



MINIMUM REQUIREMENTS FOR RETAINING WALLS / SLOPING BACKFILL

CITY OF SOLANA BEACH

COMMUNITY DEVELOPMENT DEPARTMENT / BUILDING DIVISION
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Construction of retaining walls, except those less than four feet high, measured from the bottom of the footing to the top of the wall and not supporting surcharge, requires a permit and is regulated by City of Solana Beach Municipal Code.

This information bulletin outlines the city's requirements for retaining walls with sloping backfill. There is a separate bulletin describing retaining walls with level backfill. These bulletins are intended to provide a simple alternative to designing minor retaining walls, but should be used only where appropriate soil condition at the site. See Section VII. SOIL.

I. ZONING REGULATIONS

Retaining wall heights are also regulated by the zoning laws of the city.

II. WALL HEIGHT

For the purpose of designing the wall in this information bulletin, wall height is measured from the top of the footing to the top of the wall.

Walls not shown in Tables A and B must be designed specifically for the existing conditions. The walls shown here are designed to retain only sloping backfill. No building foundation, retaining wall, driveway, parking, fence, or other potential source of loading on the upper level is allowed within a distance equal to the height of the wall. See Figure 3 and 4.

III. CAL/OSHA PERMIT/WAIVER

A CAL/OSHA construction activity permit is required for construction of trenches or excavations which are five feet or deeper and into which a person is required to descend. For more information, please contact:

CAL/OSHA Enforcement Unit District Office
575 Metropolitan Drive, Ste. 207
San Diego, CA 92108
(619) 767-2280 | DOSHSD@dir.ca.gov

IV. MASONRY BLOCKS

Concrete masonry units shall be of sizes shown on drawings and conform to ASTM C90 (CBC 2103.1) Medium Weight Units with maximum linear shrinkage of 0.06%, $F'm=1,500$ psi grouted solid reinforced cells. All head and bed joints shall be 3/8" thick. Bed joints of the starting course over the concrete foundation may be between 1/4" and 3/4". (ACI 530.1-05 section 3.3B). No special inspection is required for retaining walls up to 6 feet in height

V. SPECIFICATIONS

- a. CONCRETE - Concrete for footings must have a minimum compressive strength of 2,500 psi at 28 days. (CBC Table 1808.8.1). Cement shall conform to ASTM-C150 (ACI 318-11 section 3.2). Note: Plastic (Stucco) cement ASTM C 1328 is not permitted in retaining walls located in Seismic Design Category D.
- b. MORTAR - The mortar mix must have a compressive strength equal to 1,800 psi minimum (CBC Table 2105.2.2.1.2). Mortar for use in Masonry construction shall conform to ASTM C 270
- c. GROUT - Grout must have a compressive strength equal to 2,000 psi minimum. Grout shall conform to Section 2105.2.2.1.2 or to ASTM C 476. When grout conforms to ASTM C 476, the grout shall be specified by proportion requirements.
- d. REINFORCING STEEL - Reinforcing steel must be deformed and comply with ASTM A 615 (CBC 2103.13.1), Grade 60. When one continuous bar cannot be used, a lap or splice of 40-bar diameters is required. All bars shall be clean of loose flaky rust, grease or other materials likely to impair bond. (ACI 318-11 Section 5.7).

Reinforcement in concrete shall be protected from corrosion and exposure to chlorides. (ACI 318-11 Section 7.7.6). Concrete protection for reinforcement shall be at least 3" to earth when the concrete is poured against the earth. (ACI 318-11 Section 7.7.1).

Two #4 bars must be placed longitudinally in the footing as shown in figures 3 and 4.

One #4 reinforcing bar must be placed longitudinally within the wall in a bond beam block every 16 inches as the blocks are laid up. See Figure 2.

- e. MORTAR KEY - To insure proper bonding between the footing and the first course of block, a mortar key must be formed by embedding a flat 2x4 flush with and at the top of the freshly placed footing. It should be removed after the concrete has started to harden (about 1 hour). A mortar key may be omitted if the first course of block is set into the fresh concrete and a good bond is obtained.

VI. WALL DRAINS

Wall drains must be placed at 6-foot intervals along the length of the wall and located just above the level of the soil or paving on the front face of the wall. The drains may be formed by placing a block on its side at 6-foot intervals, by leaving out the mortar in the vertical spaces between all the blocks in the first course above the soil or paving (head joint) on the front face of the wall, by installing 4-inch diameter drain line behind the wall, or by any other acceptable equivalent method. Backfill behind wall drains or open head joints must be loose rubble or gravel at least 12 inches wide and extending from the top of the wall to the top of the footing.

VII. SOIL DESIGN CRITERIA

This information bulletin is to be used only when the soils to be retained are not expansive (i.e. sandy soils).

The design of this information bulletin is based on the following criteria:

1. Soil type: granular, non-cohesive soil backfill.
2. Active earth pressure with an equivalent fluid weight of:
 - a. 42 pounds per cubic foot for 2 to 1 slope.
 - b. 60 pounds per cubic foot for 1.5 to 1 slope.
3. Passive earth pressure with an equivalent fluid weight of:
 - a. 200 pounds per cubic foot for 2 to 1 slope.
 - b. 300 pounds per cubic foot for 1.5 to 1 slope.
4. Allowable bearing value of 1,500 psf.
5. Soil friction factor 0.25.

If existing soil conditions do not meet these design criteria or the conditions are unknown, walls should be designed by a State of California licensed civil engineer or architect. A soil report may be required. Note: Soil lateral pressure due to earthquake motion is not required for walls conforming to this bulletin.

