

Building an Addition to Your Home

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The construction of an addition generally follows the same [construction process](#) as any major renovation.

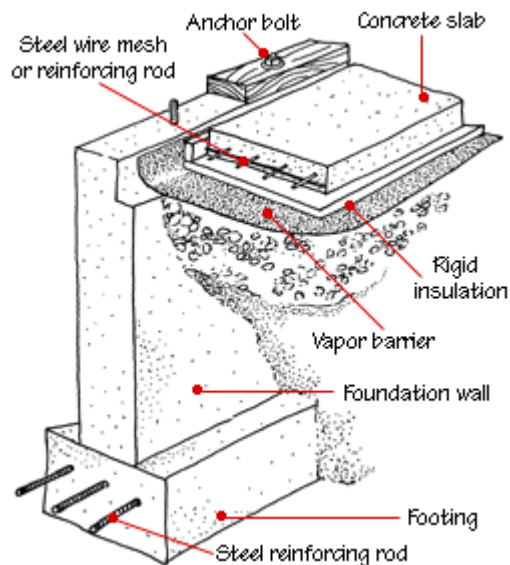
There are some differences, however. One difference we like is that where in the typical remodeling situation we have to deal with walls, floors, roofs and other structures already built by someone else, when building an addition, we get to build our own walls, etc. so we know they will be square, plumb, level and structurally sound.

The Foundation

A ground-level addition needs a foundation to shoulder its considerable weight, provide a flat and level base for construction and separate wood-based materials from contact with the ground — contact that would otherwise cause rot and allow infestation by termites and other wood-loving bugs.

By far the most common material for foundations is concrete, whether in the form of poured concrete or concrete block. Others include brick and stone.

Most additions rest on a raised, perimeter foundation that supports floors and load-bearing walls. There are two types: full perimeter and pier. A full perimeter foundation usually encloses either a basement or a crawl space or supports a slab. Pier foundations are almost always open structures — most suitable for storage buildings and vacation homes.



Conventional slab over poured concrete foundation.

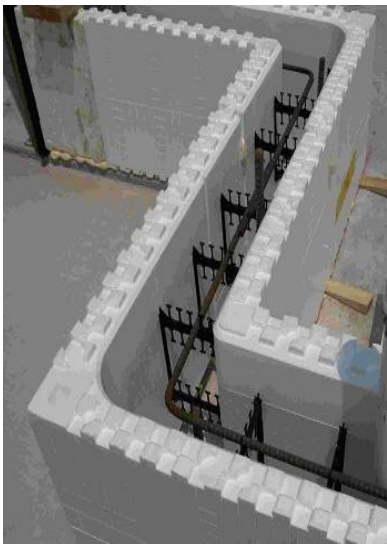
A block foundation is composed of 8" to 12" hollow concrete blocks bonded together with mortar and reinforced with rebar. This is a good, strong, foundation, generally less expensive but not as strong as poured concrete. Most of the cost of a poured concrete foundation is in the labor required to build the forms required to keep the wet concrete in place while it sets. In effect you are

building two walls to get one: the forms, then the concrete wall inside the forms. When the concrete sets, more labor is required to remove and haul away the forms.

The choice of foundation is affected by personal preferences and costs. Basements can add thousands of dollars to the cost of an addition compared to the cost of a crawlspace or slab. However, when you consider the extra usable space created by a basement it is some of the least expensive space in a home.

Insulated Concrete Forms

The problem with basements in Nebraska is they are hard to insulate and tend to leak after a time — sometimes a very short time. Leak-proofing is a matter of effective waterproofing and drainage. Both have come a long way in just a few years — so there is no longer much excuse for a leaking basement in suitable soil.



One type of ICF foundation

The problem of effective insulation has been much harder to solve. The difficulty is that concrete transfers heat much too well. One solution is to attach foam insulation to the inside of the wall, another is to frame a false wall inside the basement wall and fill the false wall with fiberglass. This can be pretty expensive since essentially you are building two walls to get one. And, at best, you will end up with a whole wall insulation value of about R-7. Not very good, which is why most basements in Nebraska feel cold and damp in winter.

