Residential Footers in Owensboro, and Daviess County

The footer is the one of the most important parts of your home and should be given great consideration. If the footer is not constructed properly it will cause problems throughout the entire structure. We live in an area with sandy soils, high water tables and a great possibility of seismic activity. The following information is provided to help ensure that footers are installed in compliance with the building code.

Footer Size

Depth: The bottom of the footer ditch should be located in undisturbed soil or compaction tested approved fill at least twenty-four inches (24") below the *proposed finished site grade*. Twenty-four inches (24") is the designated frost protection depth for Daviess County. If the footing is not placed this deep, it will heave in winter as the ground freezes. If a shallower footer is desired, using backfill to achieve this minimum twenty-four inch (24") depth, the backfill must be a minimum of twenty-four inches (24") plus an additional four inches (4") above the bottom of the footer to account for settling. This is not recommended when construction will carry through the winter months before backfill is placed, because it leaves the footer vulnerable to frost. Additionally, this is not recommended for low lying areas, because the ground outside will be higher than the ground beneath the house forming a water trap under the house. Please see our article on ***Foundations*** for further information on back filling.

Width: The footer shall be twelve inches (12") wide or wider based on the type of structure and the bearing of the earth. Use Tables ***R401.4.1*** and ***R403.1*** from the ***2006 IRC*** below to determine the design width of the footer.

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.

R401.4.2 Compressible or shifting soil. Instead of a complete geotechnical evaluation, when top or subsoils are compressible or shifting, they shall be removed to a depth and width sufficient to assure stable moisture content in each active zone and shall not be used as fill or stabilized within each active zone by chemical, dewatering or presaturation.

TABLE R403.1
MINIMUM WIDTH OF CONCRETE 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.

Thickness: The footer shall be at least six inches (6") thick. This is a minimum dimension only, and it is typical for some contractors to pour footings ten inches (10"), twelve inches (12") and even sixteen inches (16") thick to elevate the top of the footer closer to the surface of the ground, in an effort to save money on block

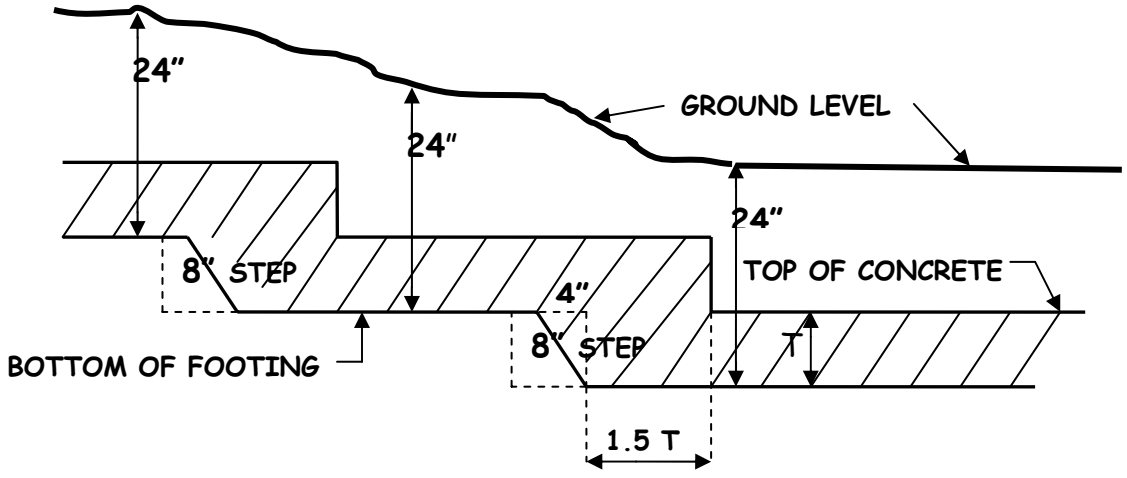
and labor. Block layers appreciate working on thicker footers, because the first course is not so deep in the trench.

Note: ***R403.1.1 Minimum size, 2006 IRC***. The footer shall extend at least two inches (2") on either side of the wall being placed on it. If a twelve inch (12") masonry block is placed on the footer, then the footer must be at least sixteen inches (16") wide, with two inches (2") of the footer extending on either side of the thickness of the wall. This is known as projection. The projection may not be greater than the thickness of the footer. *Example*: If the footer is six inches (6") thick and a twelve inch (12") block wall is placed on it, the footer cannot be any wider than twenty-four inches (24"). If eight inch (8") blocks are used, then the footer may not be any wider than twenty inches (20"). Construction is not a perfect science and sometimes the foundation walls must be "adjusted" on the top of the footer to make them line up properly. It is always helpful to make sure the footer is wide enough to account for adjustment of foundation alignment.

