



STATE OF TENNESSEE
DEPARTMENT OF COMMERCE AND INSURANCE
DIVISION OF FIRE PREVENTION
STATE FIRE MARSHAL'S OFFICE
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One- and Two-Family Dwellings and Townhouses Foundation Inspections and Codes

2-14-11

INSPECTIONS

Footers and Slabs

Inspections should be requested after poles, piers, trenches or basement areas are excavated and any required forms erected and any required reinforcing steel is in place and supported prior to the placing of concrete. The foundation inspection includes excavations for thickened slabs intended for the support of bearing walls, partitions, structural supports, equipment and special requirements for wood foundations. Monolith poured slabs are inspected the same as a footing. If rebar is required in the footing or slab, it should be in place prior to the inspection.

Slabs Other than a Monolith Pour

This occurs when a slab is poured that does not have integral footings. An inspection is required in addition to the foundation inspection. The inspection should be requested after excavation, fill material is placed and compacted, and reinforcement and forms are in place. This is not required for garage slabs, only for slabs of living spaces.

CODES

Chapter 4 of the *2009 International Residential Code* controls the design and construction of foundation and foundation spaces. This document outlines common questions about this section of the code and is not meant to replace it. It does not include all allowable methods or materials. The code can be purchased online at www.iccsafe.org.

R401.4 Soil Tests

Table R401.4.1 gives the presumptive load-bearing values of foundation materials. A load bearing value of 1,500 pounds per square foot should be used for design of foundations, unless a geotechnical evaluation shows that higher values apply to a specific job site.

The building official may require a geotechnical evaluation if there is evidence of expansive, compressible, shifting or other questionable soil characteristics. This may also include differential soils.

**TABLE R401.4.1
PRESUMPTIVE LOAD-BEARING VALUES OF
FOUNDATION MATERIALS^a**

CLASS OF MATERIAL	LOAD-BEARING PRESSURE (pounds per square foot)
Crystalline bedrock	12,000
Sedimentary and foliated rock	4,000
Sandy gravel and/or gravel (GW and GP)	3,000
Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000
Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500 ^b

For SI: 1 pound per square foot = 0.0479 kPa.

- a. When soil tests are required by Section R401.4, the allowable bearing capacities of the soil shall be part of the recommendations.
- b. Where the building official determines that in-place soils with an allowable bearing capacity of less than 1,500 psf are likely to be present at the site, the allowable bearing capacity shall be determined by a soils investigation.

R402.2 Concrete

Concrete shall have a minimum compressive strength as indicated by Table R402.2.

See Attachment 1 - Counties with Seismic Design Category & Weathering Probability.

**TABLE R402.2
MINIMUM SPECIFIED COMPRESSIVE STRENGTH OF CONCRETE**

TYPE OR LOCATION OF CONCRETE CONSTRUCTION	MINIMUM SPECIFIED COMPRESSIVE STRENGTH ^a (f' _c)		
	Weathering Potential ^b		
	Negligible	Moderate	Severe
Basement walls, foundations and other concrete not exposed to the weather	2,500	2,500	2,500 ^c
Basement slabs and interior slabs on grade, except garage floor slabs	2,500	2,500	2,500 ^c
Basement walls, foundation walls, exterior walls and other vertical concrete work exposed to the weather	2,500	3,000 ^d	3,000 ^d
Porches, carport slabs and steps exposed to the weather, and garage floor slabs	2,500	3,000 ^{d, e, f}	3,500 ^{d, e, f}

For SI: 1 pound per square inch = 6.895 kPa.

- a. Strength at 28 days psi.
- b. See Table R301.2(1) for weathering potential.
- c. Concrete in these locations that may be subject to freezing and thawing during construction shall be air-entrained concrete in accordance with Footnote d.
- d. Concrete shall be air-entrained. Total air content (percent by volume of concrete) shall be not less than 5 percent or more than 7 percent.
- e. See Section R402.2 for maximum cementitious materials content.
- f. For garage floors with a steel troweled finish, reduction of the total air content (percent by volume of concrete) to not less than 3 percent is permitted if the specified compressive strength of the concrete is increased to not less than 4,000 psi.

