

Oregon

Interpretive Ruling No. 96-12

CRAWL SPACE PERIMETER INSULATION ALTERNATE METHOD

REQUESTED BY: Oregon Building Industry Association.

REQUEST FOR RULING: An interpretive ruling is requested to allow the use of a perimeter insulated crawl space system for low rise residential dwellings as an alternative to the under-floor insulation requirements located in Section E401 of the 1996 Oregon One and Two Family Dwelling Specialty Code (Dwelling Code).

CODE SECTIONS: 1996 Dwelling Code Section E401 references **Table E401.1a, Prescriptive Compliance Paths for Residential Buildings**, and **Table E401.1b, Residential Thermal Performance Calculations**, which require a minimum of R-21 insulation in floors under conditioned spaces. 1996 Dwelling Code **Section 409.1, Crawl Space Ventilation**, provides for ventilation openings in foundation walls of crawl spaces as a passive system. Ventilation openings in under-floor crawl space areas may be omitted when this space is mechanically ventilated pursuant to Section 409.1 Exception 5 as follows:

"Ventilation openings may be omitted when continuously operated mechanical ventilation is provided at a rate of 1.0 cfm for each 50 square feet (1.02 L/s for each 10 m²) of crawl space floor area and ground surface is covered with an approved vapor barrier material. Supply air shall be provided from outdoors or from the conditioned space. An exhaust opening equal in size to the supply opening shall be provided. Vertical ducts extending to the outdoors shall be turned down or fitted with a rain cap. All vent openings shall be covered with wire mesh as specified in this section."

BACKGROUND: The energy conservation requirements in the 1993 Dwelling Code resulted in a number of enforcement and construction problems in residential structures. These problems still persist with implementation of the current code, which are generally summarized as follows:

- * **Moisture Problems** - Installation of the insulation at the time the floor system is framed frequently results in moisture accumulating in the insulation before it can be protected from the elements (rain, dew, etc.). This moisture is difficult to remove. Problems with finished floor materials, particularly hardwood flooring, result from this condition. Moreover, moisture problems can also occur when the under-floor insulation is installed before the interior wall gypsum sheathing work (drywall, sheetrock, etc.) is complete. The gypsum sheathing finishing process introduces high moisture levels within the structure.
- * **Enforcement Problems** - Although Interpretive Ruling 92-3 allows the builder to decide when to have the under-floor insulation installed, several jurisdictions strongly recommend that it be installed before the subfloor is installed to accommodate inspection. Many jurisdictions may not inspect the under-floor insulation after the subfloor is installed unless a tall crawl space area exists.

- * Damage to construction elements - Regardless of when the insulation is installed, difficulty in maintaining the integrity of the various construction elements is an ongoing problem, particularly where low crawl space heights occur. Forced air supply duct systems must be installed prior to the enclosure of the crawl space. Installing the under-floor insulation later in the construction process frequently results in damage to the duct system. By comparison, trades that do work after the under-floor insulation is installed frequently diminish the integrity of the under-floor insulation.

The energy conservation requirements in the 1993 Dwelling Code also increased concerns about the indoor air quality. A proposal was crafted to require whole-house mechanical ventilation systems for all low rise residential structures and was presented in 1993 to the previous Oregon Energy Conservation Board (ECB) for adoption. After a comprehensive review, ECB recommended adoption of the whole-house ventilation requirements for all low-rise multi-family structures but disapproved these requirements for one and two family dwellings. The multi-family ventilation requirements became effective on April 1 of last year in the 1996 Oregon Structural Specialty Code (OSSC). The 1996 Dwelling Code does not require indoor air quality ventilation systems, except where certain equipment and/or combustion systems are installed. Concurrently, the United States Environmental Protection Agency (EPA) working with the National Association of Home Builders jointly developed a proposal for radon control methods for incorporation as an appendix chapter in the CABO One and Two Family Dwelling Code. These guidelines were incorporated on April 1 of last year in the 1996 Dwelling Code.

