THE PATRIOT FILES

Closed Crawl Spaces: Where the Building Code Needs Another Look

How IRC R408.3 is being applied to existing-home repairs in the humid Southeast, what the DOE-funded field research actually measured, and how the existing-building code's repair, maintenance, and alteration classifications are meant to work.

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A repair, not a retrofit. Contaminated insulation, fungal growth, and deteriorating framing in a low coastal Virginia crawl space. The homeowner called for sanitation and structural repair; the code was applied as if this were new construction.

Summary

Closed crawl spaces are one of the most important advances in residential moisture control of the past twenty-five years. The provisions that codified them, IRC R408.3, were adopted in 2004 as a new-construction checklist. This paper examines what happens when that checklist is applied to repair and maintenance work on existing homes in the hot, humid Southeast, where most closed crawl space work is housing preservation: removing mold, rodents, and contaminated insulation, repairing rotted framing, and controlling moisture.

In many jurisdictions, sealing foundation vents, installing a ground vapor barrier, or adding mechanical drying to an existing crawl space is classified as an alteration, and that classification is used to require the full R408.3 assembly, including a sealed wall liner and foundation wall insulation. The paper reviews the field research behind R408.3, the concerns raised at the time of adoption, the practical consequences in a two-foot coastal crawl space, and the existing-building code provisions that already distinguish repair and maintenance from alteration.

Key findings

- In Advanced Energy's DOE-funded Phase III field study (2005), crawl spaces closed with an unsealed, overlapped ground vapor retarder, no wall liner, and 35 cfm of supply air averaged about 11% wood moisture, against 10.4 to 10.7% for fully sealed designs and 14.5% for the vented control. The report describes the simpler assembly as having "quickly exhibited performance similar to that of the other closed crawl space designs" [1].
- A 2004 HUD-funded review of building moisture research found the new IRC provisions "exacting and performance-oriented which will not facilitate their use," and called for field testing to identify "the essential site, design, and construction details" [2].
- Installers interviewed by Advanced Energy in 2005 reported that cost "could be prohibitive for average homeowners" and warned of "overselling the system" when the goal "was simply to create a crawl space that was reliably dry" [3].
- Advanced Energy's own Southeast guide states that the North Carolina code "does not define a closed crawl space as requiring a sealed vapor retarder" and that it is "inappropriate to require code officials to use such a stringent, yet vague, standard for enforcement" [4].

- Oak Ridge National Laboratory's foundation insulation modeling recommends no more than two feet of R-5 interior wall insulation for unvented crawl spaces in the 2,000 to 4,000 heating-degree-day band that includes Hampton Roads; R-10 is not recommended in that band at any fuel price [5].
- North Carolina's R409 requires a ground vapor retarder lapped twelve inches, permits but does not require a sealed liner, and recognizes five drying methods [6].
- Virginia DHCD's 2018 Resiliency Impact Analysis found that added repair cost "could be significant and prohibit owners from repairing the affected buildings" and concluded that "any level of repair is better than no repairs at all" [7].
- The existing-building framework already distinguishes repair, maintenance, and alteration. Classification must come before the choice of prescriptive requirements.

1. The work being regulated

Most crawl space projects on existing homes in the humid Southeast are not energy upgrades. They are sanitation, pest control, structural repair, and moisture control. The typical case is a house with contaminated fiberglass insulation, fungal growth on the framing, rodent activity, deteriorating ductwork, and wood moisture driven up by summertime condensation. The homeowner's objective is to remove the contamination, repair the damage, and keep it from coming back.

Much of this work takes place in crawl spaces twenty to twenty-four inches high throughout, with masonry piers, extensive ductwork, and limited access. These are middle-class homes whose owners cannot absorb an unplanned $20,000 to $30,000 repair. When the price of the work rises past what they can finance, the practical outcome is that nothing is done. The mold stays, the rodents stay, and the framing continues to deteriorate.



Figure 1. Left: fungal growth on floor framing. Right: fiberglass floor insulation with rodent nesting. Both are typical of the conditions that bring a contractor under an existing coastal Virginia home. Photos: Patriot Crawl Space Repairs.

