

Foundation Decision Tree

Options for Improving Basements and Crawlspaces

Basement and Crawlspacel Definitions

Unconditioned – The location is not mechanically conditioned. Any ducts in the space must be insulated.

Conditioned – The location is mechanically conditioned. Ductwork in the space is usually insulated but it is not required to be.

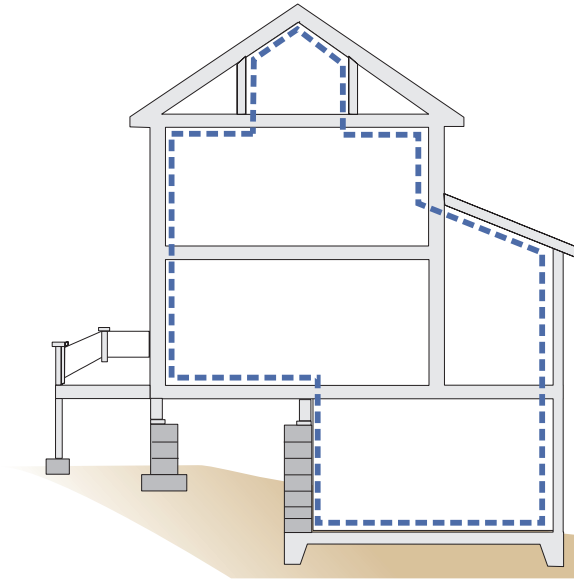
Indirectly Conditioned – The location is not directly mechanically conditioned but is indirectly conditioned due to thermal connectivity with directly conditioned spaces. Uninsulated ductwork in the space may cause it to be indirectly conditioned.

Finished Space – Full height locations that are livable. Finished spaces are usually directly mechanically conditioned.

Unfinished Space – The location is not a livable space. The space may or may not be full height but could be conditioned, indirectly conditioned or unconditioned.

Vented – If the enclosed space includes louvers or grills that allow outdoor air to freely pass through, it is a vented space and is not considered conditioned.

Unvented – If the space is unvented it could be conditioned, indirectly conditioned or unconditioned.



The Thermal Envelope

Determine where the best location for the thermal envelope exists in your home with a basement and/or crawlspace by assessing the objectives for the space. Do you want to safely store objects in a space with low humidity and temperature swings? If so, then consider sealing and insulating the wall system - making the space indirectly-conditioned. If the space dictates a ventilated approach then seal and insulate the floor to mitigate water and humidity issues.

Basements and crawlspaces represent two of the three main foundation choices for homes; the third option being slab on grade foundations.

Framed floor assemblies over basements and crawlspaces date back to a time before concrete slab foundations were common and are still employed today. The fundamental details usually consist of a wood framed joist assembly with subfloor material (e.g., diagonal 1x or plywood/OSB) and finished flooring material which serves as the main floor of the building.

Basements

A basement is usually an unvented, full-height space located underneath the framing of the main floor and may be considered **unconditioned, conditioned, or indirectly conditioned** and may also be either **finished or unfinished space**. A basement may also be considered “full” if it represents the entire footprint of the house and is entirely below grade on all sides. If situated on a sloped grade, it is often referred to as a daylight/walkout basement.

A basement commonly includes a concrete slab floor of which at least part is below-grade slab.

Crawlspaces

A closed crawlspace is a foundation with a typical clear vertical dimension less than standing height. Closed crawlspaces may be **vented or unvented**. Vented crawlspaces are always considered unconditioned spaces since they feature some type of louvered device that allows air to freely flow from outside to the crawlspace. Unvented crawlspaces are similar to short basements in that they can be either **unconditioned,**

conditioned or indirectly conditioned. Due to their height, crawlspaces are never considered finished (“livable”) spaces.

Access to the crawlspace may be through a hatch from the house interior but is more commonly through a small door in the exterior crawlspace walls. Raised, open crawlspaces are more commonly found in homes near water and are sometimes referred to as a “house on piers.” Some crawlspaces may be fully “open air” or may include some decorative lattice but they are highly vented and well connected to the outside.

Hybrids

A hybrid foundation is typically some combination of basement, crawlspace, cellar, etc. that may feature short foundation walls as well as full height spaces. Many older homes incorporate stairs from the main level down to the unfinished cellar where storage, combustion equipment such as water heaters, furnaces, utilities and laundry are located. Other hybrid foundations may include any combination of partial crawlspace abutting partial basements.