DISCUSSION: The Energy Committee considered this proposed alternate method and recommends its adoption. The committee formed a technical subcommittee to analyze the energy impacts of the proposed system relative to an underfloor insulation system. The technical subcommittee used the same computer model that was used to analyze the energy savings from the other provisions of the code. The analysis indicated that the proposed system could result in a range of energy impacts but that the model and the uncertainty of the inputs to the model limited the accuracy of the results. Several specific issues were addressed as follows:

1. The height limitations of the crawl space are proposed at 6 feet at any point. Concerns were raised that a 3-foot limit should be established to control thermal loss. The 6-foot proposed limit assumes that the 6-foot condition will only occur when a structure is located on a hill. In such a case, the average crawl space height will actually be approximately 3 feet.
2. The sealing requirements of the foundation sill plates to the foundation may be made by any number of methods. The concern being addressed is to ensure that air exfiltration from the crawl space is prevented.

Concerns about the quality of indoor air in family residences remains high with two new proposed code changes submitted this year related to ensuring proper indoor air quality. This interpretive ruling utilizes the strategy incorporated into the 1996 OSSC whole house ventilation system requirements for low-rise multi-family dwellings. Both the ventilation requirements for the conditioned space and the ventilation rate for the crawl space are currently included in the 1996 OSSC. By reusing the exhaust air from the conditioned space to ventilate the crawl space, a buffer space is created between the conditioned space and the outdoors. Reliance on a passive

ventilation system as required in 1996 Dwelling Code Section 409.1 is avoided with the use of this interpretive ruling. A passive system is more likely than not to be closed during the cold winter months, thus increasing the potential for soil gases, such as radon, to enter the living space. Placement of the passive stack vent within the conditioned space will enhance the function of stack effect. Outdoor inlet duct damper requirements in the alternate method are based on indoor air quality provisions of Oregon Structural Specialty Code, Chapter 12.

The Energy Committee concluded that the proposed system is expected to result in energy performance equivalent to the current underfloor requirements.

The Building Codes Structures Board considered this ruling and initially approved it at the March 1997 board meeting. Following the board's approval, two significant issues were raised by staff and board members that required further investigation:

1. The Dwelling Code electrical provisions prohibit the occupancy ventilation fan from being connected to the heating system circuit; and
2. If excessive moisture is present in the crawl space, elevated levels of microorganisms could develop and be entrained into the occupied spaces of the dwelling.

The first issue involves the requirement to connect the occupancy ventilation fan to the furnace circuit. This provision was intended to discourage occupants from disabling the fan. Alternate language was developed to accomplish this intent by requiring the fan to be connected to a lighting or receptacle circuit.

The Administrator solicited and received input from both the Oregon Health Division and the Oregon State University Extension Energy Program regarding the health concerns of the second issue. No information is available about whether the proposed alternate method of construction has occurred in Oregon. Therefore, it is difficult to estimate how often a hazardous situation might occur. For example, the Oregon Health Division believes the risk of a problem is likely to be low in many areas east of the Cascades. Also, houses built on elevated and sloping terrain, that have properly designed foundation drainage systems, are not expected to have a problem using this method. Nevertheless, there are areas in the state where standing water and high water tables pose a serious problem. In such an area with excessive moisture problems, unless otherwise mitigated this alternate method should not be allowed.

Because excessive moisture problems associated with high water tables and standing water in crawl spaces are site specific issues, local building officials should be charged with implementation of this alternate method only with their approval. Therefore, building officials should have the authority to require underfloor insulation pursuant to the Dwelling Code where standing water is known to be a concern.

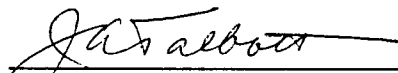
Because this type of construction has not been documented in Oregon, the use of this alternate method should be monitored. These two issues, regarding excessive moisture and documentation, were therefore incorporated into the ruling.

