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REFERAT

WOOD FOR GOOD

– A study on the service life of external wood claddings

In 1998–99 the University of Oulu's Department of Architecture conducted a broad study on the long-term durability of wooden façades. During the study nearly 123 wooden façades of different ages were examined and 2300 incidences of damage were recorded and analyzed.

The custom of panelling the exteriors of houses with boards spread to Finland at the end of the 17th century, and in general old claddings of this type have proved to last well. It has become common practice in recent decades to use somewhat thinner boards for this purpose and to coat them with industrially produced synthetic paints, mostly latex-based. These newer structures have degenerated surprisingly quickly and have proved to require a great deal of maintenance.

It has become quite common to think of timber as a poor facing material with a short service life and high maintenance requirements. The problems affecting both old and new timber facades do not arisen from the nature of the timber as such but are usually attri-

butable to mistakes in the design of the wall structure, the use of weak, thin boards, errors in structural detail, neglect of maintenance or the wrong choice of painting.

The aim here was to ascertain the factors affecting the long-term durability of timber facades by means of field investigations. This survey was undertaken in an attempt to demonstrate how durability can be ensured.

Content of the research

Five areas of differing character in three Finnish towns were selected for the field investigation in summer and autumn 1998, which consisted of an inventory of the condition and the reasons for any damage observed. The areas examined in the study included 123 wooden façades of different ages. During the study nearly 2300 incidences of damage were recorded and analyzed.

The inventory was conducted by recording information on the facade of each of the houses, in writing and by photographing them. The houses were examined for such features as the direction in which the facade faced, the overhang of the eaves, the height of the base wall, the dimensions of metal window sills, the integration of steps, etc., into the outer cladding of the building, and other factors that could cause damage to the boarding. Similarly, the shape and surface finish of the boards themselves, the types of nails used and the manner of nailing were ascertained and recorded in writing and with drawings. The thickness of the boards and the size of any ventilation gap left behind them were measured on all the houses, and in some cases samples of the wood and paint were taken for microscopic examination in the laboratory.

In addition to the basic data on each house, all damage to the boards or painted surfaces was documented with details of its extent and presumed cause. As the inventory included all the facades of the building whether damaged or not, the results could be assessed statistically to provide information on the average condition of old timber facades, the frequencies of faults of different types, and the frequencies of different causes of damage in facades of different ages. Since each instance of damage was recorded separately, it was possible to examine these by computer using cross-tabulation methods.

Conclusions

The most common types of fault are clearly paint blemishes, rotting, splitting of boards or warping of the thin boards so as to slip out of their grooves. The type of paint used affects the moisture content of the timber, but there are other factors as well that govern the durability of the facing, including the structure of the facade and climatic and environmental stresses. Frequently the cause of the damage, gives rise to faults of several kinds, mainly paint blemishes and rotting, which can proceed to various degrees of severity if left unrepaired. The damage is generally concentrated at points where water flows over the surface of the timber, or at cuts made across the grain of the wood, joins and other points in the structure that accumulate moisture. Fungal growth and rotting is chiefly to be found in the joins in the end walls of houses where these have no protecting eaves, places where boards have been extended, nail holes and points where boards are in contact with the ground.

The old Finnish construction heritage is a good basis for ensuring the long-term durability. The façade facing was formerly a sacrifice layer intended to protect the structure itself. Even so, board facings have traditionally been very durable. Today, wooden façades are felt to require considerable maintenance and to be short-lived. This conception has been reinforced by the fact that the theoretical age of wooden façades is held to be 50 years in Finland today.

