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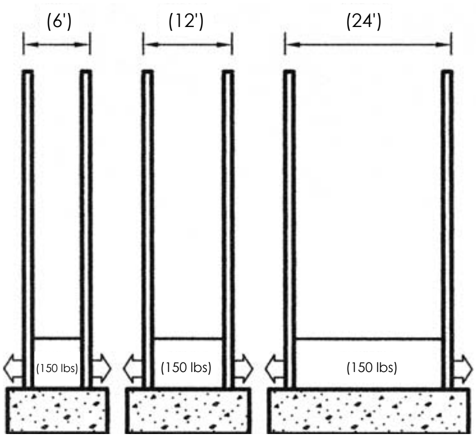
GENERAL & TECH INFORMATION

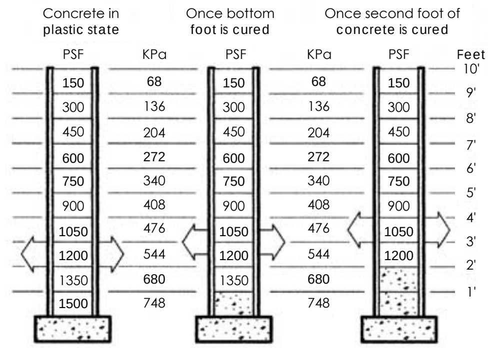
GENERAL & TECH INFO

Points To Remember

Fluid or plastic concrete exerts the same side pressure on forms regardless of their width.



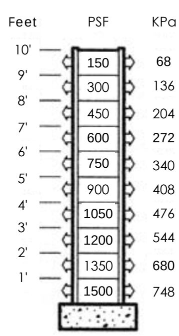
Plastic concrete exerts the same pressure on forms regardless of their width.

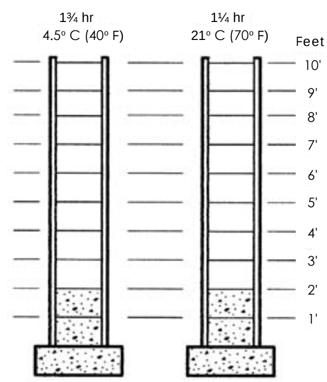


As concrete hardens, lateral pressure on forms decreases.

As you add more fluid or plastic concrete to forms, the pressure will build up toward the bottom at about the rate of 150 pounds per foot of depth. This will be true as long as all concrete remains in a plastic state.

Example: Eight feet of fluid or plastic concrete bears on the bottom foot of forms with a pressure of 8x150 pounds or 1200 pounds per square foot.





Concrete cures and gains strength faster with an increase in temperature.

Example: At 21° C (70° F), concrete sets in approximately 1¼ hour. At 4.5° C (40° F) concrete will set up in about 1¾ hour.

Slab Formwork Design Loads

The loadings used in the designs of slab formwork consists of a dead load and a live load. The weight of the formwork plus the concrete is considered dead load while the live load is made up of the with of workers, equipment, material storage and other like items which is supported by the formwork. The tables below tabulate design loads based on the concrete weight for the thickness indicated, and includes 10 pounds per square foot for the weight of forms and a live load of 50 to 75 pounds per square foot as indicated. A live of load of 75 pound per square foot is generally used when motorized carts are used to transport concrete during the placing operation.

Slab Formwork Design Load for Uniform Slab Thickness
(Includes 50 psf Live Load)
Pounds per Square Foot for Indicated Thickness

2"	4"	6"	8"	10"	12"	14	16"	18"	20"
100	110	135	160	185	210	235	260	285	310

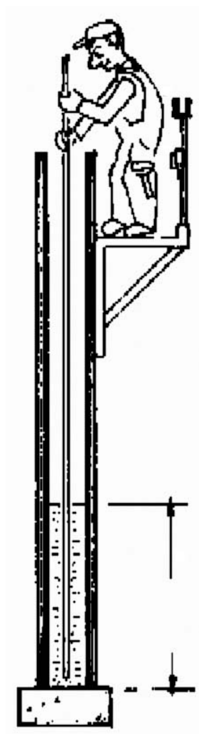
(Includes 75 psf Live Load)
Pounds per Square Foot for Indicated Thickness

2"	4"	6"	8"	10"	12"	14	16"	18"	20"
125*	135	160	185	210	235	260	285	310	335

Note: Chart is based on a concrete weight of 150 pounds per cubic foot.
*** ACI 347 recommends a minimum 100 psf for form design or 125 psf if motorized carts are used.**

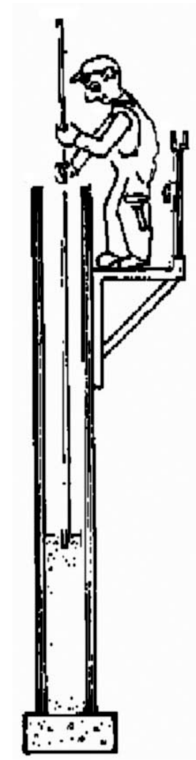
For a complete explanation of general objectives in formwork design, planning, materials and accessories, loads and pressures, design tables and much more, it is recommended that a copy of ACI publication SP-4 "Formwork for Concrete" be obtained. The current edition is available from American Concrete Institute. PO Box 9094, Farmington Hills, MI 48333.

GENERAL & TECH INFORMATION



1

5/8" rebar goes to the footing - consider concrete is still in fluid state.

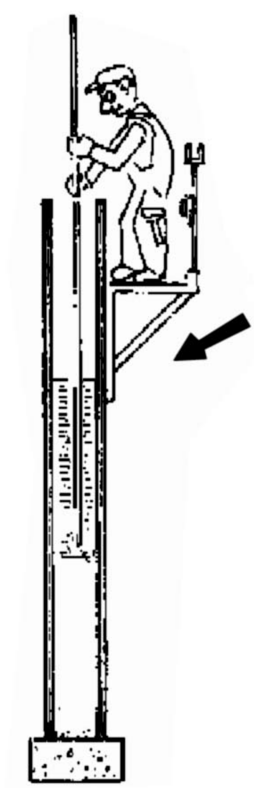


2

Later - Now 5/8" rebar only penetrates concrete a few inches - it is now ready to make your next placement of concrete.

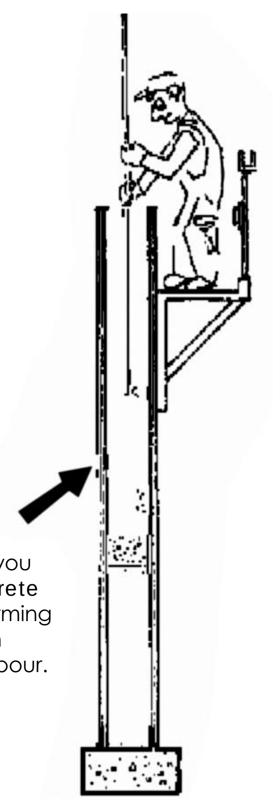
Sound Your Concrete

In order to know the firmness of your concrete as you make each lift (summer or winter), use a 5/8" piece of rebar and SOUND YOUR CONCRETE! As you push the rebar down through your concrete, you will be able to feel if your previously placed concrete has taken its initial set. This test will help you to determine if the concrete in your form is firm enough and ready to support an additional lift of concrete, without excessive pressure on your form and form ties.



