

# Contractor's Guide

# Retrofitting a Foundation

Lift the house safely with massive beams, and get the proper subs involved to ensure the new foundation will last

BY BRIAN BROPHY

Replacing a house's foundation can be a daunting task, but the work can restore a home's structural integrity and make it last for another century or more. After having retrofitted several foundations, I've settled on doing as much of the work as I can. I've found the work to be easier than expected, and the more I do myself, the more I profit. That said, when the work exceeds my expertise or comfort level, I sub it out. In the end, a handful of subs work on each project, including an engineer, an HVAC contractor, and a house-lifting company. The contractor's job is to keep the job site safe and the work moving by hiring quality subs and communicating clearly with them.

## Make the choice to retrofit

Most people would rather repair a foundation than replace it. However, certain situations call for a complete retrofit. In my experience, foundations fail mostly because they were not engineered properly for the soil condi-

tions around the house. Common sources of failure include weak bearing soil, which is not capable of properly supporting the weight of the house, or poor soil compaction, which creates voids. (For more on soil problems and solutions, see "Soil: The Other Half of the Foundation" in *FHB* #136 or online at Fine Homebuilding.com).

It is also important to pay attention to the foundation material itself. For instance, brick can deteriorate through a process known as spalling, and concrete can suffer sulfate attack, which can reduce its cohesion and strength.

Most of these failures can be detected visually, but I find it best to consult with an engineer whenever possible. An engineer can provide critical feedback that will steer the course of the work.

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## PROJECT AT A GLANCE

This farmhouse sat in a 300-acre vineyard two hours east of San Francisco for more than 100 years. It had been passed down through generations of grape growers. The original brick foundation finally reached critical failure. The brick itself was in decent shape, but all the mortar had disintegrated.

**Location:** Lockeford, Calif. • **Foundation length:** 140 lin. ft.

**Foundation height:** 6 ft. • **Type:** Concrete replacing brick

**Project length:** 15 days • **Project cost:** \$45,000

## GENERAL COST BREAKDOWN

**Engineer:** 9% (\$4050)

**HVAC/plumbing sub:** 5% (\$2250)

**Machinery rental:** 10% (\$4500)

**Material:** 10% (\$4500)

**House lift:** 15% (\$6750)

**Crew labor:** 20% (\$9000)

**Net income:** 31% (\$13,950)



## PROJECT JOURNAL

My greatest strengths as a contractor are my own crew and the relationships I have with my subs. Here is an outline of who completed each step of the project and when they were on site. A job of this scale hinges on a variety of site-specific factors, but by implementing a similar schedule in your own foundation-retrofit project, you will be more apt to stay on deadline and within your budget.

### DAY 1

**Disconnect all the ductwork** tied to the furnace and air-conditioning units. After the job is complete, the ductwork must be reconnected and the system recharged.

**Who's responsible:** HVAC subcontractor

**What to look for:** Be sure that the subcontractor temporarily seals all the ductwork openings prior to demo. This will keep the ducts—and the house—free of dirt, dust, and debris. In older homes, this is also a good opportunity to analyze the performance of the heating and cooling elements, and to replace them with more efficient models, if possible.

**Disconnect electrical and plumbing** runs to the main floor.

**Who's responsible:** Contractor's crew (electrical), plumbing subcontractor

**What to look for:** All the plumbing lines and electrical runs should be disconnected and secured so that they will not be damaged and so that they will not hinder the work under the house. If need be, remove any plumbing that will interfere with the location of the beams or the work necessary to get the beams in place. Plans should be made to replace the gas and septic lines when the foundation is removed. It is unlikely that there will ever be better access to these lines again, so take advantage of the opportunity to do the work, especially if the existing lines are dated. There will be lots of activity on the job during this phase of the project. The order in which the subs are called on site doesn't matter much, but be sure they're scheduled so that they're not forced to interrupt each other's workflow.