R403 Footings

Spread Footings shall be at least 6" in thickness (T). Projections (P) shall be at least 2". The minimum width (W) is shown on Table R403.1 below. The minimum depth of the bottom of the footing is 12". See Attachment 2 – Figure R403.1 (1).

**TABLE R403.1
MINIMUM WIDTH OF CONCRETE,
PRECAST OR MASONRY FOOTINGS
(Inches)^a**

	LOAD-BEARING VALUE OF SOIL (psf)			
	1,500	2,000	3,000	≥ 4,000
Conventional light-frame construction				
1-story	12	12	12	12
2-story	15	12	12	12
3-story	23	17	12	12
4-inch brick veneer over light frame or 8-inch hollow concrete masonry				
1-story	12	12	12	12
2-story	21	16	12	12
3-story	32	24	16	12
8-inch solid or fully grouted masonry				
1-story	16	12	12	12
2-story	29	21	14	12
3-story	42	32	21	16

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.
a. Where minimum footing width is 12 inches, use of a single wythe of solid or fully grouted 12-inch nominal concrete masonry units is permitted.

Except in the seismic areas as noted below, rebar is not required by code.

Seismic Design: Reinforcement is required in seismic design category D₀, D₁, and D₂. A list of counties in these categories is shown on Attachment 1. Seismic design categories B and C do not require special reinforcement.

Vertical Reinforcement: Masonry stem walls must have a No. 4 bar located 4' on center extending to 3" from the bottom of the footing and extending 14" into the stem wall and have a standard hook.

Horizontal Reinforcement: The footing must have one No. 4 bar located 3" from the bottom of the footing. The bar must be held in place with proper holders. One No. 4 bar must be within 12" of the top of the stem wall.

R404.1.1 Masonry Foundation Walls

Masonry foundation walls may be required to be solid units, grouted, or reinforced depending on the thickness of the wall, the height of the wall, or the height of unbalanced backfill. Unbalanced backfill is the height of the wall between the interior floor/grade and exterior grade surfaces.

See Attachments 3, 4, 5 and 6 for the tables which identify the minimum requirements for masonry foundation walls:

Seismic Design: In Seismic Design Category D₀, D₁, and D₂, wall height shall not exceed 8', unbalanced backfill shall not exceed 4', the minimum wall thickness shall be 8", stem walls shall have vertical reinforcement of one No. 3 bar at 4' on center in grouted cells

Walls with more than 4' of unbalanced backfill or exceeding 8' in height must be constructed in accordance with Tables R404.1.1(2), (3) or (4). They shall have two No. 4 horizontal bars

within 12" of the top of the wall.

R408 Under-Floor Space

Ventilation: When a Class 1 vapor retarder material is used, ventilation openings of 1 square foot per 1,500 square feet of under-floor space must be provided. If there is no vapor retarder material 1 square foot per 150 square feet of under-floor space must be provided. One opening must be within 3 feet of each corner.

Unventilated crawl spaces are permitted where the requirements of R408.3 are met.

Access: A floor opening or perimeter wall opening must be provided. Floor openings must be 18" by 24". Perimeter wall openings must be 16" by 24".