3

Still later - 5/8" rebar penetrates second lift almost all the way into second pour - better give it a little more time to set up.



4

Still later - Again you sound your concrete and now find it firming up. Now you can safely finish your pour.

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ACI 347-04

Unit weight coefficient: C_w

Less than 140 pcf:
C_w=0.5[1+(w/145 pcf)]
(but not less than 0.80)

140 to 150 pcf:
C_w=1.0

More than 150 pcf:
C_w=w/145 pcf

Chemistry coefficient C_c

Type I, II and III, w/o retarders: C_c=1.0

Type I, II and III w/ retarders: C_c=1.2

Other types containing less than 70% slag or 40% fly ash, w/o retarders: C_c=1.2

Other types containing less than 70% slag or 40% fly ash w/ retarders: C_c=1.4

Blends containing more than 70% slag or 40% fly ash: C_c=1.4

ACI 347-04 (Walls)

BASE VALUES OF LATERAL PRESSURE ON WALL FORMS
Multiply value by unit weight & chemistry coefficients to obtain pressure on wall form

Table based on: Cc= 1.0 Cw= 1.0

RATE OF PLACEMENT	p, maximum lateral pressure, psf, for temperature indicated											
	90 F		80 F		70 F		60 F		50 F		40 F	
1	663	250	728	263	810	279	920	300	1074	330	1305	375
2	694	350	763	375	850	407	967	450	1130	510	1375	600
3	726	450	798	488	890	536	1013	600	1186	690	1445	825
4	757	550	833	600	930	664	1060	750	1242	870	1515	1050
5	788	650	868	713	970	793	1107	900	1298	1050	1585	1275
6	819	750	903	825	1010	921	1153	1050	1354	1230	1655	1500
7	850		938		1050		1200		1410		1725	
8	881		973		1090		1247		1466		1795	
9	912		1008		1130		1293		1522		1865	
10	943		1043		1170		1340		1578		1935	
11	974		1078		1210		1387		1634		2005	
12	1006		1113		1250		1433		1690		2075	
13	1037		1148		1290		1480		1746		2145	
14	1068		1183		1330		1527		1802		2215	
15	1099		1218		1370		1573		1858		2285	
16	1130		1253		1410		1620		1914		2355	
17	1161		1288		1450		1667		1970		2425	

P=CwCc[150+43, 400/T+2800 R/T] applies where placement height is greater than 14'.
P=CwCc [150+9000R/T] (shaded) applies for R less than 7 FT/HR.

ACI 347-04 (Columns)

Base values of lateral pressure on column forms, * psf, for various pour rates and concrete temperatures.
Multiply value from this table by unit weight and chemistry coefficients to obtain pressure for design of column forms.

Rate of placement R, ft per hr	Concrete temperature during placement, degrees F					
	90° F	80° F	70° F	60° F	50° F	40° F
1	250	263	279	300	330	375
2	350	375	407	450	510	600
3	450	488	536	600	690	825
4	550	600	664	750	870	1050
5	650	713	793	900	1050	1275
6	750	825	921	1050	1230	1500
7	850	938	1050	1200	1410	1725
8	950	1050	1179	1350	1590	1950
9	1050	1163	1307	1500	1770	2175
10	1150	1275	1436	1650	1950	2400
11	1250	1388	1564	1800	2130	2625
12	1350	1500	1693	1950	2310	2850
13	1450	1613	1821	2100	2490	
14	1550	1725	1950	2250	2670	
16	1750	1950	2207	2550		
18	1950	2175	2464	2850		
20	2150	2400	2721			
22	2350	2625	2979			
24	2550	2850				
26	2750					
28	2950					

*** Base value of lateral pressure equals 150 + 9000 R/T**
NOTE: Depending on coefficient values, the minimum pressure of 600 C_w may govern. Do not use pressures in excess of *wh*.

GENERAL & TECH INFORMATION

Typical Form Tie Spacing For Wall Forms

LATERAL PRESSURE (LBS) IN PSF	LOADS ON FORM TIES (IN KIPS)															
3,000	3.0	5.3	6.0	12.0	18.0	27.0	36.0	48.0	60.0	75.0	90.0	108.0	126.0	147.0	168.0	192.0
2,900	2.9	5.2	5.8	11.6	17.4	26.1	34.8	46.4	58.0	72.5	87.0	104.4	121.8	142.1	162.4	185.6
2,800	2.8	5.0	5.6	11.2	16.8	25.2	33.6	44.8	56.0	70.0	84.0	100.8	117.6	137.2	156.8	179.2
2,700	2.7	4.8	5.4	10.8	16.2	24.3	32.4	43.2	54.0	67.5	81.0	97.2	113.4	132.3	151.2	172.8
2,600	2.6	4.6	5.2	10.4	15.6	23.4	31.2	41.6	52.0	65.0	78.0	93.6	109.2	127.4	145.6	166.4
2,500	2.5	4.5	5.0	10.0	15.0	22.5	30.0	40.0	50.0	62.5	75.0	90.0	105.0	122.5	140.0	160.0
2,400	2.4	4.3	4.8	9.6	14.4	21.6	28.8	38.4	48.0	60.0	72.0	86.4	100.8	117.6	134.4	153.6
2,300	2.3	4.1	4.6	9.2	13.8	20.7	27.6	36.8	46.0	57.5	69.0	82.8	96.6	112.7	128.8	147.2
2,200	2.2	3.9	4.4	8.8	13.2	19.8	26.4	35.2	44.0	55.0	66.0	79.2	92.4	107.8	123.2	140.8
2,100	2.1	3.7	4.2	8.4	12.6	18.9	25.2	33.6	42.0	52.5	63.0	75.6	88.2	102.9	117.6	134.4
2,000	2.0	3.6	4.0	8.0	12.0	18.0	24.0	32.0	40.0	50.0	60.0	72.0	84.0	98.0	112.0	128.0
1,900	1.9	3.4	3.8	7.6	11.4	17.1	22.8	30.4	38.0	47.5	57.0	68.4	79.8	93.1	106.4	121.6
1,800	1.8	3.2	3.6	7.2	10.8	16.2	21.6	28.8	36.0	45.0	54.0	64.8	75.6	88.2	100.8	115.2
1,700	1.7	3.0	3.4	6.8	10.2	15.3	20.4	27.2	34.0	42.5	51.0	61.2	71.4	83.3	95.2	108.8
1,600	1.6	2.8	3.2	6.4	9.6	14.4	19.2	26.6	32.0	40.0	48.0	57.6	67.2	78.4	89.6	102.4
1,500	1.5	2.7	3.0	6.0	9.0	13.5	18.0	24.0	30.0	37.5	45.0	54.0	63.0	73.5	84.0	96.0
1,400	1.4	2.5	2.8	5.6	8.4	12.6	16.8	22.0	28.0	35.0	42.0	50.4	58.8	68.6	78.4	89.6
1,300	1.3	2.3	2.6	5.2	7.8	11.7	15.6	20.8	26.0	32.5	39.0	46.8	54.6	63.7	72.8	83.2
1,200	1.2	2.1	2.4	4.8	7.2	10.8	14.4	19.2	24.0	30.0	36.0	43.2	50.4	58.8	67.2	76.8
1,100	1.1	2.0	2.2	4.4	6.6	9.9	13.2	17.6	22.0	27.5	33.0	39.6	46.2	53.9	61.6	70.4
1,000	1.0	1.8	2.0	4.0	6.0	9.0	12.0	16.0	20.0	25.0	30.0	36.0	42.0	49.0	56.0	64.0
900	0.9	1.6	1.8	3.6	5.4	8.1	10.8	14.4	18.0	22.5	27.0	32.4	37.8	44.1	40.4	57.6
800	0.8	1.4	1.6	3.2	4.8	7.2	9.6	12.8	16.0	20.0	24.0	28.8	33.6	39.2	44.8	51.2
700	0.7	1.2	1.4	2.8	4.2	6.3	8.4	11.2	14.0	17.5	21.0	25.2	29.4	34.3	39.2	44.8
600	0.6	1.1	1.2	2.4	3.6	5.4	7.2	9.6	12.0	15.0	18.0	21.6	25.2	29.4	33.6	38.4
Area SF (Tie spacing)	1.0 (1'x1')	1.8 (16"x16")	2.0 (1'x2')	4.0 (2'x2')	6.0 (2'x3')	9.0 (3'x3')	12.0 (3'x4')	16.0 (4'x4')	20.0 (4'x5')	25.0 (5'x5')	30.0 (5'x6')	36.0 (6'x6')	42.0 (6'x7')	49.0 (7'x7')	56.0 (7'x8')	64.0 (8'x8')

