



Crawl Space Ventilation

In the Southern United States, where high water tables often preclude basement construction, building houses on posts or piers or over crawl spaces is a tradition. Decades ago, it was common in the South to build houses on posts. In these houses, the under-floor area was extremely well vented and about as warm in summer and as cold in winter as outside ambient conditions. Although these houses would not meet expectations for thermal comfort today, they generally did not have moisture problems. Moisture that evaporated from the ground was largely dissipated to the atmosphere.

As decades passed and crawl spaces became more common, it became evident that they tended to become objectionably damp. Outside-air exchange rates are much lower in crawl spaces than in under-floor spaces of houses on posts or piers. As a result, seasonal temperatures in crawl spaces are more effectively moderated by the ground than in the under-floor spaces of houses on posts or piers. This means that crawl spaces are not as cool in winter or as warm in summer. This can reduce heating and cooling costs, and it reduces the chance of plumbing lines freezing in cold weather. In short, crawl space construction was recognized as having thermal benefits relative to post or pier construction, but it was also recognized as being more prone to moisture accumulation.

Venting a crawl space would seem to create a situation more like that of a house on posts. By the 1950s, crawl space ventilation became mandated by building codes. The basis for the code requirements was the combined idea that (1) the primary source of crawl space moisture was evaporation from the crawl space floor and (2) crawl space ventilation would allow for dissipation of this evaporated moisture.

Over time, however, it became evident that experimental evidence to support the code mandate was insufficient. Additionally, the assumptions on which the code mandate was based now appear to have been largely incorrect or to have become invalid with the widespread adoption of air-conditioning. Over the past two decades, experimental studies have shown that crawl space ventilation is usually counterproductive, especially in humid climates.

Crawl space humidification by evaporation of soil moisture is related to soil moisture content and temperature. Evaporation is generally greatest during summer, when the soil is warm, and least during winter, when it is cold. Vapor barrier ground covers appreciably inhibit evaporation from crawl space floors, thereby lowering crawl space humidity levels. When codes began mandating crawl space ventilation, the long-term durability of ground covers was in doubt. The assumption was that ground covers might eventually cease to function, which could cause appreciable evaporation of soil moisture into the crawl space area. Polyethylene has become widely used as a crawl space ground cover since code mandates for ventilation were promulgated. It has proven to remain functional for extended periods.

Although sometimes valid, the assumption that outdoor air functions as a moisture sink—in other words, as a place to dissipate moisture—is often invalid. In cold weather, the vapor pressure of outdoor air is usually low, or at least lower than the vapor pressure of crawl space air, and the assumption appears to be largely correct. In warm weather, however, outdoor vapor pressure is significantly higher, often higher than the vapor pressure of (relatively cooler) crawl space air. This is especially true if the building above the crawl space is air-conditioned. Thus, in warm weather in humid climates, outdoor air is more likely to be a source of crawl space moisture than a sink. In these climates, the assumption that outdoor air would mostly serve as a



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Crawl space moisture research performed in the Eastern United States over the past 20 years indicates that moisture conditions vary seasonally, with dampest conditions in the summer and driest conditions in the winter, and that damp summer conditions are consistently exacerbated by crawl space ventilation. Experimental work conducted in the San Francisco Bay area (with less seasonal temperature change and less humid overall weather conditions) is more ambiguous. In some of the California work, poor management of site surface water was evident. With standing water in crawl spaces and outdoor vapor pressures low, ventilation could reasonably help dissipate the water. Construction on posts or piers, however, would work even better for dissipating standing water from crawl spaces. Preventing bulk water from getting under the structure is, of course, preferable.

Following are several recommendations that can help prevent moisture problems in crawl spaces.

1. If a building is constructed on piers or posts and is working acceptably, leave it as is. If energy costs are excessive or thermal comfort is unacceptable—the building is not “working acceptably”—then floor insulation is often the best option. Skirting the building to form a crawl space and then venting the crawl space to code requirements could result in moisture problems, especially where summers are warm and humid.
2. Keep bulk water out of crawl spaces. Site grading is probably the most important consideration. Drainage from pavement and roofs is a huge potential water source. Plumbing maintenance is also critically important.
3. Use a “vapor barrier” soil ground cover to inhibit evaporation into the crawl space. Running the vapor barrier up the foundation walls is recommended. In locations where termites are prevalent, the height to which the vapor barrier can be run will be limited by concerns for termite inspection. If the vapor barrier is run up the crawl space wall to the level of the floor joists, termites could build mud tunnels on the foundation wall that would be hidden from view.
4. In the Eastern United States, seal crawl spaces from warm humid outside air, especially if the building is air-conditioned.

References

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