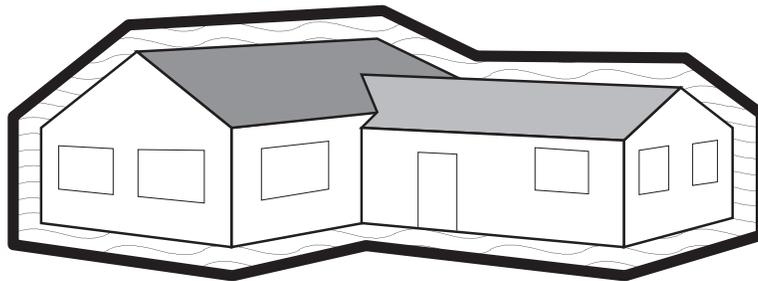


Minimizing Moisture Problems in New Houses



Excessive moisture penetration and accumulation can cause five major problems in wood-frame houses:

1. exterior finish failure
2. decay by fungi
3. excessive dimensional changes of wood members
4. wetting of insulation
5. staining and deterioration of interior surfaces

Many sources of moisture can create problems. These include rain and snow, soil contact, water flowing off the roof, and moisture condensation. However, you can minimize the impact of water on wood structures. The following general recommendations will promote maximum durability and minimum maintenance. First, use dry lumber, and protect wood products during construction. Second, keep wood assemblies dry after building by sealing out external moisture and by controlling water vapor condensation during cold weather. Third, use naturally durable or preservative-treated wood where exposure to repeated water soaking cannot be avoided.

Naturally Decay-resistant Wood

The heartwood of some wood species has natural durability against decay and is suitable for use where moderate decay hazard exists (figure 1). Sapwood is not naturally durable

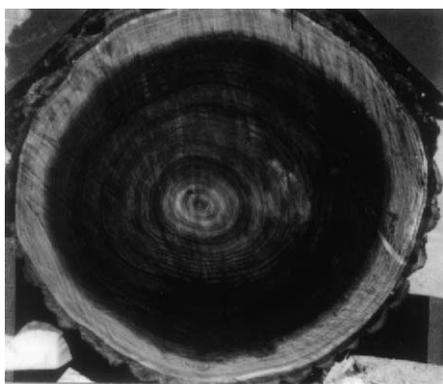


Figure 1. Cross section of a log showing the interior darker heartwood and the lighter outer ring of sapwood.

for any species. Wood species have been classified according to the resistance of their heartwood to attack by decay fungi:

- **resistant or very resistant**—black cherry, black locust, black walnut, catalpa, cedars, junipers, osage-orange, red mulberry, redwood, white oaks
- **moderately resistant**—Douglas fir, white pine, honey locust, larch, longleaf pine, slash pine, tamarack
- **slightly or nonresistant**—ashes, aspen, basswood, birches, butternut, cottonwood, elms, hackberry, hemlocks, hickories, loblolly pine, lodgepole pine, maples, ponderosa pine, red oaks, spruces, sycamore

Redwood and western redcedar are the principal decay-resistant woods used in construction. Always specify “all-heartwood” grades where resistance to decay is important.

Preservative-treated Wood

Wood may be treated with wood-preserving chemicals to protect against attack by decay fungi and insects. Pressure treatment of wood maximizes protection. Brushing, spraying, or soaking treatments typically will provide less protection against deterioration.

Commonly available wood preservatives are classified as either oil-borne or waterborne. The two most common types of oil-borne treatments are *creosote* and *pentachlorophenol*; woods treated with these preservatives are not commonly used in residential applications. The three waterborne preservatives that are generally available and are not subject to leaching by water after installation are: *acid copper chromate* (ACC), *ammoniacal copper arsenate* (ACA), and *chromated copper arsenate* (CCA). Wood treated with CCA is by far the most commonly used in house construction. New waterborne wood preservatives that contain no arsenic or chromium compounds are now coming on the market; the development of these new wood preservatives has been driven by public environmental and health concerns. Wood treated with these formulations should be available in the near future.

The amount of chemical forced into the wood during pressure treatment will determine the level of protection provided. The highest level of penetration and retention is labeled *Foundation Grade*. The next highest level is identified as *Ground Contact*, and the lowest level is designated at *Above Ground*. These labels indicate the applications for which the material is suited.

Foundations

In houses with *concrete slab foundations*, install a vapor retarder under the slab on top of a gravel bed to minimize the potential for developing moisture problems.

In houses with *crawl space foundations*, always use a ground cover to minimize water evaporation from the soil and subsequent absorption by exposed wood framing members. When there are water pipes or heating ducts in the crawl space area, apply insulation to the perimeter walls. When there are no pipes or ducts located in the crawl space, install a vapor retarder in the floor above, and vent the space.