Closed crawl spaces are usually discussed in the context of green building and high-performance construction. Those are legitimate applications. Existing-home restoration is a different kind of work with a different purpose, and the construction requirements that apply should follow from that purpose.

2. What R408.3 requires, and how it is being applied

The International Residential Code addresses unvented crawl spaces in Section R408.3. The section requires exposed earth to be covered with a Class I vapor retarder with joints overlapped six inches and sealed or taped, with edges extending up the stem wall and attached and sealed to it; one of several drying methods, including conditioned supply air with a return pathway or a dehumidifier; and, for the mechanical options, perimeter wall insulation in accordance with the energy chapter.

R408.3 Unvented crawl space. INSIGHTS (2)

For unvented under-floor spaces, the following items shall be provided:

1. Exposed earth shall be covered with a continuous Class I vapor retarder. Joints of the vapor retarder shall overlap by 6 inches (152 mm) and shall be sealed or taped. The edges of the vapor retarder shall extend not less than 6 inches (152 mm) up the stem wall and shall be attached and sealed to the stem wall or insulation.
2. One of the following shall be provided for the under-floor space:
   - 2.1. Continuously operated mechanical exhaust ventilation at a rate equal to 1 cubic foot per minute (0.47 L/s) for each 50 square feet (4.7 m^2) of *crawl space* floor area, including an air pathway to the common area (such as a duct or transfer grille), and perimeter walls insulated in accordance with Section N1102.2.10.1 of this code.
   - 2.2. *Conditioned air* supply sized to deliver at a rate equal to 1 cubic foot per minute (0.47 L/s) for each 50 square feet (4.7 m^2) of under-floor area, including a return air pathway to the common area (such as a duct or transfer grille), and perimeter walls insulated in accordance with Section N1102.2.10.1 of this code.
   - 2.3. Plenum in existing structures complying with Section M1601.5, if under-floor space is used as a plenum.
   - 2.4. Dehumidification sized in accordance with manufacturer's specifications.

Figure 2. IRC R408.3, unvented crawl space. Item 1 specifies the sealed ground vapor retarder attached to the stem wall; items 2.1 and 2.2 require perimeter wall insulation; item 2.4 permits a dehumidifier. Verify against the edition adopted in your jurisdiction.

These provisions were adopted in the 2004 supplement and function as a clear compliance checklist for new construction. The problem is how they are applied to existing homes. In many jurisdictions, sealing the foundation vents, installing a ground vapor barrier, or adding moisture control to an existing crawl space is classified as an alteration. That classification is then used to require the full new-construction assembly, including the sealed wall attachment and wall insulation, on what is a repair and maintenance project.

> **From a written Virginia code interpretation:** "Is a permit required to air seal foundation vents and access openings? Answer: Yes, this would be an alteration. See VEBC Section 601.1."

The result is that ordinary sanitation and structural repair work becomes a high-performance retrofit, at a cost difference that in this market commonly runs several thousand dollars per house.

3. What the field research showed

Beginning around 2000, Advanced Energy, with support from the U.S. Department of Energy, studied vented and closed crawl spaces in a set of homes in Princeville, North Carolina. The work established that code-compliant vented crawl spaces perform poorly under hot, humid conditions, and that closed crawl spaces maintain substantially lower humidity and wood moisture. Those findings led directly to the 2004 provisions [1].

The same study also tested a simpler closed configuration. In Phase III, beginning in June 2004, three previously vented control homes were converted by sealing the foundation vents, leaving the existing ground vapor retarder unsealed with joints overlapped six to twelve inches, installing no wall vapor retarder, retaining the R-19 floor insulation, and supplying 35 cubic feet per minute of conditioned air.