For Sloped Lots

Ditch slope: A footer is supposed to be perfectly level all the way around top and bottom. The bottom of the ditch is allowed to slope a maximum of one (1) unit vertically in ten (10) units horizontally, but the top should be perfectly level and flat for the block layers.

Step Downs: If digging on a sloped lot, as the level footer trench bottom is carried along, the relative depth will change with the surrounding ground as the lot elevation changes. The trench will need to step up or down at the point where it is getting too shallow or too deep. This step should be eight inches (8") tall to allow for a common masonry block. Double steps of sixteen inches (16") are not prohibited, but create bad stress points and homes have had cracked footers at these points as a result of double steps. For this reason, double steps are not recommended. The figure below illustrates a stepped footer from the side.

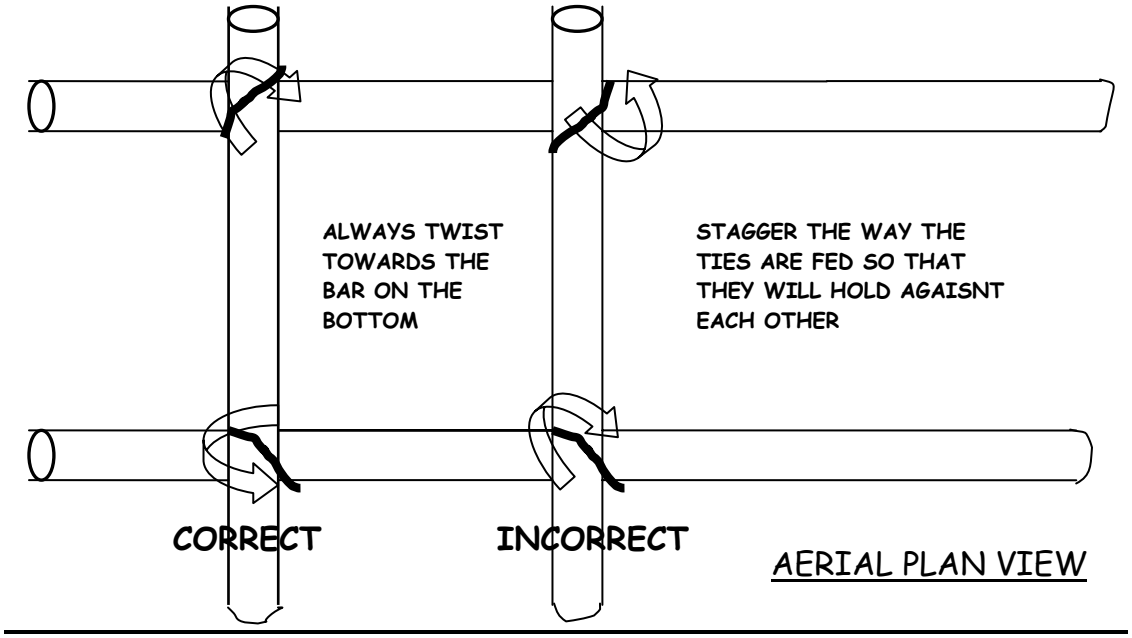


REBAR

Size: No less than #4 reinforcing steel should be used in a residential footer. Larger rebar is more expensive and harder to work with, but is permitted. #4 designates that the diameter of the steel rod is 4 1/8ths of and inch, or ½". #5 would be 5/8ths of an inch and so on.