In *basement foundations*, coat the outside wall surface to reduce moisture penetration. Install drain tile covered with gravel around the perimeter adjacent to the footings to control water buildup along the wall. Surface grading sloping away from the house will encourage water to drain away from the structure. Install a vapor retarder over a gravel bed under the concrete slab floor. Insulate the basement walls either on the inside or on the outside to reduce heat loss. The preferred method for insulating on the inside is to install a wood frame against the masonry basement wall with blanket or batt insulation inserted between the framing members (figure 2). If the basement wall is to be insulated

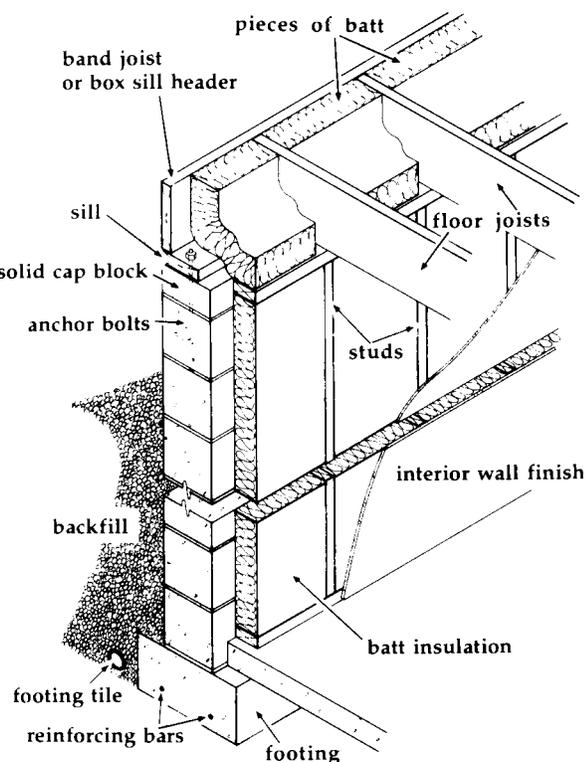


Figure 2. Basement construction with interior insulation.

on the outside, the most common method is to adhere two or three inches of extruded polystyrene plastic foam insulation panels to the exterior surface running from the footings to the top of the basement wall. Pay special attention to the portion of the basement wall above grade; this part of the basement wall should be particularly well insulated.

Interior basement posts that support beams should not rest directly on the concrete floor unless they are naturally durable or treated with waterborne preservatives. Where structural wood beams or *girders* rest in notches in the masonry foundation wall, provide an air space and install a moisture-impervious membrane. *Wood sleepers* and *bottom partition plates* resting directly on concrete basement floors or *furring strips* attached to masonry walls should be naturally durable wood or materials that have been treated with waterborne preservatives.

Exterior Siding and Trim

To reduce water soaking and penetrating into siding, maintain at least eight inches of clearance between the ground level and the bottom of the siding all around the perimeter of the structure (figure 3).

Treat all siding joints (butt, lap, and corner) with water repellent (figure 4). It is important to treat the end grain of the siding or exterior trim lumber. Fill butt and corner joints with a high quality caulking compound; acrylic latex base caulking compounds work well.

Other recommended measures to reduce potential for moisture penetration include the following.

1. Seal joints around doors and window by careful caulking.
2. Caulk and cap the outside corner of siding.
3. Install appropriate molding and metal flashing where two different types of sidings intersect (figure 5).

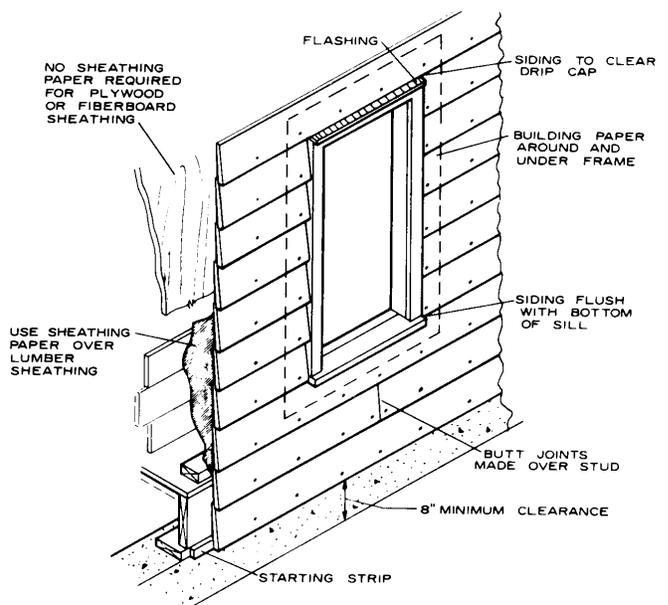


Figure 3. Maintain clearance between ground, siding.