Phase III operated from June of 2004 through mid-December 2004. Three of the control crawl spaces were converted to a new variant of closed crawl space design, called experiment group 3 (Figure 9). Experiment group 3 had all vent openings to the outside plugged with rigid foam board (2" Dow Thermax foil-faced polyisocyanurate insulation) and sealed with caulk or mastic. The ground vapor retarder was left un-sealed (joints remained overlapped by 6-12 inches) and there was no vapor retarder installed on the crawl space perimeter walls. The R-19 fiberglass batt insulation was retained in the framed floor structure, and a supply duct identical to those used in the experimental homes was installed and set to deliver the same 35 cubic feet per minute of conditioned air as in the other experiment group crawl spaces. 110 Lowe's Ct. was left as a vented crawl space control home due to its involvement in the ORNL hygrothermal study. The experiment group 1 and experiment group 2 crawl spaces were not modified at this time.

Figure 3. Phase III experiment description. Advanced Energy, *Field Study Comparison of Ventilated Versus Sealed Crawl Spaces in the South*, final report to DOE, June 22, 2005, p. 15 [1].

At the August 2, 2004 reading, the simplified closed crawl spaces averaged about **11%** wood moisture content. The fully sealed closed designs, with and without wall insulation, averaged **10.4 to 10.7%**. The remaining vented control averaged **14.5%**. The report states that the converted homes "quickly exhibited performance similar to that of the other closed crawl space designs" [1, p. 88].

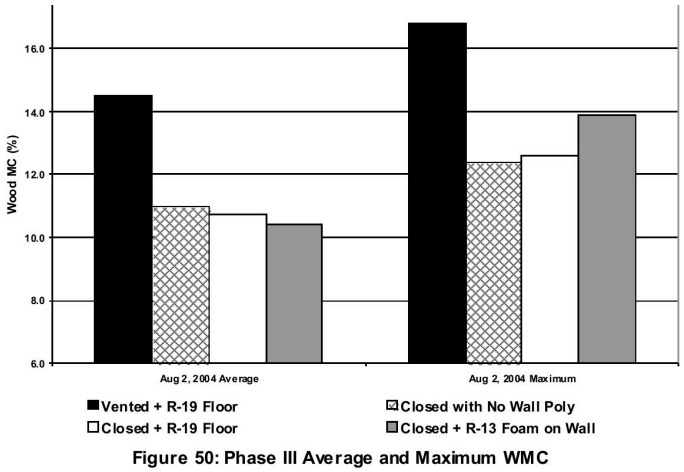


Figure 50: Phase III Average and Maximum WMC

Figure 4. Figure 50 from the Phase III report: average and maximum wood moisture content, August 2, 2004, for the vented control and three closed configurations, including "Closed with No Wall Poly" [1, p. 88].

Additional sealing lowered crawl space air humidity further. It did not produce a meaningfully drier structure at the measurement that governs durability. The report's conclusions note that the closed designs reduced wood moisture by about 30 percent relative to the vented controls [1, p. 109]. This was a limited field study of a small

number of homes, and it does not establish that an unsealed liner is appropriate everywhere. It does establish that a simpler closed assembly kept framing dry under the conditions tested, which is the question that matters for an existing-home repair in the same climate.

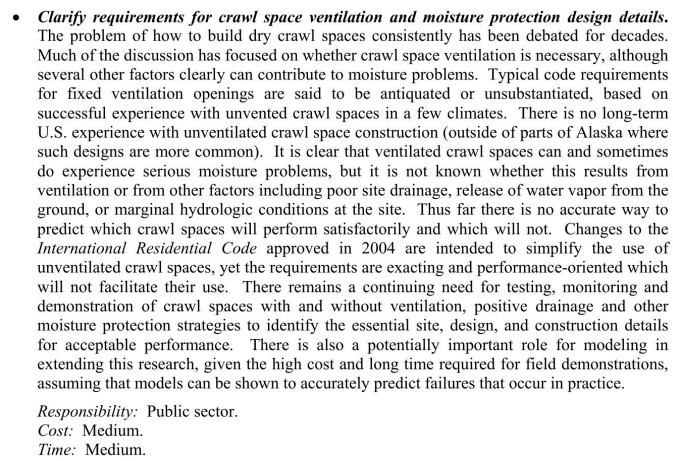
4. Concerns raised at the time of adoption

The cost and complexity of the 2004 provisions were identified early, by the researchers and by the agencies that funded them.