Recommend Form Ties	Form Ties SWL (KIPS)		Recommend Form Ties	Form Ties SWL (KIPS)
1" Threadbar	63.70		She Bolt with 3/4" Coil Inner	18.00
7/8" Threadbar Taper Tie	32.50		She Bolt with 1/2" Coil Inner	9.00
7/8" Threadbar	39.20		She Bolt with 1/2" N/C Inner	6.30
1-1/4" to 1" Coil Taper Tie	34.00		2 Strut 1/2" Coil Tie Heavy	6.75
5/8" Thread Bar Taper Tie	18.40		2 Strut 1/2" Coil Tie Standard	4.50
5/8" Threadbar	19.10		Snaptie Heavy	3.125
5/8" DCR Bar	18.40		Snaptie Standard	2.25
Use the appropriate Form Ties for loads below their respective line. A safety factor of 2 has been applied to determine sage working loads (SWL) of ties.				

Note: The above table is based on the following conditions.

Concrete - Made with type 1 cement weighing 150 pcf. contains no admixtures, slump of 4" or less and normal internal vibration to a depth of 4 ft. or less.

Concrete Temperature - For practical purposes, 50 °F is used by many form designers as the temperature of fresh concrete during winter, with 70°F being used as the summer temperature. This "rule of thumb" appears to work satisfactory unless the concrete has been heated or cooled to a controlled temperature.

Form Ties - Safe working loads are based on a factor of safety of approximately 2 to 1 (ultimate to SWL)

[BACK TO MASCO.NET]

Chart for Determining Required Quantities for Form Ties

Form Tie Calculator Based on 10,000 sq. ft. of Wall Area or 20,000 sq. ft. of Form Contact Area.	
Form Tie Spacing	**Form Ties Required**
16" x 16" = 1.77 sq. ft.	5,650
24" x 24" = 4.0 sq. ft.	2,500
24" x 32" = 5.33 sq. ft.	1,877
32" x 32" = 7.11 sq. ft.	1,407
32" x 48" = 10.67 sq. ft.	938
48" x 48" = 16 sq. ft.	625
60" x 60" = 25 sq. ft.	400

NC Threaded Bolt Capacities

Permanent connections in precast construction are normally made with either ferrule inserts or COREWALL slotted inserts using National Course (NC) threaded bolts. These NC Threaded bolts are normally not supplied by Masons Supply. However, as a convenience to the designer, the following chart listed.

NC THREADED BOLT SELECTION CHART				
	ASTMA-307 BOLTS		ASTMA-325 OR A-449 BOLTS	
Nominal Bolt	**Tension**	**Shear**	**Tension**	**Shear**
1/4" - 20	625 lbs	350 lbs	1,250 lbs	725 lbs
3/8" - 16	1,500 lbs	900 lbs	3,100 lbs	1,800 lbs
1/2" - 13	2,800 lbs	1,700 lbs	5,600 lbs	3,400 lbs
5/8" - 11	4,500 lbs	2,700 lbs	9,000 lbs	5,400 lbs
3/4" - 10	6,600 lbs	4,000 lbs	13,300 lbs	8,100 lbs
7/8" - 9	9,200 lbs	5,600 lbs	18,400 lbs	11,300 lbs
1" - 8	12,000 lbs	7,400 lbs	24,200 lbs	14,900 lbs
1-1/8" - 7	15,200 lbs	9,400 lbs	26,700 lbs	16,400 lbs
1-1/4" - 7	19,300 lbs	12,000 lbs	33,900 lbs	21,000 lbs
1-1/2" - 6	28,100 lbs	17,500 lbs	49,100 lbs	30,600 lbs

Safe working loads shown provide a factor of safety of approximately 3 to 1 (ultimate to SWL). Shear SWL's assume that the threads are included in the shear plane. 1/4"-20, 3/8"-16 and 1/2"-13 bolts are not recommended for use as structural fasteners. Above information is taken from material provided by Industrial Fastener Institute.

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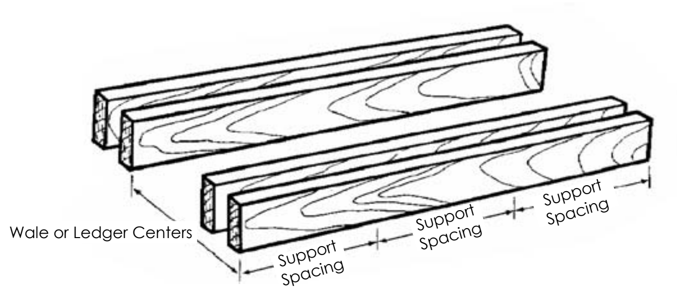
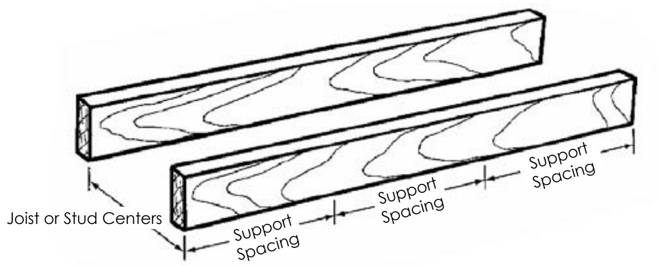


Safe Spacing of Supports for Double Ledgers or Wales Continuous Over Four or More Supports
Based on use of No. 2 Grade Southern Pine or Douglas Fir-Larch

