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RESIDENTIAL AND LIGHT COMMERCIAL BUILDINGS

Sealed Crawl Space Specifications

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A sealed (unvented) crawl space will out-perform a vented crawl space in terms of both moisture and thermal issues in South Carolina's climate. The following new-construction specifications will provide a high-performance sealed/unvented crawl space foundation. (Note: In retrofit situations, additional steps such as mechanical humidity control may be necessary to ensure adequate moisture control. Under no circumstances should a wet crawl space be sealed without the use of a mechanical dehumidification system.)

1) Combustion devices located within the crawl space shall be sealed combustion. Under no circumstances shall a naturally vented combustion device be installed in a sealed crawl space.

2) No passive ventilation openings shall be allowed between the exterior and the interior of the crawl space.

3) The top of foundation walls/piers shall be no less than 4-block (32") higher than the highest soil within the crawl space.

4) A capillary break/barrier (6-mil poly or equivalent) shall be installed between interior footings and piers. Footings shall be formed with keyway or protruding rebar to restrict horizontal movement of pier (per local code.)

5) The top course on all foundation walls and interior piers shall be solid: I.e. either poured concrete walls, solid cap blocks, bond beams or filled hollow block cores.

6) Preservative-treated 2x8 mud sills shall be used between foundation wall/pier and framing material.

7) Termite protection shall be provided by pre-treatment and by incorporation of corrosion-resistant metallic termite shield between the top of foundation walls/piers and the mud sill. The metallic termite shield shall extend to the exterior at least 1 inch past the finish wall material and to the inside at least one (1) inch past the expected width of foundation wall insulation.

8) Joints in the termite shield shall be permanently fused with solder (or equivalent) or overlapped a minimum of 6 inches and sealed with a rubberized asphalt sheet membrane at least 6 inches wide. Penetrations through the termite shield for anchor bolts, etc. shall be sealed with a minimum 6 inch square of rubberized asphalt sheet material between the termite shield and the mud sill. Rubberized asphalt material shall be a minimum of 35

mils thick with adhesive surfaces on both sides. (Example: MFM Building Products "Double Bond" material)

9) Caulk or sill sealer shall be installed between the top of the foundation wall and the termite shield, and between the termite shield and the mud sill. The joint between the mud sill and the band joist shall be caulked or similarly sealed.

10) A soil vapor retarder (vapor barrier) membrane (6-mil poly or equivalent) shall be installed to completely (100%) cover exposed soil in the crawl space. Seams should be overlapped a minimum of one foot.

11) Soil vapor retarder membrane shall turn up the inside of foundation walls to at least the height of exterior soil level. Where the outside of the foundation wall is not damp-proofed, the soil vapor retarder membrane shall extend to the top of the foundation wall.

12) Foundation walls shall be insulated on the interior surface with R-6 or higher insulation (duct insulation, rigid foam insulation, spray-in-place expanding urethane foam or equivalent, per local code). Band joists to be insulated as well. (1998 IECC)

13) Floors over crawl spaces shall not to be insulated.

14) All penetrations through subfloor and foundation walls shall be sealed with approved draft-stop material.

15) The exterior soil shall slope away from the foundation at least 6 inches in the first 10 feet completely around the perimeter. If used, gutters and downspouts should drain at least 10 feet from the foundation.

16) Where there is a probability of standing water in the crawl space, subsurface drains, French drains, sump pumps, sloped soil and other similar measures shall be used to prevent standing water.

17) In areas where radon may be encountered, a passive radon mitigation system shall be installed.

18) Clothes dryers, bathroom exhaust fans, AC condensate drains and similar moisture-containing exhausts or vents shall not drain into the crawl space.

19) A mechanical dehumidification system rated at 90 pints per day or greater and capable of being ducted shall be installed in the crawl space. Condensate shall be discharged to the exterior in an appropriate manner. No air from the house HVAC system shall be discharged to or mixed with crawl space air.

20) ALTERNATIVE to #19: A whole-house mechanical dehumidification system shall be installed to control humidity levels in the living space. This system must be capable of bringing fresh air into the house, and maintaining the house at or below 50% RH all year.

House air shall be discharged into the crawl space at a rate of 50-100 CFM, but not more than the fresh air capacity of the dehumidifier and any other house ventilation system. Crawl space air is not to be returned to the house.

21) The insulated, vapor-retarded foundation wall shall be essentially in vertical alignment with the insulated above-grade walls of the living area. Where a deck, porch or similar entity exists within the footprint of the primary foundation wall such that it creates an un-insulated interface between the crawl space and the exterior, an interior air-tight, vapor-retarded, insulated pseudo-foundation wall will be added under the above-grade walls of the adjoining living area. (I.E. The insulated foundation wall is to be directly underneath the insulated wall of the living space directly above it.)

Rational for a sealed/unvented crawl space: South Carolina's warm, humid climate creates a situation where surfaces in an air conditioned house are often below the dew point or condensation temperature of the outside air. Where condensation or very high relative humidity occurs, mold and decay can occur. In a crawl space, the soil temperature, living space temperature and duct temperature all contribute to lowering the temperature within the crawl space. Outside air entering this area can often be cooled to the point where condensation occurs, either on structural members or on ductwork. The solution to prevent condensation is to either warm the surfaces, or lower the moisture levels. Raising surface temperatures is not likely due to our climate, occupant desires and the laws of physics.

The other option to reducing high moisture levels and condensation is to lower moisture levels within the crawl space. Sources of moisture are primarily evaporation from the soil, diffusion through foundation walls, and with humid air entering the crawl space. When a soil vapor retarder (vapor barrier) is used to reduce evaporation from the soil and diffusions through foundation walls, the remaining major source of moisture is from ventilation air. A psychrometric chart can be used to show that for much of the year, South Carolina's climate is such that venting a crawl space actually makes the crawl space wetter.

A sealed crawl space has several advantages. First, the crawl space is dryer, decreasing the likelihood of mold and decay. In addition, wood is stronger when it is dryer, therefore the structure performs better. A decrease in moisture in the crawl space allows air conditioners to run more efficiently, since they have to remove less moisture from the air. Duct insulation also stays dry, maintaining the integrity of the insulation. Humidity levels within the crawl space and house are more uniform from season to season, creating less movement of hardwood floors, interior wood trim and cabinetry. Attic moisture problems are often reduced, since many attic moisture problems are related to high crawl space moisture levels.

From thermal, moisture, structural, occupant health, financial and operational standpoints, sealed crawl space foundations perform better in my opinion than vented crawl spaces. Essentially all other building science experts around the country also hold this opinion. (Ref: Energy and Environment Building Association- www.eeba.org)