Until the last decade, decay in siding did not present a problem. When it occurred it was usually limited to a few boards where there had been some obvious error; for example at points where large amounts of rain water were allowed to run down the wall from leaks in rain gutters or clogged downspouts, or where the bottom board was in contact with the soil.

About 1940, complaints began to come in of building projects in which there was extensive decay of siding on new buildings. These were mainly in Florida and the coastal area of the Gulf States, where humidity is high and the weather is warm enough for decay fungi to work during most of the year. It was feared that a lot more trouble would develop. Sapwood, now more widely used for siding, is more subject to decay for two reasons; (1) it absorbs water much more quickly than heartwood, and (2) it lacks the natural preservative chemicals that are contained in the heartwood of the more durable species. But while cases in which most of the houses in a project were damaged have continued to appear, by far the greater number of housing developments have remained free from difficulty. Through a period of years, studies have been made of 15 projects in 9 different States from which complaints had been received, and for comparison, on numerous other houses or projects scattered through the Southern States. From these and from experimental wall panels exposed at the Harrison Experimental Forest of the U. S. Forest Service, we believe that we know the principal reasons why some projects have suffered and others have not, and how future construction can be readily safeguarded.

PROJECTS WHERE DECAY HAD CAUSED COMPLAINTS

A careful examination was made of the houses at the 15 localities where decay had led to complaint. The following conditions were found associated with the siding decay:

(1) Narrow eaves and rake board of gables. Roof overhang was less than 8 inches at 87 percent and less than 6 inches at 80 percent of the localities where decay occurred. Many houses had good eaves projection but little projection at the

1 This article is based in part on a research project sponsored by the Housing and Home Finance Agency under Title III of the Housing Act of 1948, as amended.

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3 The number of buildings at each locality varied from one to several hundred and most buildings at each locality were in the same condition. Therefore, factor occurrences are expressed as percent of localities rather than percent of buildings.
ends of the roof, often just enough to accommodate a molding at the roof line. The less the roof overhang the more the walls will be wetted by rains. An overhang of 8 inches seemed beneficial and overhangs in excess of 20 inches offered almost complete protection against serious decay in one-story houses (Fig. 1).

![Fig. 1. --Wide eaves give the best protection to siding and exterior trim from decay and other moisture problems resulting from rain wetting.](image)

(2) Vapor-barrier papers, used as sheathing papers between the siding and sheathing or studs, were present at 80 percent of the locations. The functions of sheathing papers are to turn liquid water and prevent wind leakage (1). However, they should be readily permeable to water vapor. If rain water wets siding it will seep into butt joints between siding and trim and between siding boards. With a painted exterior any water seeping back of siding must dry largely to the inside, hence the need for breathing paper.

That vapor-barrier papers, used as sheathing papers, dangerously retard drying of siding wetted by rain seepage has been shown in experimental siding panels at Saucier, Miss., and by observations on a project in Florida where 246 houses were built, all of the same design. Paper was omitted from under the siding in 40 of these houses and a vapor-barrier paper was used in the other 206. Serious decay developed in the siding of the latter houses but practically none in the first 40.

The following papers are, in general, too vapor impervious for use under wood siding: asphalt-coated papers, asphalt-saturated but uncoated felts of 15 lb. or more per roll of 108 sq. ft., laminated papers with asphalt cores, and papers surfaced with aluminum foil. Vapor-barrier papers do have a proper use, particularly in the North on the warm side of walls, but not directly under wood siding. Breathing
papers can be determined with surety only by tests, but in general those papers certified or labeled by the manufacturer as meeting the Class D requirements of Federal Specification U-P-147 or the dull-finished asphalt or tar-saturated waterproofed papers of light weights (less than 15 lb. per 108 sq. ft.) are satisfactory.

(3) Butting siding to the edges of the trim at openings and at the corners. Butted joints were present in all the houses with serious decay. Butting siding to trim has usually been recommended as a safer practice than placing the trim over the ends of siding. However, the survey and experimental data here reported showed that butted joints, at least as now commonly made, are less safe. It appears that rain water easily gains entrance into siding at vertical butt joints and that with drop siding this seepage can be largely eliminated by placing the trim over the siding ends. There is insufficient evidence to predict whether the placement of trim over bevel siding would be effective. Further information is needed to show whether accurate carpentering and the use of end painting or caulking can waterproof butted joints of siding to trim (Fig. 2).

(4) Condition of the siding at time of construction. During the summer of 1950 many of the siding decay cases seen during the past 10 years were reinspected. At three locations the decayed siding had been replaced 5 or more years previously. Very little additional decay was found. For example, one building in south Mississippi required replacement of about 1/3 of the siding when 4 years old. During the following 10 years only one additional board decayed despite the fact that the design was not changed. This suggested that some designs may favor decay but that poor design alone will not necessarily lead to heavy decay.

This low decay in replacements plus the fact that most of the serious decay was found in buildings less than 5 years old suggested that incipient decay infections already present in the lumber at the time of construction may have led to the serious decay. Obviously this could not be established several years after construction but indirect evidence gave it strong support. In none of the houses with excessive decay could it be established that kiln-dried lumber was used. At 47 percent of the locations air-dried siding was reported as used and at about half these locations siding was removed from buildings and found to have stain that probably had developed while the lumber was green. Stain and decay fungi develop under the same conditions and when heavy stain occurs there is a
chance that decay fungi also may be present in the initial stages before noticeable breakdown occurs.