Uniform Load, Pounds per LF (Equals Design Load, Pounds per Sq. Ft. Times Ledger or Wale Centers in ft.)	F_b= varies psi E = 1,400,000 psi F_v = 225 psi				
	Nominal Size Lumber, bxh (S4S) at 19% Maximum Moisture				
	Double 2 x 4	**Double 2 x 6**	**Double 2 x 8**	**Double 3 x 6**	**Double 3 x 8**
	F_b psi				
	1625	**1438**	**1313**	**1438**	**1313**
1,000	35"	51"	64"	66"	83"
1,100	33"	49"	61"	63"	79"
1,200	32"	47"	59"	60"	76"
1,300	30"	45"	56"	58"	73"
1,400	29"	43"	54"	56"	70"
1,500	28"	42"	53"	54"	68"
1,600	27"	40"	51"	52"	66"
1,700	26"	39"	49"	51"	64"
1,800	25"	38"	48"	49"	62"
1,900	24"	37"	47"	48"	60"
2,000	23"	36"	45"	47"	59"
2,200	21"	34"	43"	44"	56"
2,400	20"	32"	42"	43"	54"
2,600	19"	30"	40"	41"	51"
2,800	18"	29"	38"	39"	50"
3,000	18"	28"	36"	38"	48"
3,200	17"	26"	35"	37"	46"
3,400	16"	26"	34"	35"	45"
3,600	16"	25"	33"	34"	44"
3,800	15"	24"	32"	33"	43"
4,000	15"	23"	31"	32"	42"

Note: F_b and F_v shown above includes a 25% increase because of short term loading conditions. Horizontal shear stress adjustment assumes members have no splits, checks or shakes.

Support spacings are governed by bending, shear or deflection. Maximum deflection ℓ/270 of spacing, but not more than 1/8".



Safe Spacing of Supports for Joists or Studs
Continous Over Four or More Supports
Based on use of No. 2 Grade Spruce-Pine-Fir or Hem-Fir

Uniform Load, Pounds per LF (Equals Design Load, Pounds per Sq. Ft. Times Joist or Stud Centers in ft.)	F_b= varies psi E = 1,300,000 psi F_v = 175 psi					
	Nominal Size Lumber, bxh (S4S) at 19% Maximum Moisture					
	2 x 4	**2 x 6**	**2 x 8**	**3 x 6**	**4 x 2**	**4 x 4**
	F_b psi					
	1594	**1381**	**1275**	**1381**	**1275**	**1594**
100	62"	88"	108"	99"	41"	77"
200	52"	74"	91"	84"	32"	65"
300	44"	65"	82"	76"	26"	59"
400	38"	56"	71"	70"	22"	55"
500	32"	50"	63"	65"	20"	52"
600	27"	43"	57"	59"	18"	48"
700	25"	39"	51"	55"	17"	44"
800	22"	35"	46"	51"	16"	41"
900	21"	32"	43"	47"	15"	39"
1,000	19"	30"	40"	43"	14"	36"
1,100	18"	29"	38"	40"	14"	33"
1,200	17"	27"	36"	38"	13"	31"
1,300	16"	26"	34"	36"	12"	29"
1,400	16"	25"	33"	34"	12"	27"
1,500	15"	24"	31"	32"	11"	26"
1,600	15"	23"	30"	31"	11"	25"
1,700	14"	22"	29"	30"	10"	24"
1,800	14"	22"	29"	29"	10"	23"
1,900	13"	21"	28"	28"	9"	22"
2,000	13"	21"	27"	27"	9"	21"
2,200	13"	20"	26"	26"	9"	20"
2,400	12"	19"	25"	24"	8"	19"
2,600	12"	18"	24"	23"	8"	18"
2,800	11"	18"	24"	22"	7"	17"
3,000	11"	17"	23"	22"	7"	17"

Note: F_b and F_v shown above includes a 25% increase because of short term loading conditions. Horizontal shear stress adjustment assumes members have no splits, checks or shakes.

Support spacings are governed by bending, shear or deflection. Maximum deflection ℓ/270 of spacing, but not more than 1/8".

Formula For Battered Wall Ties

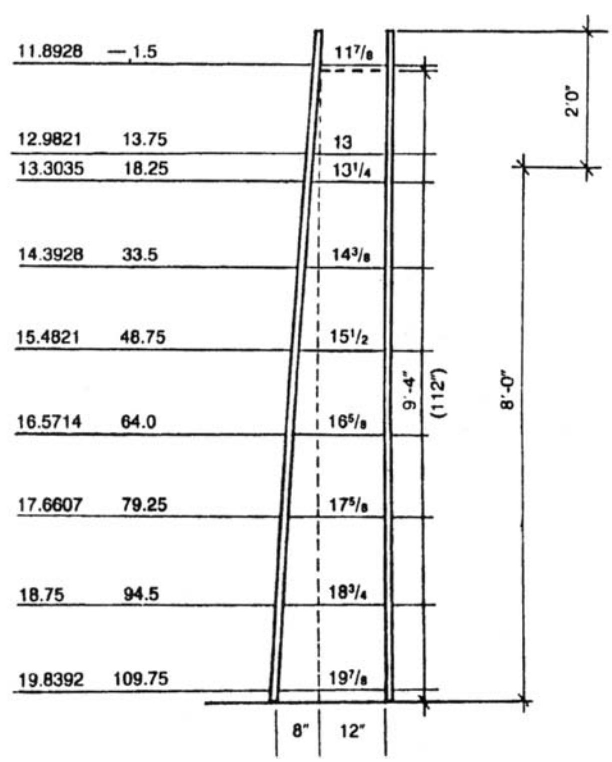
1. Get exact height of wall (in inches)
2. Determine tie spacings to use from bottom to top.
3. Calculate distance from each tie row to top of wall.
4. Establish amount of batter in wall (thickness at bottom minus top thickness).
5, Divide amount of batter in into height of wall to get Factor.
6. Divide distance from tie row to top of wall by Factor.
7. Add constant figure (thickness of wall at top)
8. Repeat steps 6 and 7 for each tie row.
9. Change fraction into nearest 1/8".

Decimal Equivalents

1/16	=	.0625
1/8	=	.125
3/16	=	.1875
1/4	=	.25
5/16	=	.3125
3/8	=	.375
7/16	=	.4375
1/2	=	.5
9/16	=	.5625
5/8	=	.625
11/16	=	.6875
3/4	=	.75
13/16	=	.8125
7/8	=	.875
15/16	=	.9375