HUD, October 2004

A review of building moisture research prepared for HUD's Office of Policy Development and Research discussed the new IRC provisions directly:

> *"Changes to the International Residential Code approved in 2004 are intended to simplify the use of unventilated crawl spaces, yet the requirements are exacting and performance-oriented which will not facilitate their use. There remains a continuing need for testing, monitoring and demonstration of crawl spaces with and without ventilation, positive drainage and other moisture protection strategies to identify the essential site, design, and construction details for acceptable performance."*
>
> Building Moisture and Durability: Past, Present and Future Work, prepared for HUD, October 2004, p. 16 [2]



- ***Clarify requirements for crawl space ventilation and moisture protection design details.*** The problem of how to build dry crawl spaces consistently has been debated for decades. Much of the discussion has focused on whether crawl space ventilation is necessary, although several other factors clearly can contribute to moisture problems. Typical code requirements for fixed ventilation openings are said to be antiquated or unsubstantiated, based on successful experience with unvented crawl spaces in a few climates. There is no long-term U.S. experience with unventilated crawl space construction (outside of parts of Alaska where such designs are more common). It is clear that ventilated crawl spaces can and sometimes do experience serious moisture problems, but it is not known whether this results from ventilation or from other factors including poor site drainage, release of water vapor from the ground, or marginal hydrologic conditions at the site. Thus far there is no accurate way to predict which crawl spaces will perform satisfactorily and which will not. Changes to the *International Residential Code* approved in 2004 are intended to simplify the use of unventilated crawl spaces, yet the requirements are exacting and performance-oriented which will not facilitate their use. There remains a continuing need for testing, monitoring and demonstration of crawl spaces with and without ventilation, positive drainage and other moisture protection strategies to identify the essential site, design, and construction details for acceptable performance. There is also a potentially important role for modeling in extending this research, given the high cost and long time required for field demonstrations, assuming that models can be shown to accurately predict failures that occur in practice.

  Responsibility: Public sector.
  Cost: Medium.
  Time: Medium.

Figure 5. The crawl space research item from the HUD report, p. 16 [2].

Advanced Energy installer interviews, 2005

In the summer and fall of 2005, Advanced Energy interviewed nine North Carolina closed crawl space installers for a second DOE-funded project. The final report, submitted in January 2008, summarizes their views:

> *"One respondent, however, felt that there was a possibility of overselling the system. Most noted that the cost of closed crawl spaces could be prohibitive for average homeowners. This interviewee pointed out that the goal of this construction was simply to create a crawl space that was reliably dry, and that this might be achieved by methods besides closing it off. He suggested finding and advocating a middle ground between traditional ventilated crawl spaces and closed crawl spaces."*
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> Closed Crawl Space Performance: Proof of Concept in the Production Builder Marketplace, final technical report to DOE, January 11, 2008, p. 22 [3]

The same report records that code officials were "not adequately informed about closed crawl space systems," that "the standards for meeting code are unclear to the installer and the code official," and that some officials required stamped engineering documents before passing a crawl space inspection [3, p. 24].

Advanced Energy's own guidance

In its installation guide for the Southeast, Advanced Energy addressed the distinction between its recommended assembly and the code requirement:

> *"The North Carolina residential code does not define a closed crawl space as requiring a sealed vapor retarder, which Advanced Energy recommends... Furthermore, it is impractical to perfectly air-seal a crawl space. The term 'sealed crawl space' suggests an extreme level of air sealing and implies that any small, unsealed air leakage path provides grounds for failing an inspection. In Advanced Energy's experience, it is inappropriate to require code officials to use such a stringent, yet vague, standard for enforcement."*
>
> Closed Crawl Spaces: An Introduction for the Southeast, p. 3 [4]

"Sealed"

The North Carolina residential code does not define a closed crawl space as requiring a sealed vapor retarder, which Advanced Energy recommends. Installers can differentiate this improved design from other closed crawl space designs by calling it "closed with a sealed liner." Furthermore, it is impractical to perfectly air-seal a crawl space. The term "sealed crawl space" suggests an extreme level of air sealing

and implies that any small, unsealed air leakage path provides grounds for failing an inspection. In Advanced Energy's experience, it is inappropriate to require code officials to use such a stringent, yet vague, standard for enforcement.