VIII. INSPECTIONS

Inspections must be performed during several phases of construction. Please call for inspections at the following times:

- a. A footing inspection is needed when the excavation for a footing has been dug with the steel tied securely in its final position, and the site is ready for the concrete to be placed.
- b. A masonry pregrout inspection is required when the block has been laid and the steel is in place, but before the grout has been placed.
 - i. If cleanout holes are used, block may be laid to the full height at the grout pour before calling for the pregrout inspection. Grout shall be placed in a continuous pour in grout lifts not exceeding 6 feet.
 - ii. If cleanout holes are not used, a masonry pregrout inspection is required prior to each grout pour. Block cannot be laid higher than the grout pour. Note that cleanouts are required for all grout pours over 5 feet in height.
- c. After grouting is completed and rock or rubble wall drains are in place, but before earth backfill is placed, call for a backfill/drainage inspection.
- d. When all work has been completed, call for a final inspection.

Table A / Requirements for Various Wall Heights 2 to 1 Slope ^{1,2,3,4,5}

Wall Type	I	II		III	
Wall Height (H) ⁶	3' - 4"	4' - 0"	4' - 8"	5' - 4"	6' - 0"
Exposed Wall Height (E) ⁷	2' - 4"	3' - 0"	3' - 8"	4' - 4"	5' - 0"
Stem Block Thickness	6"	8"	8"	8" / 12"	8" / 12"
Heel Dimension (L)	1' - 0"	1' - 0"	1' - 4"	1' - 6"	1' - 6"
Toe Dimension (T)	1' - 2"	1' - 8"	1' - 8"	1' - 9"	2' - 3"
Vert Bars (A)	#4 @ 24"	#4 @ 24"	#4 @ 24"	#4 @ 16"	#4 @ 16"
Vert Bars (B)	#4 @ 24"	#4 @ 24"	#4 @ 24"	#4 @ 16"	#4 @ 16"
Footing Width (W)	2' - 2"	2' - 8"	3' - 0"	3' - 3"	3' - 9"
Key Distance from Toe	6"	6"	6"	6"	6"
Key (W x D)	6" x 6"	6" x 6"	8" x 12"	12" x 14"	12" x 18"

Table B / Requirements for Various Wall Heights 1.5 to 1 Slope ^{1,2,3,4,5}

Wall Type	II			III	
Wall Height (H) ⁶	3' - 4"	4' - 0"	4' - 8"	5' - 4"	6' - 0"
Exposed Height (E) ⁷	2' - 4"	3' - 0"	3' - 8"	4' - 4"	5' - 0"
Stem Block Thickness	8"	8"	8" / 12" ⁶	8" / 12"	8" / 12"
Heel Dimension (L)	1' - 4"	1' - 4"	1' - 4"	1' - 6"	2' - 0"
Toe Dimension (T)	1' - 5"	2' - 0"	2' - 2"	2' - 6"	2' - 8"
Vert Bars (A)	#4 @ 24"	#4 @ 24"	#4 @ 24"	#4 @ 16"	#5 @ 16"
Vert Bars (B)	#4 @ 24"	#4 @ 24"	#4 @ 24"	#4 @ 8"	#5 @ 8"
Footing Width (W)	2' - 9"	3' - 4"	3' - 6"	4' - 0"	4' - 8"
Key Distance from Toe	6"	6"	6"	12"	12"
Key (W x D)	6" x 6"	8" x 8"	8" x 10"	12" x 15"	12" x 21"

FOOTNOTES:

¹ Tables A makes the following assumptions:

$f_y = 600000$ psi

$F_s = 24000$

Solid grouting

Using half f_m stress

² Walls not shown in Table A must be designed specifically for the actual conditions.

³ All construction must comply with the specifications shown in this information bulletin.

⁴ Walls less than 3' 4" in height shall be constructed to meet the 3' 4" wall height design criteria.

I= 6 Inches block

II= 8 Inches block

III=12 Inches block

⁵ Footing depth shall be 24 inches below finish grade and 12 inches of compacted soil is required on top of footing to stabilize the wall.

⁶ For the purpose of the structural design, wall height shall be measured from the top of the footing to the top of the wall.

⁷ For zoning requirements fence height shall be measured from finish grade.

Figure 2 / Typical Control Joints

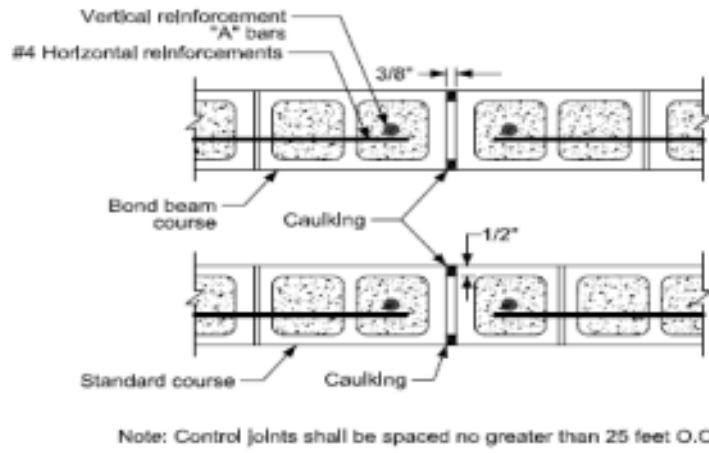


Figure 4 / Type III Retaining Wall with Level Sloping Backfill