FINDINGS:

- * 1996 Oregon One and Two Family Dwelling Specialty Code Section 108, Alternate Materials and Systems, allows acceptance of an alternate which achieves the intent of the code and provides equivalent effectiveness and safety for occupants and property.
- * This interpretation is authorized by ORS 455.060, Rulings on Acceptability of Materials, Designs or Methods of Construction, and Attorney General's Opinion OP-5208, issued October 1, 1981, which advised the statute permits authoritative interpretations of code requirements.
- * This interpretive ruling provides the equivalent energy effectiveness of under-floor insulation required in the 1996 Dwelling Code Section E401.
- * This interpretive ruling provides equivalent safety for occupants and property as required in the 1996 Dwelling Code.

CONCLUSION:

The Building Codes Structures Board accepts the recommendation of the Energy Committee, and the findings listed above.



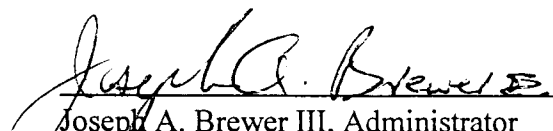
John A. Talbott, P.E., Chairman
Building Codes Structures Board

October 6, 1997
Date

RULING: The recommendations and findings of the Building Codes Structures Board are accepted and the following interpretive ruling that establishes an alternate method for 1996 Oregon One and Two Family Dwelling Specialty Code Section E401 is adopted:

CRAWL SPACE PERIMETER INSULATION ALTERNATE METHOD

For building sites determined by the building official as not normally having standing water present in the crawl space, this Alternate Method shall be approved. This Alternate Method provides at least the equivalent effectiveness of under-floor insulation required in the 1996 Oregon One and Two Family Dwelling Specialty Code (Dwelling Code) Section E401 in crawl space areas in residential structures three stories or less in height which are mechanically ventilated by use of a whole house ventilation system installed in accordance with the requirements that follow.



Joseph A. Brewer III, Administrator
Building Codes Division

October 8, 1997
Date

SECTION 1 - DEFINITIONS

- 1.1 **OCCUPANCY VENTILATION:** General ventilation which introduces outside air to the living space to ensure indoor air quality for the building occupants.
- 1.2 **CONDITIONED SPACE:** The space within a dwelling which is conditioned directly or indirectly by the operation of a heating or cooling appliance. Crawl spaces which are mechanically ventilated with occupancy ventilation are not considered to be conditioned space.

SECTION 2 - CRAWL SPACE SYSTEM

- 2.1 **General.** The use of this perimeter insulation alternate method is only allowed when all of the following occur:

2.1.1 **Mechanical ventilation.** The crawl space is mechanically ventilated with occupancy ventilation as provided in Section 3.1 below, but not less than the requirements of the Dwelling Code, Section 409.1, Exception 5, as follows:

"Ventilation openings may be omitted when continuously operated mechanical ventilation is provided at a rate of 1.0 cfm for each 50 square feet (1.02 L/s for each 10 m²) of crawl space floor area and ground surface is covered with an approved vapor barrier material. Supply air shall be provided from outdoors or from the conditioned space. An exhaust opening equal in size to the supply opening shall be provided. Vertical ducts extending to the outdoors shall be turned down or fitted with a rain cap. All vent openings shall be covered with wire mesh as specified in this section."

2.1.2 **Occupancy ventilation.** Ventilation of the crawl space is achieved by use of a mechanical ventilation system which delivers the required occupancy ventilation from the habitable space to the crawl space pursuant to Section 3.

2.1.3 **Height limitations.** The height of the crawl space shall not exceed 6 feet (1829 mm) at any point (measured from the ground to the bottom of the floor framing system excluding any girders).

SECTION 3 - OCCUPANCY VENTILATION

- 3.1 **Ventilation Fan.** A continuously operated occupancy ventilation fan capable of exhausting a minimum of 0.35 ACH from the conditioned space shall be installed pursuant to this section and the mechanical and electrical provisions of the Dwelling Code. The fan duct opening shall be placed in a centrally located area within the habitable space and shall deliver conditioned air to the crawl space. The fan shall be energized by connection to a lighting or receptacle circuit with no intervening switch, other than the disconnect required by the electrical provisions of the Dwelling Code.

Fans shall have a sone rating of 1.0 or less, except fans located in the crawl space. All fans shall be rated for continuous duty.

Exception: The duct opening may be placed in a central hallway that is open to the main living area.

