

2015 MINNESOTA STATE BUILDING CODE Table R404.1.1(3)

10-INCH MASONRY WALLS WITH REINFORCING WHERE d > 6.75 INCHES ^a

WALL HEIGHT	HEIGHT OF UNBALANCED BACKFILL ^e	MINIMUM VERTICAL REINFORCEMENT ^{b,c}		
		Soil classes and lateral soil load ^d (psf per foot below grade)		
		GW, GP,SW, and SP soils 30	GM, GC, SM, SM-C And ML soils 45	SC, MH, ML-CL and Inorganic CL soils 60
6 Feet 8 Inches	4 Feet or less	#4 at 56 inches o/c	#4 at 56 inches o/c	#4 at 56 inches o/c
	5 Feet	#4 at 56 inches o/c	#4 at 56 inches o/c	#4 at 56 inches o/c
	6 Feet 8 Inches	#4 at 56 inches o/c	#4 at 56 inches o/c	#5 at 56 inches o/c
7 feet 4 inches	4 feet or less	#4 at 56 inches o/c	#4 at 56 inches o/c	#4 at 56 inches o/c
	5 feet	#4 at 56 inches o/c	#4 at 56 inches o/c	#4 at 56 inches o/c
	6 feet	#4 at 56 inches o/c	#4 at 56 inches o/c	#5 at 56 inches o/c
	7 feet 4 inches	#4 at 56 inches o/c	#5 at 56 inches o/c	#6 at 56 inches o/c
8 feet	4 feet or less	#4 at 56 inches o/c	#4 at 56 inches o/c	#4 at 56 inches o/c
	5 feet	#4 at 56 inches o/c	#4 at 56 inches o/c	#4 at 56 inches o/c
	6 feet	#4 at 56 inches o/c	#4 at 56 inches o/c	#5 at 56 inches o/c
	7 feet	#4 at 56 inches o/c	#5 at 56 inches o/c	#6 at 56 inches o/c
	8 feet	#5 at 56 inches o/c	#6 at 56 inches o/c	#6 at 48 inches o/c
8 feet 8 inches	4 feet or less	#4 at 56 inches o/c	#4 at 56 inches o/c	#4 at 56 inches o/c
	5 feet	#4 at 56 inches o/c	#4 at 56 inches o/c	#4 at 56 inches o/c
	6 feet	#4 at 56 inches o/c	#4 at 56 inches o/c	#5 at 56 inches o/c
	7 feet	#4 at 56 inches o/c	#5 at 56 inches o/c	#6 at 56 inches o/c
	8 feet 8 inches	#5 at 56 inches o/c	#6 at 48 inches o/c	#6 at 32 inches o/c
9 feet 4 inches	4 feet or less	#4 at 56 inches o/c	#4 at 56 inches o/c	#4 at 56 inches o/c
	5 feet	#4 at 56 inches o/c	#4 at 56 inches o/c	#4 at 56 inches o/c
	6 feet	#4 at 56 inches o/c	#5 at 56 inches o/c	#5 at 56 inches o/c
	7 feet	#4 at 56 inches o/c	#5 at 56 inches o/c	#6 at 56 inches o/c
	8 feet	#5 at 56 inches o/c	#6 at 56 inches o/c	#6 at 40 inches o/c
10 feet	4 feet or less	#4 at 56 inches o/c	#4 at 56 inches o/c	#4 at 56 inches o/c
	5 feet	#4 at 56 inches o/c	#4 at 56 inches o/c	#4 at 56 inches o/c
	6 feet	#4 at 56 inches o/c	#5 at 56 inches o/c	#5 at 56 inches o/c
	7 feet	#5 at 56 inches o/c	#6 at 56 inches o/c	#6 at 48 inches o/c
	8 feet	#5 at 56 inches o/c	#6 at 48 inches o/c	#6 at 40 inches o/c
	9 feet	#6 at 56 inches o/c	#6 at 40 inches o/c	#6 at 24 inches o/c
10 feet	#6 at 48 inches o/c	#6 at 32 inches o/c	#6 at 24 inches o/c	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.157 kPa/mm.

- a. Mortar shall be Type M or S and masonry shall be laid in running bond.
- b. Alternative reinforcing bar sizes and spacing having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches.
- c. Vertical reinforcement shall be Grade 60 minimum. The distance from the face of the soil side of the wall to the center of vertical reinforcement shall be at least 6.75 inches.
- d. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist conditions without hydrostatic pressure. Refer to Table R405.1
- e. Unbalanced backfill height is the difference in height between the exterior finished ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab-on-grade is provided and is in contact with the interior surface of the foundation wall, measurement of the unbalanced backfill height is permitted to be measured from the exterior finish ground level to the top of the interior concrete slab.