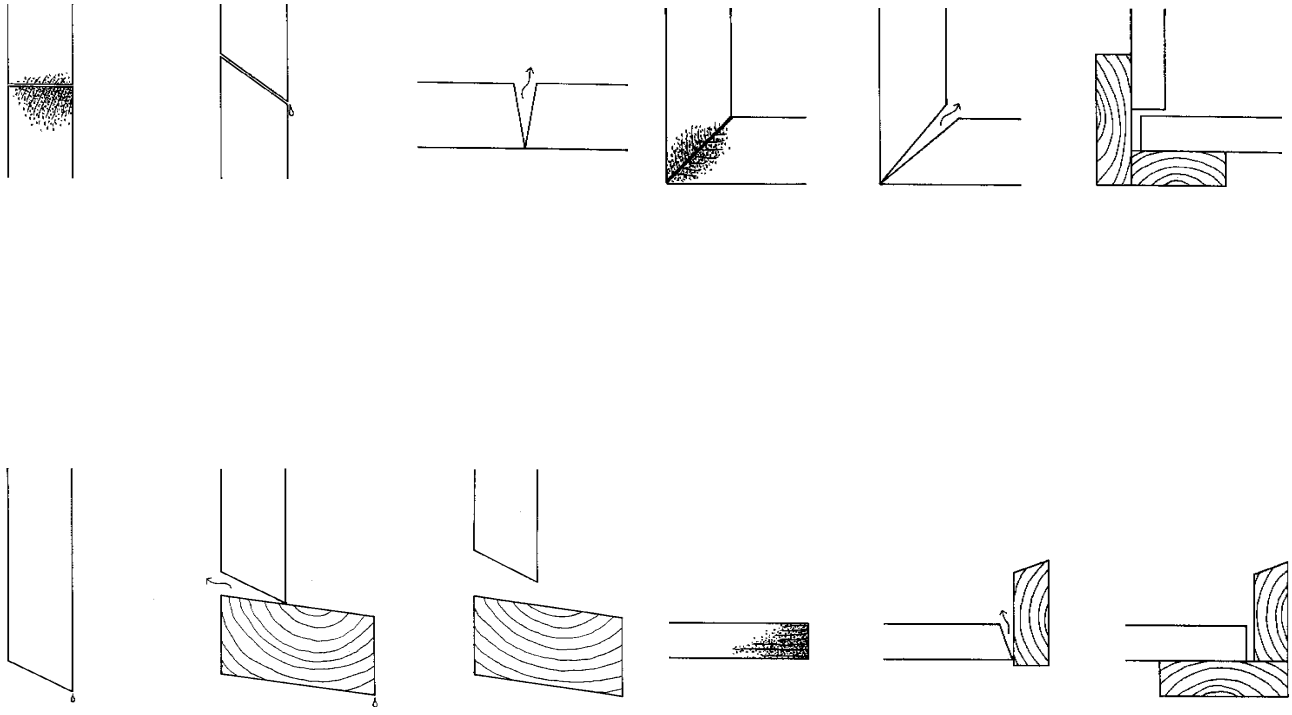
Timber construction during the last decades has not taken into consideration the simple fact that a thick façade facing is more durable than a thin one. On the contrary, Finnish design directives recommend the use of thin boards (18–21 mm). Damage to thin boards is common, regardless of the type of damage being examined. The boards on façade facings should be at least 25 mm, preferably 28 mm thick.

Structural protection is of essential importance to wooden façades. A wooden building should have eaves, but wooden façades with no eaves or very short eaves are still being constructed. And yet, the signifi-

cance of eave length to the total amount of damage is indisputable. Buildings with eaves over 500 mm long have considerably less paint and rot damage. The place most likely to damage is usually the bottom edge of the façade, which is exposed to moisture stress. The bottom edge of the boarding should be wedge-shaped to function as a drip edge. To avoid damage, molding should not be used at the bottom edge of the wall. If a bottom molding is used, it should be shaped to shed water well and it should be easy to replace. Damage can be minimized by using a sufficiently high foundation. The recommended foundation height is at least 300 mm, which design directives also recommend. Preferably, the foundation should be at least 500 mm high.