**PROJECTS FROM WHICH NO COMPLAINTS HAD COME**

During the summer of 1950 a survey was also made of houses or projects at 17 locations from which no complaints had been received. The majority of these houses were 5 to 10 years old and should have shown some siding decay if it were ever going to be excessive. Important siding decay was present in only one of several hundred buildings examined. Of the buildings without extensive siding decay, those at 65 percent of the localities had less than 8-inch roof overhang; 41 percent had non-breathing sheathing papers; and 41 percent had siding butted to the trim. Thus even though narrow roof overhang, impervious paper, and butted joints favor extensive decay, all three can be present without extensive decay developing. In contrast to the group with extensive decay, air-dried lumber was reported as used at only 12 percent of the localities while kiln-dried was known to have been used at 29 percent of the localities. The seasoning history of the siding at the other 59 percent of the localities could not be determined. The most logical interpretation of these findings is that incipient infections at the time of construction usually are necessary for extensive siding decay even where there is moderately severe exposure.

Of course there are situations where decay may occur in siding that was in first-class condition when it was put on. Uncovered porches and terraces may allow excessive rain splash on the lower siding boards. Roofs with no gutters and no overhang let too much water run over the siding. The same is true for leaks in gutters and for roof designs that concentrate the runoff at points where it will strike a wall. Porches, steps, and fences are subject to so much wetting that any sapwood in them should have preservative treatment. But in most construction the survey findings indicate clearly that wood free of fungus infections, particularly decay, is of prime importance for siding and exterior trim, and kiln-dried stock provides additional insurance.

**THE USE OF SOUND WOOD**

There are two reasons why lumber infected with fungi, whether stain, mold, or decay fungi, is a poor risk for exterior woodwork. First, air-drying doesn't kill all fungi in wood. Many will live for weeks or months and some for years in air-dried wood. So long as the wood is dry, these fungi remain dormant but when wetted they will revive. If water seepage occurs regularly the fungi may grow out through the paint, causing unsightly discolorations. If a decay fungus is present, it will make further progress at each prolonged wetting and the board may eventually need replacement. In the second place, infected wood will absorb water more readily than clean wood. This combination of greater water absorption and a decay fungus already present in the wood is undoubtedly one of the main reasons why some siding develops extensive decay when structural designs favor wetting or hinder drying.

If initially fungus-free wood is used, the chances of trouble should be much less. Even with moderately heavy seepage, siding free of fungus infections will dry out within a few days after each rain if a breathing paper is used. Thus there is little chance for a fungus spore (or seed) to be carried into a joint, germinate, and grow sufficiently to become established before the wood dries out.
During the past few years entirely too much stained and decay-infected lumber has been put on the market. The methods of producing fungus-free lumber are well known and economically feasible (3). In fact, during the middle 1930's effective fungus control was the rule rather than the exception. Fungus-free lumber can be produced either by kiln drying or by the use of sap stain control dips and air-seasoning (Fig. 3). Kiln drying with the usually recommended schedules will sterilize wood, i.e. kill any fungi already present. However, if kiln drying is delayed until fungi have had a couple of weeks to develop, kiln drying will be only partly effective. It will kill the fungi present but the lumber will retain its water-absorbing properties.

Fig. 3.--The heavily stained lumber on the left would be a bad risk for siding or exterior trim. Such lumber often contains incipient decay that can develop on rewetting. The clean boards on right have been protected before air-seasoning by one of the standard dipping solutions used by most of the better sawmills.
The production of bright, fungus-free lumber is only the first step necessary in getting the proper wood into siding. After seasoning and manufacturing, the lumber must be protected from wetting during the merchandising process and at the building site. Particularly it should not be piled directly on the ground or on decaying skids. Improper storage or handling anywhere along the line can lead to water absorption and infection.

CONCLUSIONS

The first line of defense against decay in siding and exterior trim is the use of dry uninfected lumber and the prevention of the discharge of large amounts of water directly against siding. This means that the architect and builder must see that the proper lumber is specified and that it is properly handled during construction, and that in the design there are no roof or other features that will permit aggregated water flow or splash against siding. It also means that in a maintenance program, clogging or breaking of gutters and downspouts should be remedied without undue delay. If attention is paid to the above points the decay hazard in siding apparently is very low.

However, since carelessness or emergencies too often cause failures in the first line of defense and because the survey upon which this is based may not be sufficient to give entire assurance of freedom from trouble, the following additional safeguards should have attention: (a) When sheathing papers are used they should be of the breathing type. These cost no more than non-breathing papers and are also desirable in avoiding trouble from condensation of moisture from the interior of the house. (b) Good roof overhang will keep much rain water from hitting siding. Also, the survey and the experimental data indicated that the placement of trim over drop siding does not create a decay hazard. In fact, it appeared safer than the butted joints of siding to trim as commonly made.

The use of sound lumber and designs to limit water absorption by siding and hasten the drying of any wetted wood not only safeguards against decay but also should reduce paint failure, excessive warping, twisting, and nail pulling. These are all associated with moisture problems. In general, these troubles are more bothersome than decay.

When heavily stained lumber must be used for exterior trim or siding and where it can absorb water at the joints it can be given good protection by on-the-job use of oil-carried preservatives, like pentachlorophenol or copper naphthenate in mineral spirits (2). The vital points most needing protection are the end cuts. Thus treatment must follow sawing to size and shape on the job.

Further data are needed on the effects of end painting, back painting, moisture-repellent dips, and caulking of joints in reducing wetting of siding. End painting would be only partially effective if any leaks in joints occurred, because it would not prevent back wetting, which is most conducive to paint blistering. Complete back painting would be more effective but might be dangerous in preventing drying if any leakage through the paint film occurred. In preliminary tests, the dipping of the end 6 inches of siding in a toxic moisture-repellent solution has been very effective. This, or the painting of the end plus 6 inches or so of the back at the end, may eventually prove to be very useful adjuncts to the other moisture-control measures discussed in this paper.
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