2015 MINNESOTA STATE BUILDING CODE TABLE R404.1 (1)
MAXIMUM ANCHOR BOLT AND BLOCKING SPACING FOR SUPPORTED FOUNDATION WALLS

MAXIMUM WALL HEIGHT	MAXIMUM UNBALANCED BACKFILL HEIGHT	SOIL CLASSES	SOIL LOAD (Pcf / ft)	TOP OF WALL REACTION (plf) ^b	½" DIAMETER ANCHOR BOLT SPACING (inches) ^a	SPACING OF BLOCKING PERPENDICULAR TO FLOOR JOISTS (inches)
8'-0"	7'-4"	GW, GP, SW, & SP	30	250	72	60
		GM, GC, SM-SC, & ML	45	370	72	40
		SC, MH, ML-CL, & I-CL	60	490	48	30
9'-0"	8'-4"	GW, GP, SW, & SP	30	320	72	48
		GM, GC, SM-SC, & ML	45	480	48	32
		SC, MH, ML-CL, & I-CL	60	640	40	24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8mm

- Sill plate shall be 2" x 6" minimum. Anchor bolts shall be 0.5" diameter cast in place with 7" embed. Anchor bolts shall have a 2" diameter by 0.125" washer tightened and countersunk 0.25" into the top plate
- Minimum load to be used for sizing of accepted anchors or fasteners if bolts are not used.

2015 MINNESOTA STATE BUILDING CODE TABLE R405.1
PROPERTIES OF SOILS CLASSIFIED ACCORDING TO THE UNIFIED SOIL CLASSIFICATION SYSTEM

SOIL GROUP	UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOL	SOIL DESCRIPTION	DRAINAGE CHARACTERISTICS ^a	FROST HEAVE POTENTIAL	VOLUME CHANGE POTENTIAL EXPANSION ^b
GROUP 1	GW	Well graded gravels, gravel sand mixtures, little or no fines.	Good	Low	Low
	GP	Poorly graded gravels or gravel sand mixtures, little or no fines.	Good	Low	Low
	SW	Well graded sands, gravelly sands, little or no fines.	Good	Low	Low
	SP	Poorly graded sands or gravelly sands, little or no fines.	Good	Low	Low
	GM	Silty gravels, gravel-sand-silt mixtures	Good	Medium	Low
	SM	Silty sand, sand-silt mixtures	Good	Medium	Low
GROUP 11	GC	Clayey gravels, gravel-sand-clay mixtures	Medium	Medium	Low
	SC	Clay sands, sand-clay mixture	Medium	Medium	Low
	ML	Inorganic silts and very fine sands, rock flower, silty or clayey fine sands or clayey silts with slight plasticity.	Medium	High	Low
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	Medium	Medium	Medium to low
GROUP 111	CH	Inorganic clays of high plasticity, fat clays	Poor	Medium	High
	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	Poor	High	High
GROUP 1V	OL	Organic silts and organic silty clays of low plasticity.	Poor	Medium	Medium
	OH	Organic clays of medium to high plasticity, organic silts.	Unsatisfactory	Medium	High
	PT	Peat and other highly organic soils.	Unsatisfactory	Medium	High

For SI: 1 inch = 25.4 mm.

- The percolation rate for good drainage is over 4 inches per hour, medium drainage is 2 inches to 4 inches per hour, and poor is less than 2 inches per hour.
- Soils with a low potential expansion typically have a plasticity index (PI) of 0 to 15, soils with a medium potential expansion have a PI of 10 to 35 and soils with a high potential expansion have a PI greater than 20.

TABLE OF EQUIVALENT AREA

SPACING OF REBAR ON CENTER									
	8"	16"	24"	32"	40"	48"	56"	64"	72"
#3	.0138	.0069	.0046	.0034	.0028	.0023	.0020	.0017	.0015
#4	.0250	.0125	.0083	.0063	.0050	.0042*	.0036	.0031	.0028
#5	.0388	.0194	.0129	.0097	.0078	.0064	.0055	.0048	.0043
#6	.055	.0275	.0183	.0138	.0110	.0091	.0078	.0069	.0061

From Table #4 @ 48" o/c * (Eq. Area = $0.2\text{in}^2/48\text{ in.} = 0.0042\text{ in}^2/\text{in}$)

From Table #5 @ 72" o/c = $.0043\text{ in}^2/\text{in}$

From Table #3 @ 24" o/c = $.0045\text{ in}^2/\text{in}$

Sample: From the table above: If #4 rods @ 48" o/c have an area of .0042

Equivalent area from the table could be #3 rods @ 24" o/c or #5 rods @ 72" o/c.