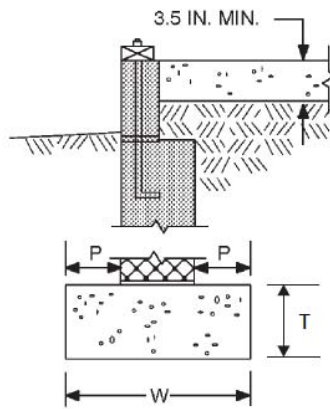
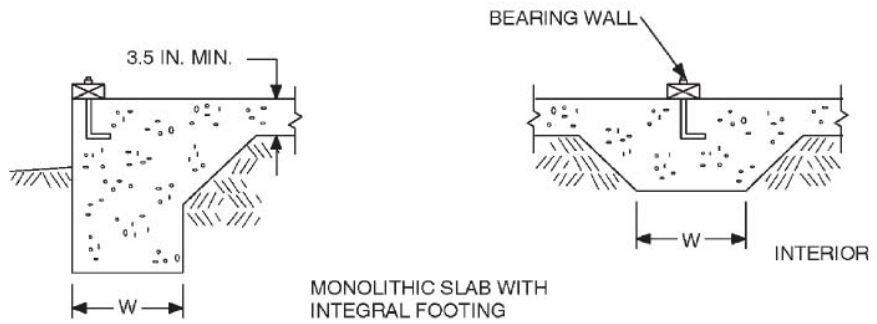
ATTACHMENTS

Attachment 1 - Counties with Seismic Design Category & Weathering Probability

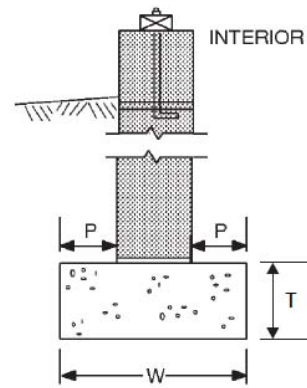
County	Seismic Design Category*	Weathering Probability
Anderson	C	Severe
Bedford	B	Severe
Benton	D	Severe
Bledsoe	C	Severe
Blount	C	Severe
Bradley	C	Severe
Campbell	C	Severe
Cannon	B	Severe
Carroll	D	Severe
Carter	C	Severe
Cheatham	C	Severe
Chester	D	Moderate
Claiborne	C	Severe
Clay	B	Severe
Cocke	C	Severe
Coffee	B	Severe
Crockett	D	Moderate
Cumberland	C	Severe
Davidson	C	Severe
Decatur	D	Moderate
DeKalb	B	Severe
Dickson	C	Severe
Dyer	D	Severe
Fayette	D	Moderate
Fentress	B	Severe
Franklin	C	Moderate
Gibson	D	Severe
Giles	C	Moderate
Grainger	C	Severe
Greene	C	Severe
Grundy	C	Severe
Hamblen	C	Severe
Hamilton	C	Severe
Hancock	C	Severe
Hardeman	D	Moderate
Hardin	D	Moderate
Hawkins	C	Severe
Haywood	D	Moderate
Henderson	D	Moderate
Henry	D	Severe
Hickman	C	Severe
Houston	D	Severe
Humphreys	D	Severe
Jackson	B	Severe
Jefferson	C	Severe
Johnson	C	Severe
Knox	C	Severe
Lake	D	Severe

County	Seismic Design Category*	Weathering Probability
Lauderdale	D	Moderate
Lawrence	C	Moderate
Lewis	C	Moderate
Lincoln	B	Moderate
Loudon	C	Severe
Macon	B	Severe
Madison	D	Moderate
Marion	C	Moderate
Marshall	B	Severe
Maury	C	Severe
McMinn	C	Severe
McNairy	D	Moderate
Meigs	C	Severe
Monroe	C	Severe
Montgomery	D	Severe
Moore	B	Moderate
Morgan	C	Severe
Obion	D	Severe
Overton	B	Severe
Perry	D	Moderate
Pickett	B	Severe
Polk	C	Severe
Putnam	B	Severe
Rhea	C	Severe
Roane	C	Severe
Robertson	C	Severe
Rutherford	B	Severe
Scott	C	Severe
Sequatchie	C	Severe
Sevier	C	Severe
Shelby	D	Moderate
Smith	B	Severe
Stewart	D	Severe
Sullivan	C	Severe
Sumner	C	Severe
Tipton	D	Moderate
Trousdale	B	Severe
Unicoi	C	Severe
Union	C	Severe
Van Buren	B	Severe
Warren	B	Severe
Washington	C	Severe
Wayne	C	Moderate
Weakley	D	Severe
White	B	Severe
Williamson	C	Severe
Wilson	B	Severe