$$\frac{\text{How}}{\text{Batter}} = \text{Factor}$$

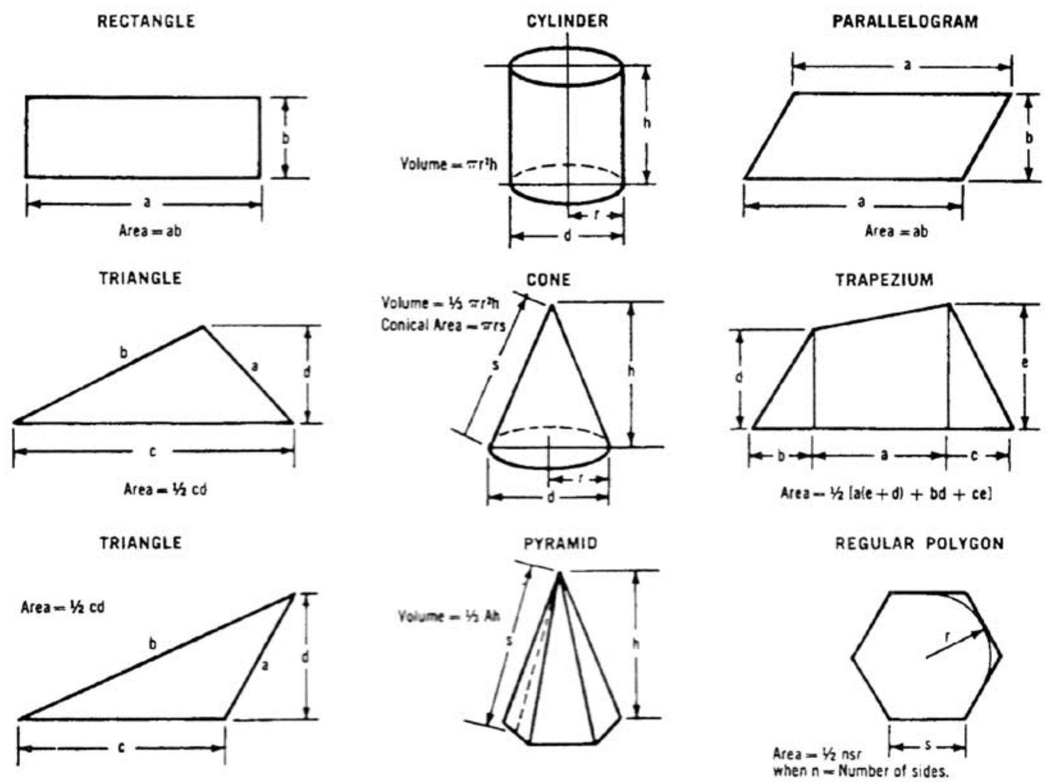
$$\frac{112}{8} = 14$$



Engineering Data

FORMULAS

Area of a square = length x breadth or height.
Area of a rectangle = length x breadth or height.
Area of a triangle = base x ½ altitude.
Area of parallelogram = base x altitude.
Area of trapezoid = altitude x ½ the sum of parellel sides.
Area of trapezium = divide into two triangles, total their areas.
Circumference of circle = diameter x 3.1416.
Circumference of cirle = radius x 6.283185.
Diameter of circle = circumference x .3183.
Diameter of circle = square root of area x 1.12838.
Radius of circle = circumference x .0159155.
Area of a circle = half diameter x half circumference.
Area of a circle = square of diameter x .7854.
Area of a circle = square of circumference x .07958.
Area of a sector of circle = length of arc x ½ radius.
Area of a segment of circle = area of sector of equal radius-area of a triange, when the segment is less, and plus area of triangle, when segment is greater than the semi-circle.
Area of circular ring = sum of the diameter of the two circles x difference of the diameter of the two circles and that product x .7854.
Side of square that shall equal area of circle = circumference x .2821.
Diameter of circle that shall contain area of a given square = side of square x 1.1284.
Side of inscribed equilateral triange = diameter x .86.
Side of inscribed square = diameter x .7071.
Side of inscribed square = circumference x .225.
Area of ellipse = product of the two diameters x .7854.
Area of a parabola = base x ⅔ of a altitude.
Area of a regular polygon = sum of its sides x perpendicular from its center to one of its sides divided by 2.
Surface of sphere = diameter x circumference.
Solidity of sphere = surface x 1/6 diameter.
Solidity of sphere = cube of diameter x .5236.
Solidity of sphere = cube of radius x 4.1888.
Solidity of sphere = cube of circumference x .016887.
Diameter of sphere = cube root of solidity x 1.2407.
Diameter of sphere = square root of surface x .56419.
Circumference of sphere = square root of surface x 1.772454.
Circumference of sphere = cube root of solidity x 3.8978.
Contents of segment of sphere = (height squared plus three times the square of radius of base) x (height x .5236).
Side of inscribed cube of sphere = radius x 1.1547.
Side of inscribed cube of sphere = square root of diameter.
Contents of pyramid or cone = area of base x ⅓ altitude.
Contents of frustum or pyramid or cone = multiply areas of two ends together and extract square root. Add to this root the two areas and x ⅓ altitude.
Contents of a wedge = area of base x ⅛ altitude.



MEASURES OF PRESSURES

1 pound per square inch = 144 pounds per square foot = 0.068 Atmosphere = 2.042 inches of mercury (at 62° F) = 27.7 inches of water (at 62° F) = 2.31 feet of water (at 62° F)

1 atmosphere = 30 inches of mercury (at 62° F) = 14.7 pounds per square inch = 2116.3 pounds per square foot = 33.95 feet of water (at 62° F).

1 foot of water (at 62° F) = 62.355 pounds per square foot = 0.433 pound per square inch.

1 inch of mercury (at 62° F) = 1.132 foot of water = 13.58 inches of water = 0.491 pound per square inch.

SQUARE MEASURE

1 square kilometer = 0.3861 square mile = 247.1 acres
1 hectare = 2.471 acre = 107.640 square feet
1 square meter = 10.764 square feet = 1.196 square yard
1 square centimeter = 0.155 square inch
1 square millimeter = 0.00155 square inch

1 square mile = 2.5899 square kilometers
1 acre = 0.4047 hectare
1 square yard = 0.836 square meter
1 square foot = 0.0929 square meter = 929 square centimeters
1 square inch = 6.425 square centimeters = 645.2 square millimeters
1 acre = 43,560 sf

WEIGHT MEASURE

1 GRAM = 0.03527 OUNCE
1 OUNCE = 28.35 GRAMS
1 KILOGRAM = 2.2046 POUNDS
1 POUND = 0.4536 KILOGRAM
1 METRIC TON = 0.98421 ENGLISH TON
1 ENGLISH TON = 1.016 METRIC TON
1 KIP = 4.448 KILONEWTONS

LINEAR MEASURE

1 kilometer = 0.6214 mile
1 meter = 3.2808 feet
1 meter = 1.0936 yards
1 meter = 39.37 inches
1 centimeter = 0.3937 inches
1 millimeter = 0.03937 inches
1 mile = 1.609 kilometer
1 yard = 0.9144 meter
1 foot = 0.3048 meter
1 foot = 304.8 millimeters
1 inch = 2.54 centimeters
1 inch = 25.4 millimeters

CUBIC MEASURE

1 cubic meter = 35.314 cubic feet = 1.308 cubic yards
1 cubic meter = 264.2 U.S. gallons
1 cubic centimeter = 0.061 cubic inch
1 liter(cubic decimeter) = 0.0353 cubic foot = 61.023 cubic inch
1 liter = 0.2642 U.S. gallon = 1.0567 U.S quart
1 cubic yard = 0.7645 cubic meter
1 cubic foot = 0.02832 cubic meter = 28.317 liters
1 cubic inch = 16.38716 cubic centimeters
1 U.S. gallon = 3.785 liters
1 U.S. quart = 0.946 liter
1 U.S. gallon = 0.91598 imperial gallon