- 3.2 Central Forced-air heating systems.** Occupancy ventilation shall be integrated with a central forced-air heating system. A 6-inch (152 mm) diameter or equivalent outdoor air inlet duct of not more than 35 feet (10 668 mm) in length, shall connect to the return air plenum within 6 feet (1829 mm) of the air handler/blower fan cabinet. The outdoor air inlet duct shall have a damper or air-flow regulator which limits total outdoor air inlet flow rates from 100 to 140 percent of the occupancy ventilation rate specified in Section 3.1 under normal operating conditions.
- 3.3 Outdoor air inlets requirements.** Outdoor air inlets for occupancy ventilation shall be screened with wire mesh according to Dwelling Code Section 409.1 or otherwise protected from entry by insects, leaves or other material. Outdoor air for a ventilation system shall not be taken from the following locations:
1. Closer than 10 feet (3048 mm) from an appliance vent outlet, unless such vent outlet is at least 3 feet above the outdoor air inlet.
 2. Closer than 10 feet (3048 mm) from a vent opening of a plumbing drainage system unless such vent outlet is at least 3 feet (914 mm) above the outdoor air inlet.
 3. Attics, crawl spaces or garages.
- 3.4 Insulation of outdoor air supply ducts.** Untempered outdoor air supply ducts in conditioned spaces shall be insulated to a minimum of R-4.

SECTION 4 - CRAWL SPACE REQUIREMENTS

- 4.1 Passive Stack Vent.** A passive stack vent equal in size to the occupancy ventilation fan duct, but not less than 4 inches (102 mm) in nominal diameter, shall be installed from the crawl space vertically through the roof to the outside. The passive vent shall be located a minimum of 15 feet (4572 mm) from the location of the supply opening and shall not be installed in an exterior wall. Vertical ducts extending to the outdoors shall be turned down or fitted with a rain cap. All vent openings shall be covered with wire mesh as specified in Dwelling Code Section 409.1.
- 4.2 Insulation required.** Crawl space walls, rim joist areas and cripple walls extending above the foundation sill height, shall be insulated to the minimum requirements of the Dwelling Code Section E401.1 for walls enclosing conditioned space. Where attached to concrete or masonry walls, the insulation shall be a rigid type material tightly fitted with fasteners, adhesives or combination thereof extending from the top of the foundation sill to the top of the foundation footing. When applicable, the requirements for foam plastic insulation in Dwelling Code Section 317 shall be met.

- 4.3 Furnace duct insulation.** Furnace ducts located within perimeter insulated crawl spaces shall be insulated to a minimum of R-4.
- 4.4 Sealing requirements.** Air exfiltration shall be prevented by sealing foundation sill plates to the foundation. Exterior wall sheathing or siding materials shall be sealed to the exterior concrete wall or sill plate with caulking, gasketing or other approved methods. No openings, other than underfloor drains, are allowed from the foundation walls to the crawl space unless they are sealed to prevent exfiltration.
- 4.5 Installation and inspection.** Insulated crawl space walls shall be installed and inspected prior to the placement of the decking or subfloor. Insulation of cripple walls and rim joist areas may be installed and inspected prior to the final inspection.
- 4.6 Floor sealing.** Floors shall be sealed in accordance with the Dwelling Code Section E401.8.2 and a vapor barrier shall be installed in accordance with Section E401.9.1, Item 3, even though insulation is not provided.
- 4.7 Ground cover.** Ground cover shall be installed in the crawl space in accordance with the Dwelling Code Section E401.9.2.

SECTION 5 - DOCUMENTATION REQUIREMENTS

- 5.1 Permit submittal.** Upon approval of a permit for any project that uses this alternate method, a copy of the approved permit shall be submitted to the Building Codes Division's Dwelling Program at the following address:

State of Oregon
Building Codes Division
Dwelling Program
1535 Edgewater Street NW
PO Box 14470
Salem OR 97309

Note: See the attached Reference Figure 1 which is not a part of this ruling, but is provided for the reader's convenience.

Interpretive Ruling 96-12
 Reference Figure 1