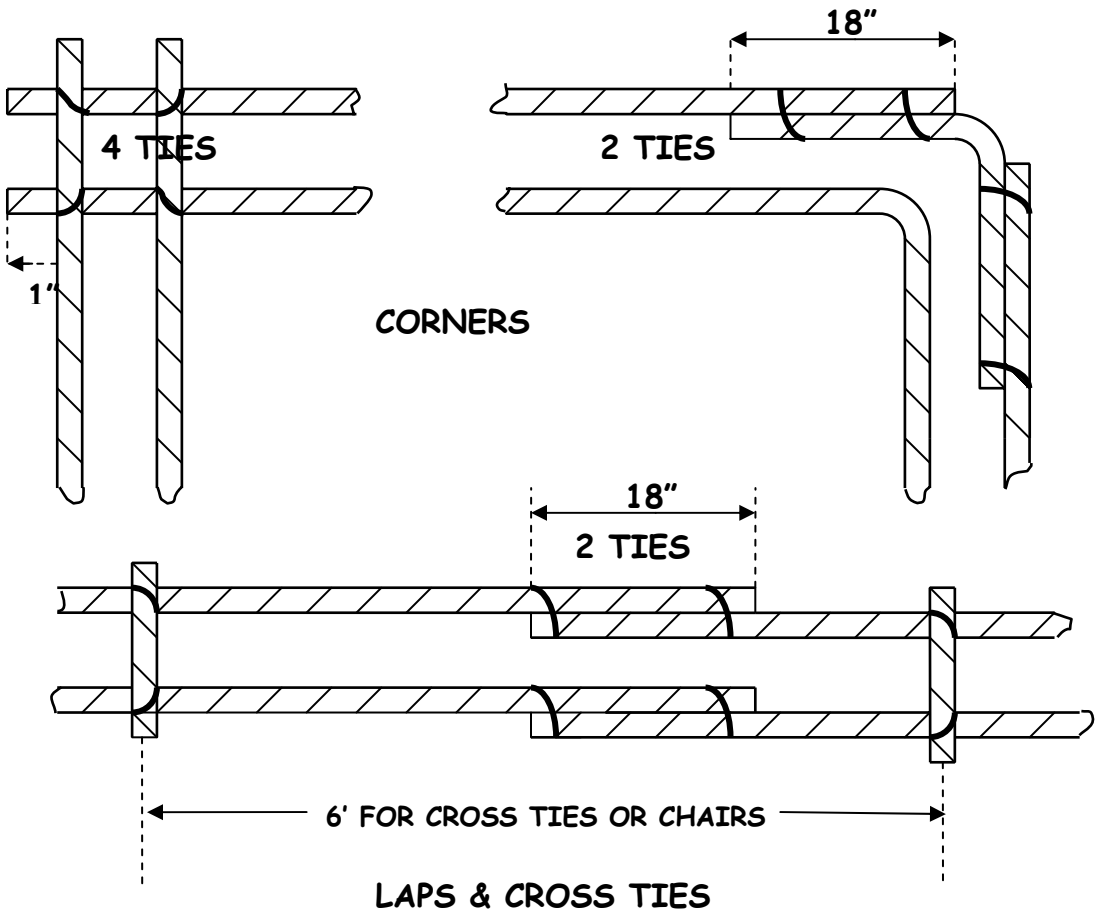
Lap: When connecting two pieces of steel end to end, the ends of the bars must be lapped to make a joint that will not pull apart. As a rule of thumb, the lap should be forty (40) diameters of the thickness of the steel. If #4 steel that is ½" thick is used, then forty (40) diameters would be twenty inches (20") of lap. For #5 bar, it would be twenty-five inches (25") and so on. We generally look for at least eighteen inches (18") of lap in Daviess County. Every lap should have at least two good ties on it about three inches (3") from either end.

Ties: Steel should be tied tightly with approved tie wire. Tie wire and pliers can be used to make the ties, or what is known as a "TWISTY" or twist ties can be used. This is a six inch (6") section of wire with loops formed on both ends which utilizes a hand tool that twists a knot as it is spun. These are much easier and faster for the novice steel worker. **There is a right and wrong way to tie steel**. To make a tie on the lap joints simply feed the tie under the bars and twist it tightly on top, the direction of rotation does not matter. When tying a crossed set of bars, however, the direction matters. When twisting the wires rotate the tie so that it crosses the top bar at a 90 degree angle to the run of the bar. The wrong direction will produce a 45 degree line with the bar and is not as tight a connection. Additionally the ties should not all be oriented in the same direction. If the first tie in a group is fed from North to South and twisted clockwise, then the next should be fed East to West and may need to be twisted counter clockwise to achieve the correct angle. This method will ensure tight ties and strong intersections in your steel that won't fall apart when the concrete is poured. The figures below will illustrate the correct methods.