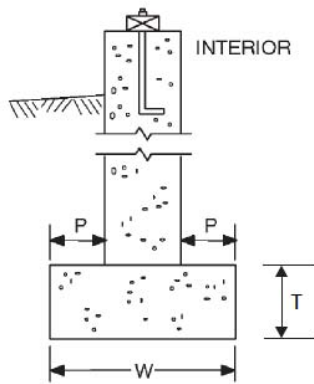
Attachment 2 – Figure R403.1(1)



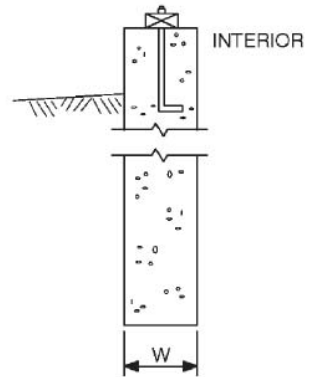
GROUND SUPPORT SLAB WITH MASONRY WALL AND SPREAD FOOTING



BASEMENT OR CRAWL SPACE WITH MASONRY WALL AND SPREAD FOOTING



BASEMENT OR CRAWL SPACE WITH CONCRETE WALL AND SPREAD FOOTING



BASEMENT OR CRAWL SPACE WITH FOUNDATION WALL BEARING DIRECTLY ON SOIL

For SI: 1 inch = 25.4 mm.

FIGURE R403.1(1)
CONCRETE AND MASONRY FOUNDATION DETAILS

Attachment 3– Table R404.1.1(1)

**TABLE R404.1.1(1)
PLAIN MASONRY FOUNDATION WALLS**

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^c (feet)	PLAIN MASONRY ^a MINIMUM NOMINAL WALL THICKNESS (inches)		
		Soil classes ^b		
		GW, GP, SW and SP	GM, GC, SM, SM-SC and ML	SC, MH, ML-CL and inorganic CL
5	4	6 solid ^d or 8	6 solid ^d or 8	6 solid ^d or 8
	5	6 solid ^d or 8	8	10
6	4	6 solid ^d or 8	6 solid ^d or 8	6 solid ^d or 8
	5	6 solid ^d or 8	8	10
	6	8	10	12
7	4	6 solid ^d or 8	8	8
	5	6 solid ^d or 8	10	10
	6	10	12	10 solid ^d
	7	12	10 solid ^d	12 solid ^d
8	4	6 solid ^d or 8	6 solid ^d or 8	8
	5	6 solid ^d or 8	10	12
	6	10	12	12 solid ^d
	7	12	12 solid ^d	Footnote e
	8	10 solid ^d	12 solid ^d	Footnote e
9	4	6 solid ^d or 8	6 solid ^d or 8	8
	5	8	10	12
	6	10	12	12 solid ^d
	7	12	12 solid ^d	Footnote e
	8	12 solid ^d	Footnote e	Footnote e
	9	Footnote e	Footnote e	Footnote e

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 Pa.

a. Mortar shall be Type M or S and masonry shall be laid in running bond. UngROUTED hollow masonry units are permitted except where otherwise indicated.

b. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table R405.1.

c. Unbalanced backfill height is the difference in height between the exterior finish 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 from the exterior finish ground level to the top of the interior concrete slab is permitted.

d. Solid grouted hollow units or solid masonry units.

e. Wall construction shall be in accordance with either Table R404.1.1(2), Table R404.1.1(3), Table R404.1.1(4), or a design shall be provided.