**Build the cribbing** necessary to support the structure, and install the steel I-beams with a crane. Lift the house with jacks, and stabilize it on cribbing.

**Who's responsible:** House lifters

**What to look for:** Be sure that the beams are placed in the correct position and that the load-bearing points of the structure are well supported. If the engineer has offered recommendations on beam placement, be sure that the house lifters' installation is in sync with that plan.



#### CONTRACTOR'S NOTE

The beams rolled under this house were lifted with individual 30-ton jacks. Some outfits use a unified hydraulic-jack system that raises and lowers the house evenly in one shot. Those systems require less labor, but the individual jacks that were used on this job work well, too.

## DAY 2

**Begin the excavation work** around the house.

**Who's responsible:** Contractor's crew

**What to look for:** Crew members should be comfortable with and capable of operating a rented Bobcat and mini-excavator. Someone should dig by hand around critical elements like gas or sewer lines. Be sure that enough space is created between the location of the foundation and the edge of the trench to work safely. Also, take measures to reduce erosion. There will be lots of soil on site for the duration of this project, and you don't want a rainstorm washing piles of dirt into the basement. Moving excess soil away from the trench and placing silt fence around each dirt pile is usually enough.

## DAY 3

**Excavation work continues.**

## DAY 4

**Begin foundation removal** after all excavation is complete.

**Who's responsible:** Contractor's crew

**What to look for:** Use the bucket on the mini-excavator to pull down large sections. Use the Bobcat to haul away all the material and to make room for the new footings. Work carefully around any existing gas lines or sewer lines. Remove the bricks in these locations by hand with sledgehammers and wrecking bars, never with machinery.

## DAY 5

**Foundation removal continues.**



**"Foundations fail mostly because they were not engineered properly for the soil conditions."**



### **CONTRACTOR'S NOTE**

*We create a trench wide enough, about 6 ft., to allow the Bobcat to drive down to the grade of the slab. This makes removing the old foundation material a lot easier. It also creates a large, safe working zone for those building the new footings and foundation walls.*

## **Consult an engineer**

always consult an engineer before I start foundation-retrofit work. It would be easy enough to let local codes dictate the details of a project, but the codes in my part of the country are rather lax. I want to be sure that my job is done right and that my work reflects the specific demands of the site. An engineer helps me to do that. My engineer offers guidance on everything from the temporary support-beam placement and footing construction to rebar and anchor-bolt placement.

Choosing the right engineer is imperative, but unfortunately, there isn't a formula to follow when deciding who is best. I've worked with the same engineer on every project, and the only recommendation I can offer is to find someone who has worked on house lifts before and whom you trust.

## DAY 6

**Finish foundation removal** and final cleanup of debris.

**Who's responsible:** Contractor's crew

**What to look for:** The job site should be clear of brick and any construction debris to make room for forming new footings.

## DAY 7

**Dig and form the new footings** for the foundation stemwalls.

**Who's responsible:** Contractor's crew

**What to look for:** Be sure that the overall dimensions of the footings are code-compliant and in tune with the engineer's recommendations. These footings are 24 in. wide by 24 in. deep and are reinforced with ½-in. rebar placed horizontally 3 in. from the top and bottom of the forms and vertically every 18 in.

*For more information on building square and level footings and walls, visit the Site Work and Foundations section under the How-to tab at [FineHomebuilding.com](http://FineHomebuilding.com).*



### CONTRACTOR'S NOTE

*Ideally, day 8 of the project will fall on a Friday, as it did on this job, so that the footings can cure through the weekend.*

## DAY 8

**Pour new footings.**

**Who's responsible:** Contractor's crew

**What to look for:** The grade of the footings is determined and marked with a transit and chalkline when the forms are built. Be sure that the crew is following the proper grade. Also, be sure that all the rebar is well supported; otherwise, it will sink to the bottom of the form when concrete is poured and reduce the strength of the footing. Rebar can be set atop metal chairs or dobies, or be suspended from above by wrapping the rebar with wire and attaching the wire to a furring strip nailed to each side of the form.