INCHES TO MILLIMETERS

FRAC.	DECIMAL	MM
1/16	.0625	1.5875
1/8	.125	3.1750
3/16	.1875	4.7625
1/4	.25	6.3500
5/16	.3125	7.9375
3/8	.375	9.5250
7/16	.4375	11.1125
1/2	.5	12.7000
9/16	.5625	14.1288
5/8	.625	15.8750
11/16	.6875	17.4625
3/4	.75	19.0500
13/16	.8125	20.6375
7/8	.875	22.2250
15/16	.9375	23.8125

INCHES	MM	INCHES	MM	INCHES	MM
1	25.4	17	431.8	33	838.2
2	50.8	18	457.2	34	863.6
3	76.2	19	482.6	35	889.0
4	101.6	20	508.0	36	914.4
5	127.0	21	533.4	37	939.8
6	152.4	22	558.8	38	965.2
7	177.8	23	584.2	39	990.6
8	203.2	24	609.6	40	1016.0
9	228.6	25	635.0	41	1041.4
10	254.0	26	660.4	42	1066.8
11	279.4	27	685.8	43	1092.2
12	304.8	28	711.2	44	1117.6
13	330.2	29	736.6	45	1143.0
14	356.6	30	762.0	46	1168.4
15	381.0	31	787.4	47	1193.8
16	406.4	32	812.8	48	1219.2

FEET TO METERS

FEET	METERS	FEET	METERS
1	0.3048	16	4.8768
2	0.6096	17	5.1816
3	0.9144	18	5.4864
4	1.2192	19	5.7912
5	1.5240	20	6.0960
6	1.8288	30	9.1440
7	2.1336	40	12.1920
8	2.4384	50	15.2400
9	2.7432	60	18.2880
10	3.0480	70	21.3360
11	3.3528	80	24.3840
12	3.6576	90	27.4320
13	3.9624	100	30.4800
14	4.2672	150	45.7200
15	4.5720	200	60.9600

INCHES TO MILLIMETERS

MM	INCHES	MM	INCHES	MM	INCHES	MM	INCHES
1	.0394	50	1.9685	375	14.7638	700	27.5590
2	.0787	75	2.9528	400	15.7480	725	28.5433
3	.1181	100	3.9370	425	16.7323	750	29.5276
4	.1575	125	4.9212	450	17.7165	775	30.5118
5	.1968	150	5.9055	475	18.7008	800	31.4960
6	.2362	175	6.8898	500	19.6850	825	32.4803
7	.2756	200	7.8740	525	20.6693	850	33.4646
8	.3150	225	8.8583	550	21.6535	875	34.4488
9	.3543	250	9.8425	575	22.6378	900	35.4331
10	.3937	275	10.8268	600	23.6220	925	36.4173
15	.5906	300	11.8110	625	24.6063	950	37.4016
20	.7874	325	12.7953	650	25.5905	975	38.3858
25	.9842	350	13.7795	675	26.5748	1000	39.3701

METERS TO FEET

METERS	FEET	METERS	FEET
1	3.2808	30	98.4252
2	6.5617	35	114.8294
3	9.8425	40	131.2336
4	13.1234	45	147.6378
5	16.4042	50	164.0420
6	19.6850	55	180.4462
7	22.9659	60	196.8504
8	26.2467	65	213.2546
9	29.5276	70	229.6588
10	32.8084	75	246.0630
15	49.2126	80	262.4672
20	65.6168	90	295.2756
25	82.0210	100	328.0840

Volume Conversions (Approximate)

US Measure		Multiply by		SI (Metric)		Multiply by		US Customary
in^3	x	16.0	=	ml	x	0.06	=	in^3
fl. oz.	x	29.6	=	ml	x	0.03	=	fl.oz.
cups	x	0.24	=	liters	x	0.036	=	cups
pints	x	0.47	=	liters	x	2.1	=	pints
quarts	x	0.95	=	liters	x	1.06	=	quarts
gallons	x	3.79	=	liters	x	0.26		gallons
ft	x	0.028	=	m	x	35.3		ft
yds^3	x	0.76	=	ft	x	1.31		yds^3
ft^3	x	28.3	=	liters				
yds^3	x	764.5	=	liters				

Weight Conversions (Approximate)

US Measure		Multiply by		SI (Metric)		Multiply by		US Customary
oz.	x	28.3	=	grams	x	0.035	=	oz.
lbs.	x	0.45	=	kg	x	2.2	=	lbs.
short tons	x	0.91	=	metric tons	x	1.1	=	short tons

Comparison of Typical Concrete Quantities

1 MPa	=	145 psi		1 ft.	=	0.3 m
1 m^3	=	1.3 yd^3		1 in.	=	2.5 cm
1 liter/m^3	=	0.2 gal./yd^3		1 f. oz./100 lbs. cement	=	65 ml/100 kg cement
1 kg	=	2.2 lbs.		1 lb./yd^3	=	0.6 kg/m^3
1 kg/m^3	=	1.686 lbs/yd^3		1 yd^3	=	0.7646 m^3
Unit weight (water)	=	1 kg/L		1 fl. oz.	=	30 ml
1 metric ton (1000 kg)	=	2205 lbs.		1 gal.	=	3.8 liter

Comparison of Typical (Approximate) Concrete Values

Typical Value	US Customary	Metric
Weight: bag of cement	94 lbs.	± 43 kg
Typical Design Strength	3000 psi	21 MPa
High Strength Concrete	6000 psi	41 MPa
Cement Content 5 bag mix 6 bag mix 7 bag mix	 470 lbs/yd^3 564 lbs/yd^3 658 lbs/yd^3	 279 kg/m^3 335 kg/m^3 390 kg/m^3
Concrete Density	145 lb/ft^3	2323 kg/m^3
Slump	3 - 4 in.	7.5 - 10 cm
Slab thickness	4 in.	10 cm

GLOSSARY OF TERMINOLOGY

GLOSSARY OF TERMINOLOGY

ALIGNER Lumber or metal members used to align vertical formwork. (plumbing strut oralignment device)

ANCHOR BRACKET A projecting member designed in combination with a specified anchor to attach to a previous concrete pour so as to support the dead weight of the subsequent formwork and live loads specified.

ANCHORS Devices used to secure formwork, braces or accessories to previously placed concrete, either embedded during placement or set in holes drilled in hardened concrete. There are two basic parts: the embedded anchor device and the external fastener which is removed after use.

BATTER WALL Wall with one or both faces slanting from the vertical, usually creating a wall thicker at its base than at its top.

BEAM FORM The entire formwork to form the bottom and both sides of a beam.

BEAM POCKET Opening left in a vertical member in which a beam is to rest; also an opening in a column or girder form where forms for intersecting beams will be framed.

BEAM SIDE Vertical side panels or parts of a beam form.

BOX-OUT An opening or pocket formed in concrete positioning a box-like form within the wall forms.

BRACE Any external structural member used to resist horizontal forces exerted on the forms such as wind loads.

BRACKET Projecting member from a structure to support weight beyond its face.

BREAK-BACK The distance from the face of concrete to the end of the remaining imbedded portion of a tie (snapped off wire-tie, or the face of concrete clearance of a three-piece tie inner unit) (also referred to as Cut-Back).

BRICK LEDGE (BRICK SEAT) Ledge on wall or footing to support a course of masonry.

BUCK Framing to void an opening in a wall, such as a door buck, which forms the opening for a door.