Technology has come to the rescue, however, in the form of *Insulated Concrete Forms* for foundation construction (actually, you can build the entire addition with them if you like). ICFs are concrete forms made of high-density polystyrene foam that are simply left in place once the poured concrete has set. They insulate the wall starting at R-17 and going up from there, and result in between 25% and 50% energy savings over conventional poured concrete basement walls. In the recent Oak Ridge National Laboratory tests of various insulated wall structures ICFs were the best performers. (Read the report [here](#).)

The cost of ICF basements is about the same as that of a conventional poured concrete basement. The higher cost of the forms is offset by the savings in the labor required to erect the forms and by using less concrete — as much as 25% less with some ICF systems. But when compared to a concrete wall *and* applied insulation, the savings using ICF are substantial. As much as 20% over a conventional poured concrete basement. Combine this initial savings with the energy savings over the lifetime of the addition, and you are talking about one of the best construction bargains available today.

Wall and Roof Framing

Conventional wood framing, called "stick and batt" or stud-wall framing, uses a lot of wood and is very hard to insulate. New approaches have reduced wood waste, but the problem of making a conventional wall air tight has still to be solved. Once your foundation is in, we begin framing the walls and roof. There are a number of options for wall and roof building, from conventional stud framing to very "out there" approaches such as straw bale and rammed earth (we don't build any of these, by the way).

Conventional Framing

Since early in the 19th century, most residential construction framing has been stud or "stick and batt framing". Stick framing replaced heavy timber framing (or



Conventional framing uses a lot of wood and is very hard to insulate.

post and beam construction) which had been the staple wood building system since the beginning of recorded history. It started in Fort Dearborn, Illinois, a town of fewer than 100 inhabitants. After the invention of stick framing by Augustine Taylor in 1833, most houses in town were built using this innovative, easier, system. At the time, local builders thought the notion of light framing was so ludicrous that they ridiculed it as "balloon framing," saying the buildings were so light they would just float away in a good breeze. They didn't. In fewer than 60 years the town had a million inhabitants and had been renamed Chicago.

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Light wood framing is still a great structural system. Its only problems are that it takes a lot of wood and is so very hard to insulate and seal. The most common insulation material is fiberglass batts inserted into stud cavities and stapled to adjoining studs and plates. So ubiquitous is this combination of framing/insulation that it is commonly referred to as "stick and batt".

Traditional stick framing over builds and wastes lumber resources. A strong movement to less wasteful framing has been building for two decades and has been adopted as a recommendation by the U. S. Department of Energy. Known as "[Optimum Value Engineering](#)", it is a collection of advanced framing techniques that eliminate many wasteful practices that have become standard

over the years.

The effectiveness of stick framing has come into increasing question since the 1960s, and even the new OVE approach does not do much to allay these growing concerns.

- Lumber is continuing to increase in price and decrease in quality. Straight, high quality framing lumber is becoming scarce, and when available is getting very expensive. It has reached the point now that engineered lumber is becoming less expensive than traditional cut lumber, and is of much better quality. There is no likelihood that this situation is going to change for the better.

- Stick framed walls and roofs are very hard to effectively insulate (Read about it in [Whole Wall Insulation](#)). There are too many joints and gaps that permit air infiltration. Research has found that a space of as little as 1 millimeter inside a stud cavity is enough to start a convection current that transfers heat at an alarming rate. And insulation methods such as blown in or applied cellulose while more effective, are also considerably more expensive than the usual fiberglass batts.

- Conventional framed walls and roofs require a considerable amount of skilled labor and a lot of time to complete. Framing a house often takes two-three weeks during which time the entire structure is exposed to the elements. This exposure has been found to be a primary cause of mold infestation in new structures.

The solution to the problems of stick framing has been to abandon this 19th century technology and develop a whole new way of framing for the 21st century, most commonly called *structural insulated panel* framing.