Figure 6. Terminology section of Advanced Energy's Southeast guide [4].

Cost, complexity, and enforceability were on the record from the beginning. The prescriptive details did not change, and they are now being applied to existing-home repairs.

5. The low coastal crawl space

The work described in this paper is concentrated from coastal Virginia around the Gulf to Houston and up the lower Mississippi Delta. In these crawl spaces the foundation walls are commonly two feet high or less, winters are mild, and the moisture problem is summertime condensation on framing and ductwork chilled from above by the air-conditioned house.



Figure 7. A typical low coastal Virginia crawl space. Wall height and clearance limit both the energy value of wall insulation and the practicality of installing and inspecting it. Photo: Patriot Crawl Space Repairs.

Wall insulation

Oak Ridge National Laboratory's *Builder's Foundation Handbook* models the life-cycle economics of foundation insulation by climate and configuration. For unvented crawl spaces with concrete or masonry walls and interior insulation, the configuration used in closed crawl space retrofits, its Table 3-1 recommends two feet of R-5 rigid board at all fuel price levels in the 2,000 to 4,000 heating-degree-day band. R-10 is not recommended at any fuel price in that band, and the handbook's interior-insulation recommendations do not reach R-10 until the horizontal-plus-vertical configurations used in 6,000-plus heating-degree-day climates [5]. Hampton Roads sits at roughly 3,400 heating degree days. Using that modeling and our own calculations, the savings from wall insulation in a short coastal crawl space are on the order of a few dollars per month. Those are calculated estimates, not field measurements.

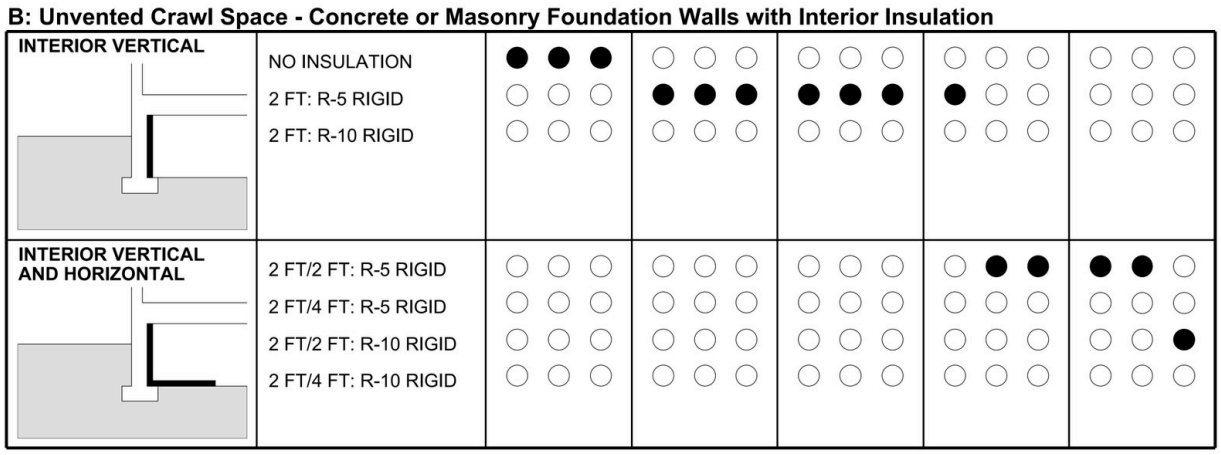


Figure 8. ORNL Builder's Foundation Handbook, Table 3-1, Section B: insulation recommendations for unvented crawl spaces with interior wall insulation, by climate and fuel price. Hampton Roads falls in the 2,000 to 4,000 HDD column [5].

The costs on the other side of the ledger are not modeled. Covering the foundation walls with foam and liner adds rodent harborage, obstructs termite inspection, and complicates structural repair. Virginia's coastal soils carry significant subterranean termite pressure, and pest management contractors are responsible for damage in areas they cannot inspect. Advanced Energy's guide notes that pest contractors "may be reluctant" to treat or warranty crawl spaces where access is obstructed [4, p. 16].



