ for all other soils

24-62 base unit

Soil Type	Backfill Slope	Level	Level	Level	3H:1V
	Surcharge	0 kPa	12 kPa	0 kPa	0 kPa
	Seismic PGA	0g	0g	0.20g	0g
	Clay, $\phi = 26^\circ$	3.2 m	2.3 m	2.7 m	2.3 m
Sand, $\phi = 30^\circ$	3.2 m	2.3 m	3.2 m	2.7 m	
Sand/Gravel, $\phi = 34^\circ$	3.7 m	2.7 m	3.2 m	3.2 m	
Crushed Stone, $\phi = 38^\circ$	4.1 m	3.2 m	3.7 m	3.7 m	

24-ME (300 mm extension) base unit

Soil Type	Backfill Slope	Level	Level	Level	3H:1V
	Surcharge	0 kPa	12 kPa	0 kPa	0 kPa
	Seismic PGA	0g	0g	0.20g	0g
	Clay, $\phi = 26^\circ$	3.2 m	1.8 m	2.7 m	2.3 m
Sand, $\phi = 30^\circ$	3.2 m	1.8 m	2.7 m	2.7 m	
Sand/Gravel, $\phi = 34^\circ$	3.7 m	2.7 m	3.2 m	3.2 m	
Crushed Stone, $\phi = 38^\circ$	3.7 m	3.2 m	3.2 m	3.7 m	

24-86 & 24-62 base units

Soil Type	Backfill Slope	Level	Level	Level	3H:1V
	Surcharge	0 kPa	12 kPa	0 kPa	0 kPa
	Seismic PGA	0g	0g	0.20g	0g
	Clay, $\phi = 26^\circ$	4.1 m	2.7 m	4.1 m	2.7 m
Sand, $\phi = 30^\circ$	4.6 m	3.2 m	4.1 m	3.2 m	
Sand/Gravel, $\phi = 34^\circ$	4.6 m	4.1 m	4.1 m	4.1 m	
Crushed Stone, $\phi = 38^\circ$	5.0 m	4.6 m	4.6 m	5.0 m	

600 mm CIP tail extension

Soil Type	Backfill Slope	Level	Level	Level	3H:1V
	Surcharge	0 kPa	12 kPa	0 kPa	0 kPa
	Seismic PGA	0g	0g	0.20g	0g
	Clay, $\phi = 26^\circ$	3.7 m	2.7 m	3.7 m	2.7 m
Sand, $\phi = 30^\circ$	4.1 m	2.7 m	3.7 m	3.2 m	
Sand/Gravel, $\phi = 34^\circ$	4.1 m	3.7 m	3.7 m	3.7 m	
Crushed Stone, $\phi = 38^\circ$	4.6 m	3.7 m	4.1 m	4.1 m	