BUG HOLE Void on the surface of formed concrete caused by an adhering air or water bubble not displaced during consolidation.

BULKHEAD A partition in the forms blocking fresh concrete from a section of the forms or closing the end of a form, such as at the construction joint.

CAMBER An inward curvature of a wall or an upward curvature of an elevated slab or beam form to improve appearance or to compensate for anticipated load deflection.

CANTILEVER FORM A special forming technique in which the lateral concrete pressure is resisted by a cantilevered vertical member.

CAPITAL The tapered upper section of a column under the drop head. Conical shaped with round columns, pyramidal shaped with square columns.

CAULK To use a putty-type material to seal form joints from grout leakage.

CHAMFER A beveled external corner. It is usually formed in the concrete work by use of a chamfer strip placed in the form at the outside corner to provide a rounded or beveled corner.

CHASE An elongated void or opening formed into a concrete surface.

CLEANOUT An opening in the forms for removal of refuse, closed before the concrete is placed.

CLEAT Small board used to connect two or more pieces of formwork lumber together.

CLIMBING FORM A form which is raised vertically for succeeding lifts of concrete in a given structure, usually supported on anchor bolts or rods embedded in the top of the previous lift. The form is moved only after an entire lift is placed and (partially) hardened; this should not be confused with a slip form which moves during placement of the concrete.

COIL BOLT The hex-head outer unit of a three-piece wall tie with external contoured threads to engage the helical threads of a coil tie inner unit.

COIL TIE The non-reusable inner unit or center part of a three-piece wall form tie. Ties are made with two or more straight wire struts with helix coils welded at each end forming female threads.

COLUMN CLAMP Any of the various types of stiffening or fastening units to hold a column form sides together

CONSTRUCTION JOINT The surface where two adjacent placements of concrete meet, frequently with a keyway or reinforcement across the joint.

CONTROL JOINT Formed, saw cut, or tooled groove in a concrete surface to regulate the location of shrinkage cracks.

CORBEL The projection from the face of a concrete wall which is used to support a beam or elevated slab.

CROSSMEMBER Intermediate stiffening member of a form panel connected at both ends of the perimeter frame.

CRUSH PLATE An expendable strip of wood used as a pad to protect either the form or concrete surface from damage during prying action to strip forms.

DADO Rectangular groove in the perimeter frame of a form which allows for the passage of ties without leaving a gap between forms.

DEAD LOAD The load of forms, stringers, joists, reinforcing rods, and the actual concrete to be placed.

DEADMAN A steel beam, block of concrete or other heavy item used to provide anchorage for a guy line or form brace.

MASCO

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GLOSSARY OF TERMINOLOGY

DESIGN PRESSURE The predetermined load per square foot at form face predicated by pressure, temperature, rate of concrete placement and height of concrete above point considered.

DIAPHRAGM Cross walls positioned between long span, deep beams to provide lateral stability to the beams.

DOUGHNUT A large washer of any shape to increase bearing area of bolts and form ties, also to act as a shim.

DRAFT The slight taper difference between opposite sides of a form so that it will readily strip out the concrete.

DUTCHMAN Usually a solid lumber thickness utilized to fill in under one side of (cribbing) equal height wall forms such as on a side slope footing, also to compensate for lineal dimension variation between opposing forms due to a slight angle corner or curved wall.

ELEVATION A drawing showing a specific area projection of a structure on a vertical plane.

EMBEDMENT An insert, anchor bolt or other device attached at the form face so as to be encapsulated by the concrete for future attachments or structural performance.

END-BARS Perimeter frame members similar to end-rails but are usually perpendicular to crossmembers.

END-RAILS Perimeter frame members of prefab form panel which are perpendicular to side-rails.

EXPANSION JOINT A thickness of flexible material between consecutive placements of concrete to absorb linear expansion of concrete.

FACTOR OF SAFETY Ratio of ultimate load to allowable load.

FALSEWORK (Shoring) The temporary structure erected to support work in the process of construction, such as shoring or vertical post to support an elevated wall or spandrel beam.

FILLER A non-standard width form panel used to take up odd dimensions.

FILLER STRIP Piece of wood, metal or other material placed between large ganged slab form areas and vertical surfaces to permit easy stripping

FILLET A beveled or rounded inside corner.

FORM COATING Anti-bonding material applied to form face surface to induce easy stripping.

FORMWORK The total system of support for freshly placed concrete including the mold or sheathing which contacts the concrete as well as all supporting members, hardware, and necessary bracing.

FULL LIQUID HEAD Concrete pressure where the entire pour is still in a liquid state.

GANG FORM A large area of wall form with independent structural integrity. May also be a grouping of panels to be used as a unit for convenience in erecting, stripping and reusing.

GIRDER FORM Self-supporting form system where the load is carried in bending by the side panels.

GRADE STRIP A temporary wood strip secured to form face prior to concrete placement to denote finished grade elevation.

GUYS (GUY WIRE) Cable anchor from ground to top of wall form to brace in one direction through tension.

HAIRPIN The wedge used to tighten some types of form ties, also a hairpinshaped anchor set in place while concrete is plastic.

HANDSET FORM A modular form erected and stripped by hand rather than a crane.

HAUNCH A projection built on a wall or column used to support a load outside the wall or column.

HE-BOLT The outer unit of a three-piece wall tie, of which the external threads of the outer units engage the internal threads of an inner unit such as a coil tie.

HEAD (LIQUID HEAT) The vertical height measurement of liquid concrete in wall form.

HONEYCOMB Undesirable voids left in the formed concrete surface revealing unbonded coarse aggregates.

INITIAL SET An early state of the concrete curing process at transformation from a liquid to a solid.

INNER UNIT (INNER TIE) The non-reusable center part of a three-piece she-bolt tie.

INSERT A female threaded connector embedded in a concrete to which a male anchor device can be connected.

INVERT The lowest visible surface; the floor of a drain, sewer, tunnel, culvert, or channel.

JUMBO Traveling support for forms, commonly used in gang-formed tunnel work.

KERF To make a series of cuts or notches in order to curve a wood member.

KEYWAY A recess or groove created in an earlier pour of concrete which is filled with concrete of the next pour giving shear strength to the joint.

KICKER A piece of wood (block or board) or metal attached to a formwork member to take the thrust of another member.

KNEE BRACE A brace between horizontal and vertical members in a building frame or formwork to make the structure more stable.

LEDGER A horizontal structural member secured to a concrete wall and used to support forms.

LIFT BEAM See Spreader Beam.

LIFT BRACKET Special brackets attached to top of ganged forms to facilitate fast, safe attachment of crane sling lines.

LIFTER A lifting device used to vertically elevate ganged forms to subsequent vertical reuses.

