TECH NOTES

Backfilling Foundation Walls

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Concrete Foundations Association of North America

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Recommendations and code requirements regarding backfill of newly poured basements are one of the most ignored aspects of foundation construction. The International Residential Code, American Concrete Institute (ACI) 332 Standard and the CFA Standard all state that foundation walls must be supported at the top and bottom before backfill is placed. Empirical tables presented in each are based on that premise.

The 2006 IRC States:

> *R404.1.7 Backfill placement. Backfill shall not be placed against the wall until the wall has sufficient strength and has been anchored to the floor above, or has been sufficiently braced to prevent damage by the backfill.*
>
> *Exception: Bracing is not required for walls supporting less than 4 feet of unbalanced backfill.*

A foundation wall is designed as a simply supported beam with restraint at the top and bottom (Fig 1). If there is no support at the top, the wall becomes a cantilevered element requiring a significantly different design, as well as reinforcement requirements for both the wall and footing.

The reality, however, is that most walls are backfilled without the stipulated support. The fact that the walls are much stronger than they need to be to resist designed lateral loads helps keep problems to a minimum but in many cases, backfilling without sufficient support is a problem waiting to happen.

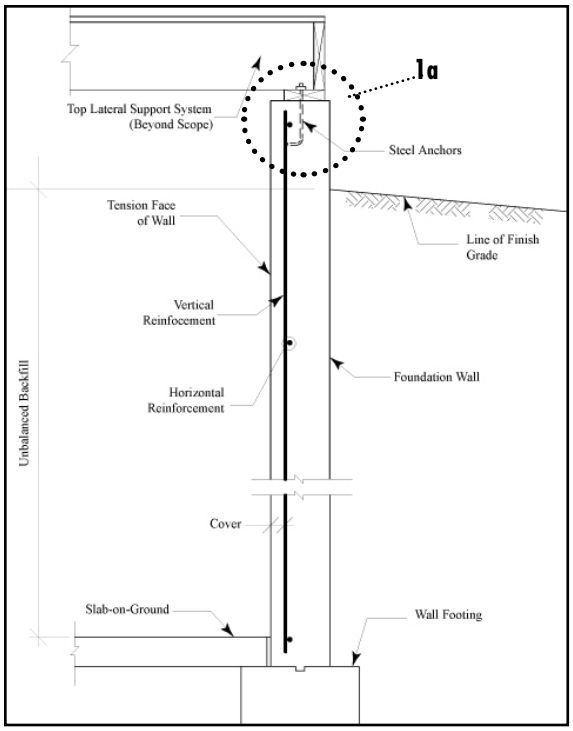

Fig 1: Typical simply-supported foundation wall

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1: This plate-to-deck connection is the weakest part of the foundation assembly. Fig 1a below is enlarged from circled area of Fig. 1.

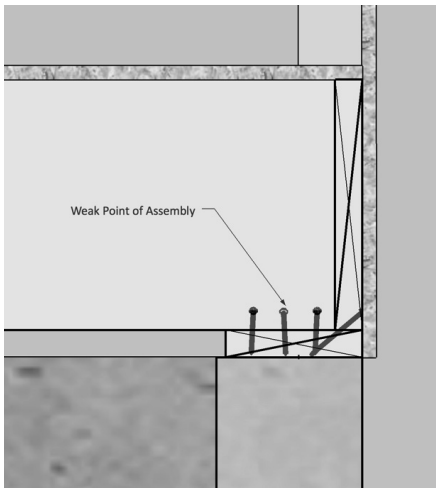


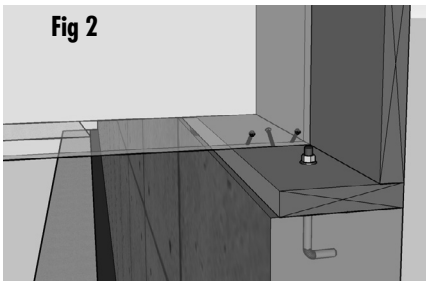
Fig 1a

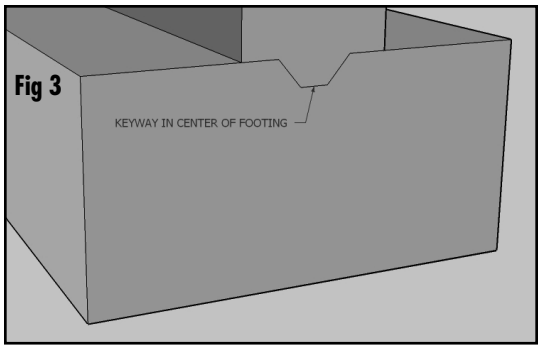
This means that either temporary bracing or a properly constructed and connected deck (Fig 2) must be present at the top of the wall and either a keyway (Fig 3) or dowels (Fig 4) are in-place at the bottom of the wall.