Attachement 4– Table R404.1.1(2)

TABLE R404.1.1(2)
8-INCH MASONRY FOUNDATION WALLS WITH REINFORCING
WHERE $d > 5$ INCHES^{a, c}

WALL HEIGHT	HEIGHT OF UNBALANCED BACKFILL ^e	MINIMUM VERTICAL REINFORCEMENT AND SPACING (INCHES) ^{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-SC and ML soils 45	SC, ML-CL and inorganic CL soils 60
6 feet 8 inches	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#4 at 48
	6 feet 8 inches	#4 at 48	#5 at 48	#6 at 48
7 feet 4 inches	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#4 at 48
	6 feet	#4 at 48	#5 at 48	#5 at 48
	7 feet 4 inches	#5 at 48	#6 at 48	#6 at 40
8 feet	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#4 at 48
	6 feet	#4 at 48	#5 at 48	#5 at 48
	7 feet	#5 at 48	#6 at 48	#6 at 40
	8 feet	#5 at 48	#6 at 48	#6 at 32
8 feet 8 inches	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#5 at 48
	6 feet	#4 at 48	#5 at 48	#6 at 48
	7 feet	#5 at 48	#6 at 48	#6 at 40
	8 feet 8 inches	#6 at 48	#6 at 32	#6 at 24
9 feet 4 inches	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#5 at 48
	6 feet	#4 at 48	#5 at 48	#6 at 48
	7 feet	#5 at 48	#6 at 48	#6 at 40
	8 feet	#6 at 48	#6 at 40	#6 at 24
	9 feet 4 inches	#6 at 40	#6 at 24	#6 at 16
10 feet	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#5 at 48
	6 feet	#4 at 48	#5 at 48	#6 at 48
	7 feet	#5 at 48	#6 at 48	#6 at 32
	8 feet	#6 at 48	#6 at 32	#6 at 24
	9 feet	#6 at 40	#6 at 24	#6 at 16
	10 feet	#6 at 32	#6 at 16	#6 at 16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per 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 spacings 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, d , from the face of the soil side of the wall to the center of vertical reinforcement shall be at least 5 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 finish 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 from the exterior finish ground level to the top of the interior concrete slab is permitted.

Attachment 5– Table R404.1.1(3)

TABLE R404.1.1(3)
10-INCH FOUNDATION WALLS WITH REINFORCING
 WHERE $d > 6.75$ INCHES^{a, c}

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

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per 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 spacings 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, d , 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 finish 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 from the exterior finish ground level to the top of the interior concrete slab is permitted.

Attachment 6– Table R404.1.1(4)

TABLE R404.1.1(4)
12-INCH MASONRY FOUNDATION WALLS WITH REINFORCING
WHERE $d > 8.75$ INCHES^{a, c}

WALL HEIGHT	HEIGHT OF UNBALANCED BACKFILL ^e	MINIMUM VERTICAL REINFORCEMENT AND SPACING (INCHES) ^{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-SC and ML soils 45	SC, ML-CL and inorganic CL soils 60
6 feet 8 inches	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet 8 inches	#4 at 72	#4 at 72	#5 at 72
7 feet 4 inches	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#4 at 72	#5 at 72
	7 feet 4 inches	#4 at 72	#5 at 72	#6 at 72
8 feet	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#4 at 72	#5 at 72
	7 feet	#4 at 72	#5 at 72	#6 at 72
	8 feet	#5 at 72	#6 at 72	#6 at 64
8 feet 8 inches	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#4 at 72	#5 at 72
	7 feet	#4 at 72	#5 at 72	#6 at 72
	8 feet 8 inches	#5 at 72	#7 at 72	#6 at 48
9 feet 4 inches	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#5 at 72	#5 at 72
	7 feet	#4 at 72	#5 at 72	#6 at 72
	8 feet	#5 at 72	#6 at 72	#6 at 56
	9 feet 4 inches	#6 at 72	#6 at 48	#6 at 40
10 feet	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#5 at 72	#5 at 72
	7 feet	#4 at 72	#6 at 72	#6 at 72
	8 feet	#5 at 72	#6 at 72	#6 at 48
	9 feet	#6 at 72	#6 at 56	#6 at 40
	10 feet	#6 at 64	#6 at 40	#6 at 32

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per 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 spacings 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, d , from the face of the soil side of the wall to the center of vertical reinforcement shall be at least 8.75 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 finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground levels. Where an interior concrete slab-on-grade is provided and 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 is permitted.