Figure 9. Left: rodent damage behind a wall liner. Right: a full sealed-liner and wall-foam assembly, which conceals the foundation wall and sill from inspection. Photos: Patriot Crawl Space Repairs.

Floor insulation

Floor insulation is not a clean alternative. Fiberglass between the floor joists becomes a nesting area for rodents, conceals framing that needs to be inspected for moisture and decay, and has to be removed when it becomes wet or contaminated. In a low coastal crawl space, neither continuous wall insulation nor floor insulation is simple or low-cost. What is needed is a recognized path that leaves the walls and floor framing accessible when moisture control is in place.

Sealing details and drying methods

A fully sealed ground and wall liner may be warranted where radon or soil gas is a concern. A shallow crawl space with good drainage, low soil-gas risk, and effective mechanical drying does not need every sealing detail in the most complete specification. Houses also differ in the drying method that fits them: a house with ductwork in the crawl space can use conditioned supply air; a house without ducts may be better served by a dehumidifier.



Figure 10. A coastal assembly: foundation vents sealed, ground vapor barrier overlapped and pinned, walls left bare for inspection, conditioned supply air. Photo: Patriot Crawl Space Repairs.

North Carolina's R409

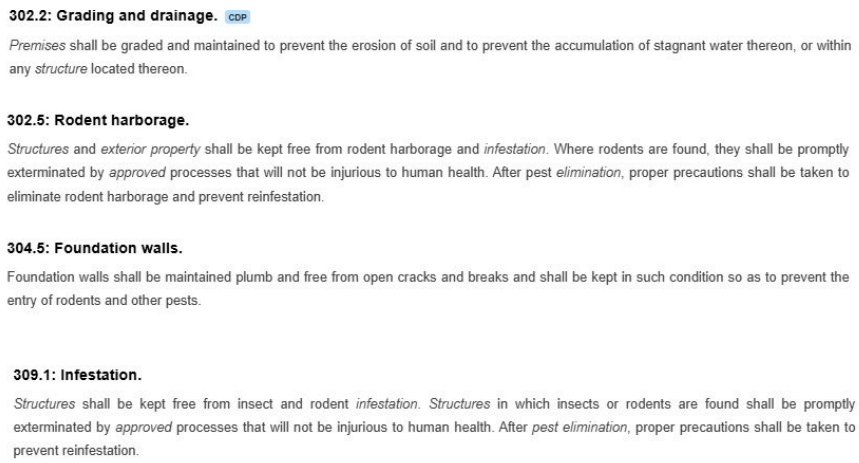
North Carolina, where the original research was done, adopted its own closed crawl space section. R409.2.1 requires a 6-mil ground vapor retarder with joints lapped not less than twelve inches, with no requirement to seal the seams or attach the retarder to the walls. R409.2.2 permits, but does not require, a full interior liner. R409.5 recognizes five drying methods: dehumidifier, supply air, house air, exhaust fan, and conditioned space [6].

6. Repair, maintenance, and alteration

The existing-building framework distinguishes three kinds of work. Repair corrects an unacceptable condition. Maintenance preserves an acceptable condition. Alteration is construction work that is neither. The classification determines which requirements apply.

Consider the typical remediation described in Section 1. Removing contaminated insulation and repairing damaged wood corrects existing problems: that is repair. Sealing foundation openings, controlling ground moisture, correcting drainage, and maintaining appropriate humidity prevent those conditions from returning: that is maintenance. Installing materials or equipment does not by itself make the project an alteration, and the trade term "encapsulation" does not establish a legal classification.

The International Property Maintenance Code already treats the relevant conditions as maintenance matters: grading and drainage (302.2), rodent harborage (302.5), foundation walls kept in condition to prevent entry of rodents and pests (304.5), and insect and rodent infestation (309.1) [8].



302.2: Grading and drainage. CDP

Premises shall be graded and maintained to prevent the erosion of soil and to prevent the accumulation of stagnant water thereon, or within any *structure* located thereon.

302.5: Rodent harborage.