GLOSSARY OF TERMINOLOGY

LINER	Any sheet or layer of material attached directly to the inside face of the forms to improve surface quality, alter the texture, or to imprint specific architectural patterns on the finished concrete.
LIVE LOAD	The total weight of workers, equipment, buggies, vibrators and other loads that will exist and move about due to the method of placement, leveling and screeding of the concrete pour.
LOAD EQUALIZERS	A system of equalizing sheaves designed to distribute the load equally to each form lift point when multiple-leg slings are used to lift a form.
MODULAR FORMWORK	Prefabricated all-metal or metal-supported-plywood systems in standard sizes with an integral provision for tie and connecting hardware.
MONOLITHIC	Concrete placement technique in which the slab, the beams, the columns, and the walls or any combination of the above elements are poured at the same time.
MUDSILL	A plank, or concrete slab, on the ground, to provide a level surface and support to concrete forms.
MULTI-LIFT	The vertical stacking of forms in tiers for any height wall. A wall requiring more than one row of forms is generally referred to as multilift.
NAILER	Strip of wood or other material attached to or set in concrete or attached to steel to facilitate making nailed connections.
OFFSET	A displacement or abrupt change in line or the distance between two parallel lines; such as a change in wall thickness which will create a vertical offset.
ONE-SIDED FORMWORK	A wall formwork system having only one forming side, requiring special provisions for tieing and support. Commonly required when placing concrete against sheet pile, slurry walls, soldier beam embankments, and existing concrete or concrete block walls.
PANEL	A section of form sheathing constructed from boards, plywood, metalsheets, etc., that can be erected and stripped as a unit. Panels can be built on jobsite or prefabricated factory built.
PAN-JOIST	A light slab with ribs normally 24 to 36 inches on center acting as beams. The joists or ribs run at right angles to primary beams or girders.
PARAPET	Part of a wall that extends above the roof level.
PENCIL ROD	Metal rod (wire), usually about ¼" diameter, used in conjunction with special bearing clamps to perform as a wall form tie.
PENETRATION	Any concrete embedment device that must pass through the form face (such as anchor bolts, rebar, or dowel rods).
PERMANENT FORM	Any form that remains in place after the concrete has developed its design strength. The form may or may not become an integral part of the structure.
PILASTER	Column built with a wall, usually projecting beyond the wall face.
PLATE	A flat horizontal member such as a 2 x 4 placed on the footing for leveling and upon which the forms are set, sometimes referred to as a "shoe."
PLUMB	Vertical or the act of making vertical.
POST-TENSIONED CONCRETE	Reinforced concrete in which, after the concrete has set and sufficiently hardened, the desirable distribution of stress is achieved by post tensioning steel tendons, bars or wires.
PRECAST CONCRETE	Concrete units (such as beams, joists, deck panels, or wall panels) cast elsewhere than its final position and then set in place.
PRESTRESSED CONCRETE	A system for utilizing the compressive strength of concrete by producing required compressive stresses with highly stressed tension rods, tendons or wires.
REBAR	Abbreviation for "Reinforcing Bar."
RETAINING WALL	A wall, which is designed to resist horizontal loads such as those imposed by soil or water.
RIBS	Parallel structural members backing sheathing in a prefabricated form. Same as crossmembers.
RIGGING	Suspension components, such as chains, shackles, connecting links and eye hooks used to suspend formwork gangs or components from a crane or similar lifting device.
RUSTIFICATION	A groove in the concrete formed by securing a strip to the face of the formwork. Also referred to as a "feature strip."
SAFETY FACTOR	See Factor of Safety.
SCAB	A small piece of wood fastened to two formwork members to secure a butt joint.
SCAFFOLD BRACKET	A premanufactured cantilevered bracket designed to attach to formwork gangs and support scaffold planks that are used for a work platform when placing and vibrating concrete.
SCAFFOLDING	An elevated platform supporting workers, tools, and materials, either attached to wall forms or free standing.
SCREED	The tool used to control the top surface elevation of freshly placed concrete.
SHEATHING	The material forming the contact face of forms, also called lagging or sheeting.
SHE-BOLT	The outer unit of a three-piece wall tie that contains female threads to engage the external threaded inner unit (rod). SHIM Thin pieces of material used to bring abutting members to an even, level bearing.
SIDERAIL	Perimeter frame member of prefab form panel which is perpendicular to crossmembers.
SILL	Horizontal bearing member as a plate. See Plate.
SKIN PLATE	The steel form face of an all-steel form.

GLOSSARY OF TERMINOLOGY

SLAB The thinner portion of the floor, usually of uniform depth, that is between the drop heads or beams.

SLING A length of cable with a loop at each end, usually the cable line from the crane hook to ganged form.

SLIP FORM A form which moves, usually continuously, during placing of the concrete. Movement may be either horizontal or vertical. Slip forming is like an extrusion process with the forms acting as moving dies to shape the concrete.

SNAP TIE A wire-type tie with or without spreader washer or cones. After forms are released, the protruding tie ends are snapped off by twisting at a predetermined break-off crimp usually about 1" in the concrete.

SOLDIERS Vertical wales used for strengthening or alignment.

SPANDREL BEAM A beam in the perimeter of a building, spanning between columns and usually supporting floors or roof. An up-turned spandrel depth dimension extends above the floor, and a down-turned spandrel extends below the floor.

SPREADER A brace, usually of wood, inserted in forms to keep the form faces the proper distance apart until the concrete is placed.

SPREADER BEAM A beam utilized to distribute the weight of a ganged form through two or more equalized vertical pick-up points.

SPUD Adjustable bolt-like strut extending between the skin of tunnel forms and bored rock tunnel walls to provide position support of the formwork.

STAKE A pointed wood or metal object driven in ground to attach brace or to support form sides in footing forming.

STIFFENER A structural member for the support of the plywood face or skin plate on panel forms sometimes called ribs.

STRIP To remove formwork from concrete.

STRIPPING BAR A solid bar positioned in-between form panels or adjoining ganged forms which is the first unit stripped thereby providing relief to readily strip the large form panels; also referred to as “wrecking strips.”

STRONGBACK A load gathering member attached to the back of the formwork on the outside of the walers for added strength, to hold proper alignment (sometimes referred to as “stiffbacks”).

STUD Supporting member to which sheathing is attached.

TAG LINE Line connected to gang form or flying form to control free swing movement during crane lifting.

TAPER TIE A one-piece reusable form tie with a slight taper to facilitate removal.

TELLTALE Any device designed to indicate movement of formwork.

TEMPLATE Thin plate or board frame used as a guide in positioning or spacing of form parts, reinforcements, anchors, etc.

TIE A concrete form tie is a tensile unit adapted to holding concrete forms secure against the lateral pressure of unhardened concrete, with or without provision for spacing the forms a definite distance apart, and with or without provision for removal of metal to a specified distance back from the finished concrete surface.

TIE DADO Half-slot thickness dado’s at the siderails of adjoining forms provide the tie location slot common to many prefabricated form systems.

TOENAIL To drive a nail at an angle.

TRAVELER Traveling support and bracing for ganged tunnel and culvert formwork.

WALER Load gathering members used to hold studs or panel forms in position.

WALKWAY SYSTEM All components including, but not limited to, scaffold brackets, scaffold planks, guard rails, toeboards and guard rail posts erected to provide a work platform for placing and vibrating concrete and to prevent workers from falling.

WATERSTOP Rubber, plastic, or other material inserted in a construction joint to prevent the seepage of water through the joint.

WEDGE A piece of wood or metal tapered to a thin edge, used to adjust elevation, tighten formwork, etc.

WEDGE BOLT A two-way action designed wedge which contains a slot to facilitate its function as a connecting bolt also.