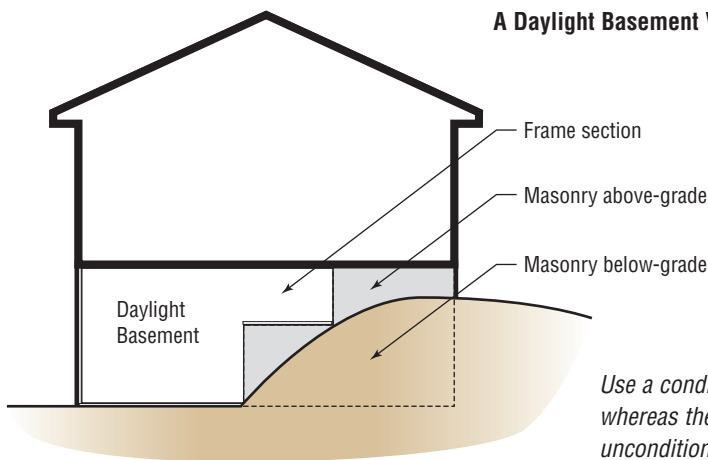
Make the Choice

The goal is to determine what type of foundation is present and create a plan to alter or improve the building thermal envelope. In general, if the space below the main floor is:

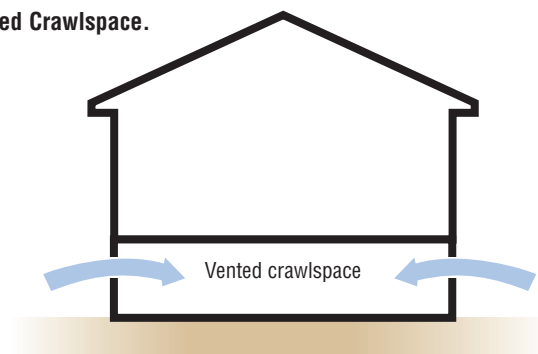
Conditioned, then the foundation **walls** should be well sealed and insulated. If any ductwork is present, insulating and sealing the ducts are less critical since they are inside the conditioned thermal envelope.

Alternatively, if the space below the framed floor is:

Unconditioned, then the **floor overhead** should be carefully sealed and insulated. If a duct system is present, insulating and sealing it is extremely crucial since the ducts will likely leak and lose conditioned air to this location outside the thermal envelope.



A Daylight Basement Versus a Vented Crawlspace.



Use a conditioned approach in daylight basements with walls sealed and insulated, whereas the vented crawlspace will likely be airsealed and insulated at the floor and remain unconditioned.

Basements

If the basement is finished, the space is considered conditioned. If the basement is unfinished it could still be conditioned or indirectly conditioned if the walls are sealed and insulated. Because ductwork and mechanical equipment are commonly installed in this location, it makes sense from an energy standpoint to at least consider insulating and air sealing the basement walls and to safely bring the mechanical system and ductwork inside the building thermal envelope.

Advantages of bringing the basement inside the thermal envelope include:

- Ductwork and air handler losses are minimized
- Piping is less likely to freeze
- Overhead main floor is usually warmer in winter and experiences fewer drafts
- Insulation/air barrier on basement walls is usually easier and more effective than underfloor efforts
- Cooling benefit in the summer due to ground coupling of the space
- Storage of items in a more stable environment
- Future renovations necessitating a finished habitable space are already on the right track

Disadvantages

- Radon risk may increase since basement is now connected to the house*
- Combustion appliances should not draw combustion air from basement**
- Any basement moisture problem would be more directly connected to the house

Crawlspaces

All crawlspace floors need a sealed 6 mil vapor barrier, but is venting a crawlspace a good idea? Not necessarily.

While the vents provide combustion air for standard combustion equipment and might help to mitigate a possible radon problem, the truth is that venting outside air into a crawlspace carries several liabilities as well. Particularly in a humid climate, venting outside air does not actually dry out the crawlspace and in most cases actually makes it worse by increasing the risks for mold growth and termite infestation. Vents also provide an easier pathway for insects and pests to enter a crawlspace.

The classic vented crawlspace experiences extremely cold and dry air in the winter which fosters cold drafts in the living space. Vented crawls also encounter warm humid air entering during the summer. This cycling often causes the framing members, subfloor and finished flooring to experience significant biannual moisture swings that can result in shrinking and cracking during the dry periods and swelling and buckling during the humid months.

An enclosed, unvented crawlspace with insulated walls, proper exterior drainage and that receives a small amount of conditioning (e.g., a dedicated dehumidifier) tends to maintain more constant conditions and minimizes risk of mold, pests and other moisture problems. Heat pumps or high efficiency furnaces (that supply their own combustion air) with ductwork located inside this “conditioned crawl” perform well and save energy over a standard vented crawlspace.

*For radon information, visit the EPA website: www.epa.gov/radon.

**See the *Basement and Crawlspace* recipe card for a discussion on combustion safety.