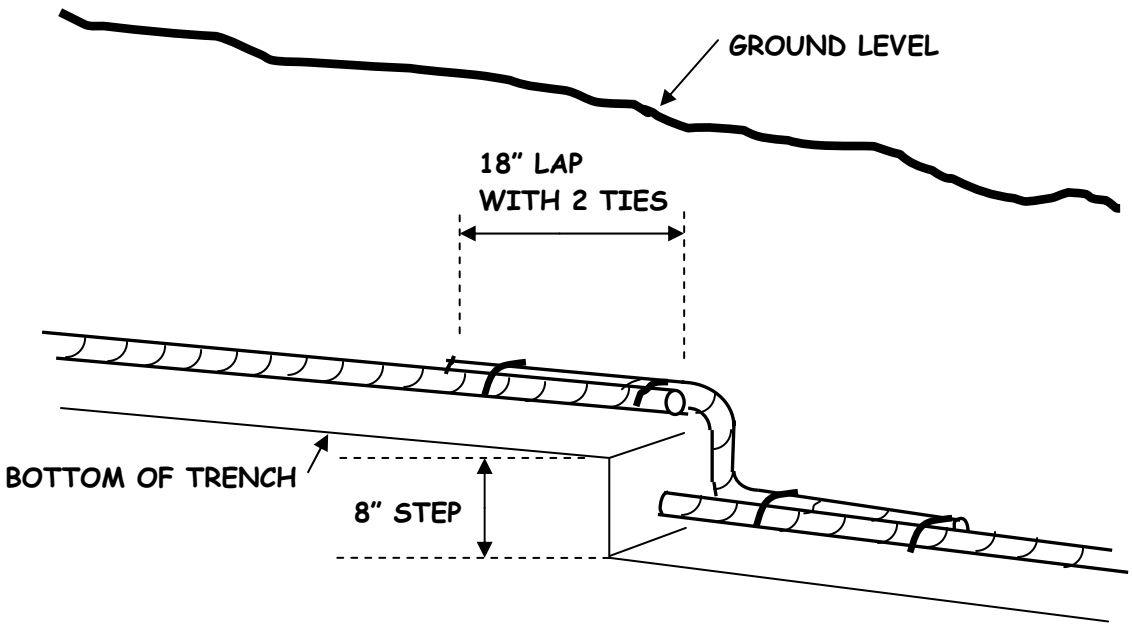


Clearance: All the steel in the footer should be at least three inches (3") from the dirt in any direction. There are three methods that can be employed to keep the steel three inches (3") off the bottom of the trench. The plastic chairs sold where the steel is purchased that clamp onto the bar may be used. Concrete bricks may be broken in half long ways and stood on the side under the bars, or #3 rebar can be driven into the ground with the horizontal bars hung from it. Typically a support would be needed every six (6)to eight (8) feet to keep the steel up high enough.

Corners and Ts: The best practice is to bend the steel through the corners and Ts, but also acceptable is to double cross the connections making what looks like a TicTacToe grid with a tie at every cross. Also, a short piece of rebar can be bent to run through the corner that is long enough to lap eighteen inches (18") on each long bar coming to the corner. The piece must be at least thirty-six (36") long to accomplish this. The diagrams below will illustrate each of these.



AERIAL PLAN VIEWS



Electrical Service Grounding

Every foundation for a structure that may have an electrical service installed in the future must have an exposed piece of steel so that the electrician may bond the service to the foundation steel. This is found in Article 250.52 of the National Electric Code.

Size: This shall be a #4 bar so that the electrician's listed clamp will work.

Location: The grounding steel should be exposed at a location near to where the service will be installed on the structure, but if this is unknown it can be put anywhere that it will be SAFE and ACCESSIBLE.

Installation: Take a 20' piece of #4 and measure back from one end equal to the depth of the footer trench where it is to be located, adding six inches (6"). Bend the bar 90 degrees at this point and tie it into the foundation steel so that the short vertical end is touching the outer wall of the ditch and sticking straight up. This piece will need to be tied in at least 4 places to make sure there is a good connection. It is important that the bar in its resting position will stay in place before you tie it, so the ties remain tight. The end of the bar extending up out of the top of the concrete must be clear of the foundation wall to be laid later. **DO NOT** paint the bar to identify it, as the paint will insulate the future connection. Put a cap on it or tie a ribbon on it if there is a need to identify the location of the bar. See the figure below for an example of a typical installation in a wall separating the garage and house.

ELECTRICAL SERVICE GROUNDING