Structural Insulated Panels

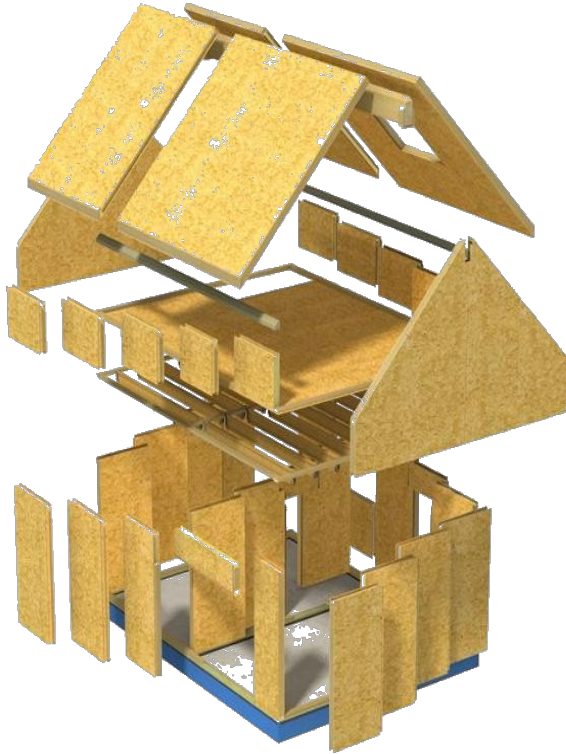
Structural Insulated Panels (SIPs) are prefabricated insulated structural panels used to frame walls, floors and roofs. They are made in a factory under controlled conditions and shipped to the job site, where they are joined together to construct the building.

They were first developed and tested by the Forest Products Laboratory of the United States Forest Service in 1935. Until about ten years ago, they were not in wide use. However, the SIP manufacturing industry has greatly expanded in recent years in response to increasing demand by builders for labor, material, and energy saving products.



Construction

A SIP is an engineered sandwich consisting a solid foam core 3.5 to 11.5 inches thick and structural facing (or sheathing on) each side. The facing is glued to the foam core under pressure. The foam in most products is similar to the Styrofoam in coffee cups. The most common facing materials are oriented strand board (OSB) and plywood, though manufacturers can customize the exterior and interior sheathing materials according to customer requirements.



SIP Panel Construction. Drawing:
[Dimension Canada.](#)

Speed of Construction

The speed of construction using SIP framing is much faster. Walls and roofs can be erected quickly, saving time and money, without compromising quality.

Strength

Testing has shown that a wall panel with two, half-inch thick OSB skins many times stronger than a conventional 2" x 4" stud wall.

Thermal Insulation

Structural Insulated Panels are usually constructed of an inner core of insulating foam and an outer skin of oriented strand board which creates a very strong, lightweight panel. The thickness of the inner core determines the R-Value of the panel. But the greatest advantage of these panels is that they provide superior and more uniform insulation and a more airtight dwelling. This makes the building

more comfortable, energy-efficient, and much quieter.

Recent tests conducted by the Oak Ridge National Laboratory (ORNL) found that SIP framing provides a much higher whole-wall R-value than a comparable stick framed house.

The study measured "whole wall" thermal transfer performance of SIP and conventional framed walls. Whole-wall measurements take into consideration heat loss due to seams and thermal bridging through wall studs, and are therefore more accurate than testing only the insulation material when measuring the R-values of buildings. A 4-inch SIP wall scored R-14 on the whole wall tests, compared to R-9.8 for a 2" x 4" stud frame wall. The results of whole-wall tests of 6-inch SIPs compared to 2" x 6" wood stud walls were similar. The

SIP wall scored R-21.6, while the wood stud wall scored a whole-wall R-value of 13.7. The most notable result was that *a 4" SIP wall out-performed a 6" conventional wall.*

These results are not that surprising, since SIP-built houses have fewer seams and therefore tend to be more airtight than stick-built houses. Also, since the insulation exists between two load-bearing panels, there is less framing needed in SIP building and therefore less thermal bridging through wall studs.

Comparative Cost

The cost of Structurally Insulated Panels is usually reported in the trade journals as "more than" an equivalent stick built wall. That is not our experience. If you look only at the cost of the materials delivered. It's true, SIPs are costlier. But then the walls have to be built. A conventional wall has to be framed, sheathed (pronounced "sheeted"), insulated and dry walled. A SIP has to be erected — something like stacking Leggos®. A typical addition using SIPs can be framed in two days by two carpenters, compared to about 10 days for conventional framing. After the framed wall is up and sheathed, it still has to be insulated, then it has to be dry walled. That's two additional craftsmen, more time, and more money.

It's hard to know for sure without building two identical structures side by side, one with SIP framing and one with conventional framing, but our experience suggests that the overall cost of building with SIPs is about 20% less than building conventionally — which does not sound like much until you realize that \$5,000 of framing will cost only \$4,000 using SIPs. That is a savings equal to the cost of two or three very nice cabinets for the new kitchen.