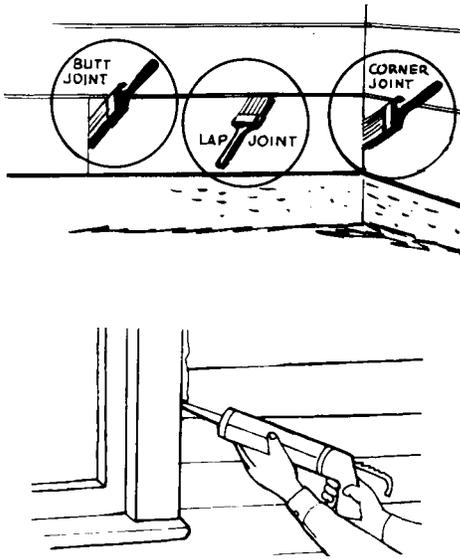


Figure 4. Treat, caulk joints to reduce water penetration.

4. Use metal flashing to separate siding and roofing materials, and maintain at least two inches of clearance between siding and roofing (figure 6).

Interior Surfaces

Install a vapor retarder immediately beneath the interior covering on exterior walls. This film will reduce migration of water vapor into the exterior wall cavity during cold weather. Polyethylene plastic sheet materials typically are used to provide this protection, although metallic films are also effective. Make sure that the vapor retarder is continuous; overlap joints and seal penetrations. Caulk any holes or cracks on the inside surfaces to promote air tightness. Seal around all door, window, floor, and ceiling moldings and around electrical outlets.

Window and Exterior Doors

High quality wood windows are furnished with a water-repellent treatment, weatherstripping, and proper glazing. Glazing must be inspected periodically and maintained.

Always use high quality exterior doors. If wood flush doors are preferred, install solid-core rather than hollow-core units; make sure that panel doors are rated for exterior exposure. Doors should be weatherstripped and finished with appropriate exterior coatings. Treat exposed edges with a water repellent before finishing.

Install drip cap mouldings and metal flashing above window and door openings to shed water and reduce potential for interior penetration of water.

Roofs

An overhang of 24 inches or more will reduce the impact of rain and water runoff from the roof. A metal drip edge at the lower margins of the roof is recommended. Eaves troughs and downspouts should be used to quickly channel water runoff away from the house. Use naturally durable wood or wood treated with waterborne preservatives for exterior trim on houses. Install metal flashing at valleys and dormers and

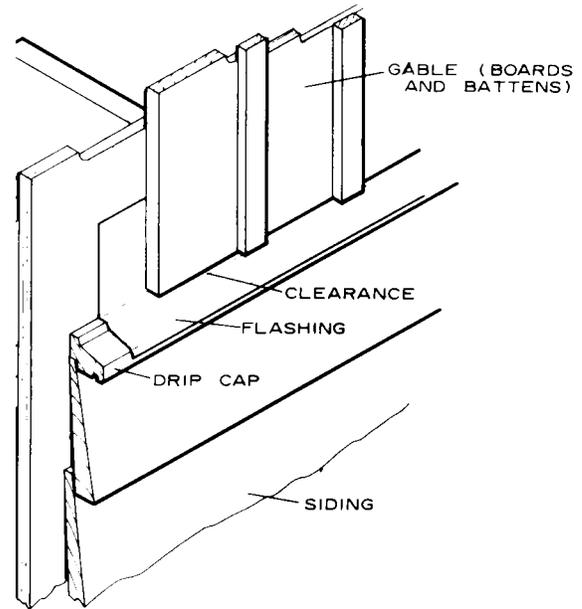


Figure 5. Proper transition from one type of siding to another.

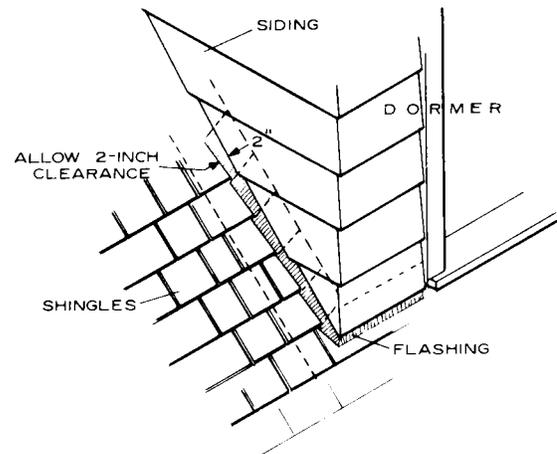


Figure 6. Separate siding from shingles with metal flashing.

around any vents or chimneys to reduce potential for water penetration into wood roof sheathing or framing (figure 6).