Structures and *exterior property* shall be kept free from rodent harborage and *infestation*. Where rodents are found, they shall be promptly exterminated by *approved* processes that will not be injurious to human health. After pest *elimination*, proper precautions shall be taken to eliminate rodent harborage and prevent reinfestation.

304.5: Foundation walls.

Foundation walls shall be maintained plumb and free from open cracks and breaks and shall be kept in such condition so as to prevent the entry of rodents and other pests.

309.1: Infestation.

Structures shall be kept free from insect and rodent *infestation*. *Structures* in which insects or rodents are found shall be promptly exterminated by *approved* processes that will not be injurious to human health. After *pest elimination*, proper precautions shall be taken to prevent reinfestation.

Figure 11. International Property Maintenance Code sections 302.2, 302.5, 304.5, and 309.1 [8].

Virginia's Existing Building Code is explicit that routine maintenance, ordinary repairs exempt from permit, and "abatement of wear due to normal service conditions shall not be subject to the requirements for repairs" in the repair chapter, and that portions of a building not being repaired need not comply with new-construction requirements [9].

501.1 Scope. Repairs, including the patching or restoration or replacement of damaged materials, elements, equipment or fixtures ~~for the purpose of maintaining such components in good or sound condition with respect to existing loads or performance requirements~~, shall comply with the requirements of this chapter. Repairs to historic *buildings* need only comply with Chapter 9. Portions of the *existing building* or *structure* not being repaired shall not be required to comply with the requirements of this code applicable to newly constructed *buildings* or *structures*. Work on nondamaged components that is necessary for the required repair of damaged components shall be considered part of the repair and shall not be subject to the provisions of Chapter 6~~, 7 or 8~~. Routine maintenance required by Section 302, ordinary repairs exempt from permit in accordance with Section 108.2 of the VCC, and abatement of wear due to normal service conditions shall not be subject to the requirements for repairs in this section.

Figure 12. VEBC 501.1 Scope, as reproduced in the 2018 Virginia code cycle Board Report [9].

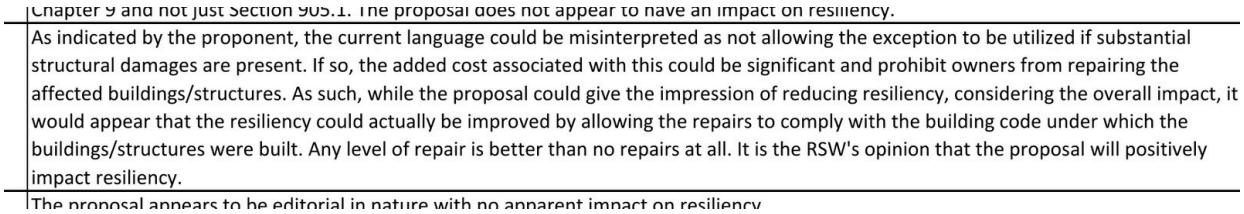
None of this is a loophole. The ICC developed separate existing-building provisions because repairing an existing building is not the same as constructing a new one. Nor is it a free pass: regulated electrical, structural, plumbing, and mechanical work still requires permits. But the sequence matters. The first step is to determine what the

homeowner is trying to accomplish and what work is necessary, and then apply the provisions that govern that work. Starting from a new-construction specification and assuming it governs everything under an existing house inverts the analysis.

The cost of getting it wrong

During Virginia's 2018 code development cycle, DHCD's Resiliency Subworkgroup analyzed proposals to the existing-building code. On a proposal clarifying the repair exception, it wrote:

> *"If so, the added cost associated with this could be significant and prohibit owners from repairing the affected buildings/structures... it would appear that the resiliency could actually be improved by allowing the repairs to comply with the building code under which the buildings/structures were built. Any level of repair is better than no repairs at all."*
>
> Virginia DHCD, 2018 Code Update Cycle Resiliency Impact Analysis, analysis of EB601.1(2)-18, p. 7 [7]



Chapter 9 and not just Section 905.1. The proposal does not appear to have an impact on resiliency.
As indicated by the proponent, the current language could be misinterpreted as not allowing the exception to be utilized if substantial structural damages are present. If so, the added cost associated with this could be significant and prohibit owners from repairing the affected buildings/structures. As such, while the proposal could give the impression of reducing resiliency, considering the overall impact, it would appear that the resiliency could actually be improved by allowing the repairs to comply with the building code under which the buildings/structures were built. Any level of repair is better than no repairs at all. It is the RSW's opinion that the proposal will positively impact resiliency.
The proposal appears to be editorial in nature with no apparent impact on resiliency.