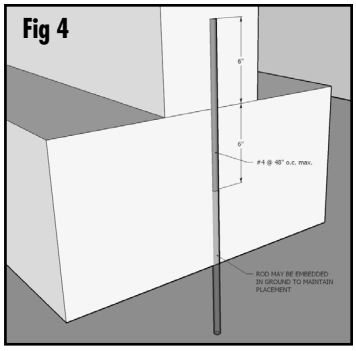
Fig 2, right: Typical completed deck connection

Fig 3, below left: Typical keyway footing connection

Fig 4, below right: Typical rebar dowel footing connection

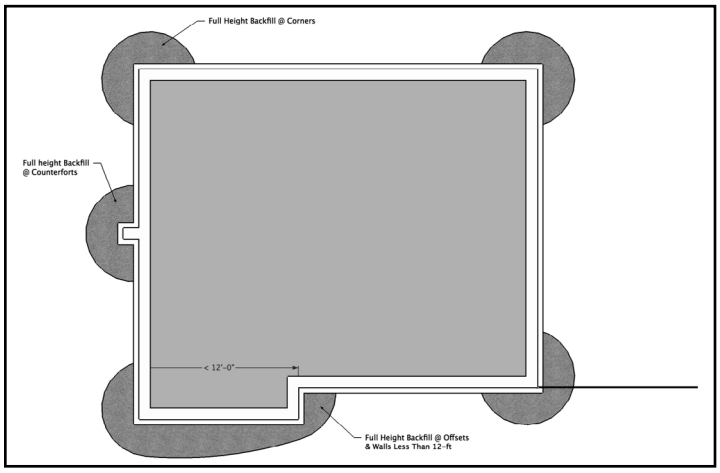






There are several methods that foundation contractors can use to reduce the likelihood of a problem. First, keep the height of the backfill to no more than 4' except at the corners or offsets until the deck is in place. Four feet of unbalanced backfill will usually not exert sufficient pressure to damage the wall.

Fig 5: Common allowable areas for full-height backfill



You can generally backfill to full height at corners and offsets. A wall extending at right angles to the backfilling is the best support you can have for a wall. In most cased you can backfill short segments of walls (up to 12' in length) full height. When you have closely spaced supports at right angles to the wall (such as corners or offsets) the wall actually can span horizontally as well as vertically. This recommendation should be used with caution unless an engineer has given specific design requirements for the method. (Fig 5)

Closely related to offsets is the use of counterforts (Fig 6)—thickened areas of walls or buttress walls—that, in effect, act the same way as offsets or corners.

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These can be on either the inside or outside of the wall and should be cast integrally with the wall. This concept is similar to the use of piers in masonry construction.

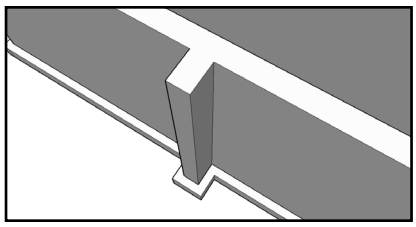

Fig 6: A counterfort monolithic with the foundation wall will support longer wall lengths like an offset or corner

The type and consistency of soils greatly impacts the design lateral load on foundations. Consequently, the backfill condition should be considered during the design of the foundation wall. If the original soil excavated from the over dig is to be used, the wall must be designed for the resulting soil pressures. The pressure on a foundation can be reduced if well-draining soils or granular fills replace the excavated native soils.

When it is time to backfill, the process used is as important or perhaps even more important than the material. It is not acceptable to compact the soils by driving heavy equipment next to the walls - the force exerted will exceed even the largest of assumed soil pressures. Neither is it suitable to saturate the fill with a garden hose to accelerate the settlement. If the soil used for the excavation is not well-drained, the excess water may cause a wall failure. The recommended backfill procedure involves light equipment, preferably a tamper. The fill is set into the hole in two-foot lifts (Fig 7) and then compacted prior to the next layer. This process achieves full height compaction rather than a surface compaction that will maintain the final grade.

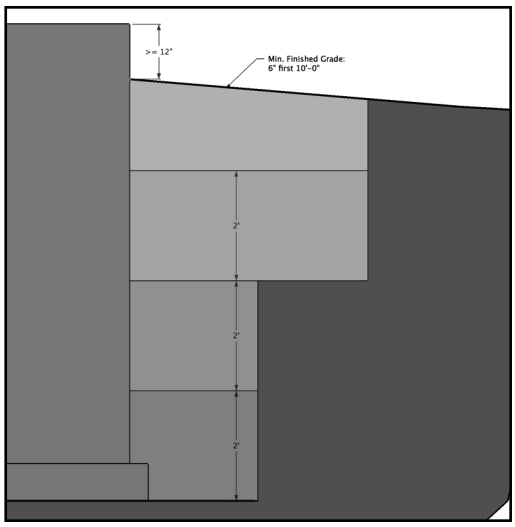

Fig 7: Backfill in tamped lifts and finish with proper slope

Finally, always leave the final grade with a positive slope away from the foundation. The top of grade must not be higher than 4-in. from the top of a foundation wall with masonry veneer or 6-in. in all other cases. The grade must then slope away (positive) from the foundation a minimum of six inches (6-in.) in the first ten feet (10-ft.). The greater the positive slope, the better maintenance of slope considering settlement.

Treating the foundation properly during the initial stages of construction, will pay dividends for the life of the house. For more information on residential foundations, visit the Concrete Foundations Association web site at www.cfawalls.org.

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