When the ends of wood beams or other structural members are directly exposed to the weather, use naturally durable woods or wood treated with waterborne preservatives. Thoroughly treat the exposed ends with a water repellent or water-repellent preservatives.

Attic Ventilation

Adequate attic ventilation must be provided for unheated attic spaces in houses. Attics are ventilated to eliminate water vapor in winter and to reduce heat buildup in summer. Provide inlet vents at the lower margins of the roof and outlet vents near the peak of the roof. The preferred airflow through unheated attic spaces is provided by continuous inlet and outlet vents. Provide at least one square foot of net free vent area for each 300 square feet of attic floor, if a vapor retarder has been installed in the ceiling below the attic.

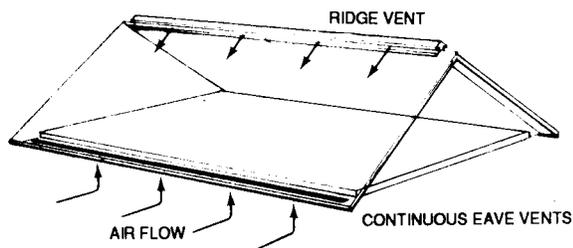


Figure 7. An effective attic ventilation system.

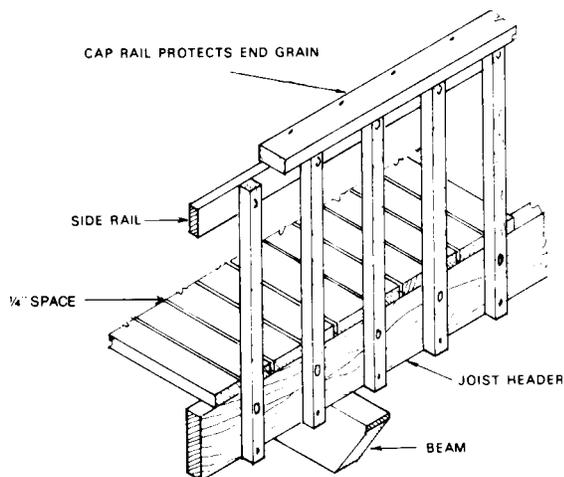


Figure 8. Proper deck and railing construction.

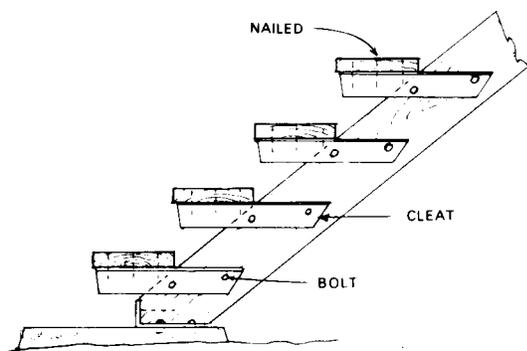


Figure 9. Recommended exterior stairs construction.

Double the vent area if the retarder is not present. Screens and louvers often are provided for attic vents; consider these impediments to air flow when calculating the required net free vent area. Provide approximately equal areas of inlet and of outlet vents (figure 7).

Porches, Decks, and Stairs

Separate wood from concrete slabs. Concrete entry, patio, or porch slabs poured against wood-frame exterior walls should be separated from the wall by a metal flashing and should slope away from the building.

Construct exterior wood decks of naturally durable or preservative-treated materials. Allow at least one-fourth inch between deck boards or planks to allow water drainage and promote drying. Use wood caps to protect the tops of vertical posts and other exposed end grain members (figure 8). The end grain of wood absorbs water quickly and deep penetration of water may result. Apply an appropriate water-repellent preservative or exterior stain to protect against weathering damage.

Even naturally durable or preservative-treated wood members used to construct outside stairs should be built to reduce water penetration and accumulation. Fasten stair treads to the supporting stringers using cleats attached to the stringer to receive the steps (figure 9).

Summary

Proper care in selecting and installing wood construction members in houses can reduce decay hazards, minimize maintenance, and promote long useful service. Whenever possible, keep wood dry; guard against excessive exposure, accumulation, and penetration of water in exterior applications. Where repeated exposure to water is anticipated or unavoidable, use only naturally durable wood or material treated with a leach-resistant waterborne preservative. Inspect houses regularly for evidence of moisture problems and water damage; take immediate corrective action when problems are detected. For more information, see these extension publications: Pm-1033, *Selection and Use of Preservative-treated Wood*; Pm-947, *Controlling Winter Moisture Problems in Houses*; Pm-362, *Finishing Exterior Wood Surfaces*; and Pm-363, *Paint Problems on Exterior Wood*.

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