Figure 13. Resiliency Subworkgroup analysis, p. 7 [7].

On another proposal in the same cycle, the subworkgroup noted that cost increases "could prove to be unbearable, resulting in proposed projects not seen to fruition," and that clarifying the provisions "could prevent the abandonment of such rehabilitation projects due to considerable cost increases" [7, p. 15].

7. Recommendations

1. **Apply the existing-building repair and maintenance provisions correctly.** Classify the work before deciding which prescriptive requirements apply. Repair and maintenance work that corrects existing mold, rodent contamination, and moisture damage should not be treated as an alteration that triggers the full R408.3 assembly. This requires no change to the code.

2. **Where a project is genuinely an alteration, review the national prescriptive assembly against the full body of field research,** including Advanced Energy's simpler Phase III configuration.

3. **Separate the requirements needed for moisture control from those intended primarily for energy efficiency.** Moisture control, energy conservation, soil-gas protection, and indoor air quality are related but not identical objectives.

4. **Recognize alternative assemblies for different climates and existing-building conditions,** including a path for short, hot-humid coastal crawl spaces to remain without wall or floor insulation when moisture control and other applicable requirements are satisfied. North Carolina's R409 is a working model.

5. **Evaluate installation and life-cycle cost, not only modeled energy savings:** termite inspection, rodent exclusion, foundation maintenance, and future structural repair.

6. **Include experienced restoration contractors and pest management professionals** in the discussions where requirements affecting existing homes are developed.

None of these recommendations requires abandoning building science or lowering a legitimate safety standard. They require examining whether the requirements fit the purpose and conditions of the project. In the coastal Southeast, crawl space work on existing homes is housing preservation. Construction standards for existing homes ought to support it.

References

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[2] Dacquisto, D.J., Crandell, J.H., and Lyons, J. 2004. *Building Moisture and Durability: Past, Present and Future Work.* Prepared by Newport Partners, LLC for U.S. Department of Housing and Urban Development, Office of Policy Development and Research. October 2004. p. 16. huduser.gov

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[5] Carmody, J., Christian, J., and Labs, K. 1991. *Builder's Foundation Handbook.* ORNL/CON-295. Oak Ridge, TN: Oak Ridge National Laboratory. Table 3-1, p. 40.

[6] North Carolina Residential Code, Section R409, Closed Crawl Spaces: R409.2.1, R409.2.2, R409.5.

[7] Virginia Department of Housing and Community Development. *2018 Code Update Cycle: Resiliency Impact Analysis.* Resiliency Subworkgroup analyses of EB601.1(2)-18 (p. 7) and EB704.1-18 (p. 15). See also 2018 cycle Board Report, September 5, 2019, proposal EB501.1(1)-18.

[8] International Code Council. *International Property Maintenance Code*, Sections 302.2, 302.5, 304.5, 309.1.

[9] Virginia Existing Building Code, Section 501.1 Scope, as reproduced in the 2018 Virginia code cycle Board Report. International Residential Code, Section R408.3.

About the author



Robbie McCarty is the owner of Patriot Crawl Space Repairs in Hampton Roads, Virginia. He personally inspects more than 600 crawl spaces a year and has been involved in building, renovating, inspecting, and selling hundreds of homes across roughly three decades in Virginia construction and real estate. He holds a Virginia Class A contractor's license, a master plumber license, a licensed pest control operator credential, and MICRO certification as a mold remediation contractor.

His company specializes in structural repair, mold remediation, pest exclusion, and moisture control in the hot, humid coastal Southeast. The Patriot Files video series and papers examine how construction requirements are developed and applied to existing homes.

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