## DAY 9

**Build the forms** for the foundation stemwalls.

**Who's responsible:** Contractor's crew

**What to look for:** Check to be sure that all the walls are plumb, square, and level. All the rebar should be in place in accordance with the engineer's recommendations. Prior to the concrete truck's arrival, new anchor bolts should be hung from the mudsills by attaching a nut to each bolt.



### CONTRACTOR'S NOTE

*On this project, we built 140 lin. ft. of form using 2x4s for walers, 1½-in. plywood, and snap ties. You can certainly sub out this work, but building forms goes quickly. I've found that building forms costs less than hiring a concrete subcontractor to do the work.*

## DAY 10

**Formwork continues.**

## DAY 12

**Strip the forms**, and fill voids.

**Who's responsible:** Contractor's crew

**What to look for:** Use a trowel and masonry mortar to fill any honeycombing, or small voids between the aggregate. If larger voids form—on top of the wall in hard-to-reach areas, for instance—patch them with a 3000-psi concrete mix. The holes in the foundation that are left for beam removal will be patched later with a similar mix.

## DAY 13

**Lower the house** onto the new foundation walls.

**Who's responsible:** House lifters

**What to look for:** The most critical error that can occur when retrofitting a foundation is having the house lifters transfer the weight of the house from the beams to the new foundation too quickly. Let the foundation cure properly before the house is lowered, which may demand supplemental wetting over the course of a week if admixtures weren't used.

## DAY 14

**Patch access holes**, and reconnect all the mechanical, plumbing, and electrical systems.

**Who's responsible:** HVAC subcontractor and contractor's crew

**What to look for:** Assess the condition of all ductwork, plumbing lines, and electrical wires. This is the time to replace any damaged, dated, or questionable materials.

## DAY 15

**Backfill, compact, and regrade** the soil surrounding the new foundation.

**Who's responsible:** Contractor's crew

**What to look for:** The final grade of the site should slope down and away from the new foundation. This ensures that surface water will drain away from the foundation instead of settling alongside it.



### CONTRACTOR'S NOTE

I specify the driest concrete mix that my plant will supply for optimum strength and that will cure properly in my climate, which usually demands the use of additives. Drier concrete, however, sometimes leads to small voids in the wall after the forms are stripped.



### CONTRACTOR'S NOTE

This wall was damp-proofed using a spray-on product called Pene-Krete ([www.super-krete.com](http://www.super-krete.com)) before backfilling. If using a damp-proofing membrane, stop it 4 in. below final grade. Reduce installation errors by snapping a chalkline on the foundation wall at this height.

## DAY 11

**Pour foundation stemwalls.**

**Who's responsible:** Contractor's crew

**What to look for:** The concrete truck should have clear access to the foundation. Concrete trucks weigh a lot and have the ability to cause substantial damage to driveways, buried sewer pipes, and septic tanks. Keep the truck on solid ground.

Before the concrete starts to flow, spray all the forms with a release agent to make stripping the new walls easier. Minimize voids in the wall by ensuring that the concrete hose is at the bottom of the form, and by filling the form from the bottom up instead of letting concrete fall from the top of the form to the bottom. During the pour, shake the forms with a vibrating rod to help settle the concrete.

## RESOURCE LIST

If you're tackling this type of job in the future, check out these resources for more information.

### Working With Concrete

by Rick Arnold (*The Taunton Press*, 2003)  
Everything you need to know regarding concrete work, from site excavation to pouring to final grading.

### Upward Expansion

by Scott Grice and Michael Dobseavage (*FineHomebuilding.com*)  
A short video on the process of lifting a house using hydraulic jacks.

### For Pros by Pros:

**Foundations and Concrete Work**  
from the editors of *Fine Homebuilding* (*The Taunton Press*, 2008)  
A comprehensive resource on building foundations, including a chapter on retrofitting a foundation.