The timber facades of older buildings were constructed so as to ensure that water ran off the face of the boards as efficiently as possible, but the ornamentation on modern facades is commonly designed badly, causing water to stand in certain places, so that it gradually soaks into the surface of the wood. The ends of the boards, joins and corners are not always protected with ornamental battens as they used to be, and the water easily soaks in to the ends and eats its way into the grain. The situation is seldom very serious where horizontal panelling is concerned, but problems arise with vertical panelling if the ends of the boards are not cut at an angle, as was the case in earlier times, and the water manages to sink into the wood.

There are no definite recommendations on nailing distances. Finnish design directives only state that in board extensions, boards often need to be nailed near the ends, and to prevent splitting, holes should be pre-drilled for the nails. In job site conditions, nail holes are very rarely pre-drilled. In practice, nailing often causes splitting, because boards nailed closer than 30 mm to the end nearly always split. On the contrary, boards nailed farther than 70 mm from the end rarely split, unless the board is very thin. For this reason, boards should be nailed at least 70 mm from the end. Use of a nailing machine is not recommended. If a machine is used, the pressure should be low enough to leave the nails heads on the surface. Final nailing should be done by hand to prevent the nails from being driven too deep,



which would tear the surface of the wood and make the wood susceptible to paint and rot damage.

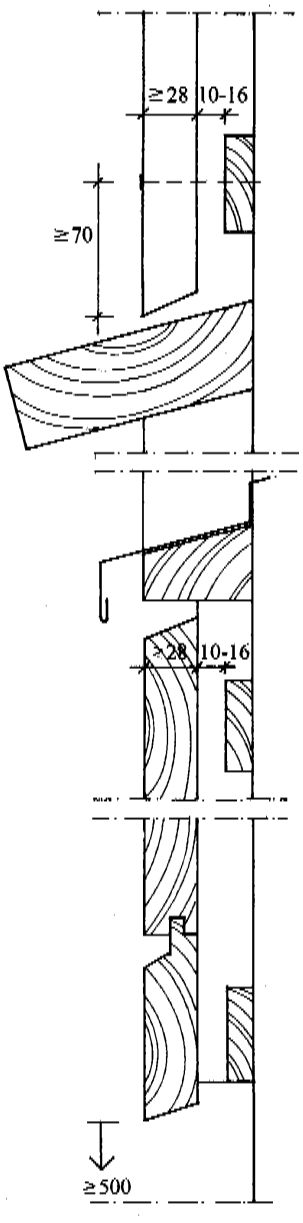
A mitered corner is always susceptible to damage and should therefore be avoided. If this type of corner is used, this study indicates it should be tight and ventilated. This means the corner boards should be sawed at an acute angle and the facing boards should be thick. This procedure was commonly used in mitered corners of façade facings of old buildings, which have been lasted well.

Current wooden façade design and construction directives emphasize the significance of the size of the ventilation space. Nevertheless, the effect of the size of the ventilation space on rot and paint damage is surprisingly small. More important than size is an open, freely ventilated ventilation space. To avoid splitting, however, the ventilation space should not be larger than 16 mm. With a small space the boards dry reasonably slowly, preventing quick changes in their moisture content.

Elimination of the causes of local damage is an important part of wooden façade maintenance. Neglecting simple maintenance measures can quickly cause extensive damage. Thus, for example, gutters and downspouts should be kept in good condition. Filth and litter on moldings, for example, also gather moisture and make them susceptible to damage.

Painting wooden façades

A wooden façade should be designed to last, if neces-



sary, without paint or other maintenance. An untreated and unpainted board facing loses only about 3 mm of its surface per 100 years. Façade durability should not be dependent on a paint coating. Because painting is usually neglected at some point in time, it is important to design and construct a façade with as few easily damaged details as possible, and so that such details are easily replaceable. Painting is still the primary method of improving the long-term durability of a wooden façade. Therefore, maintenance of the painted surface and sufficiently frequent repainting are the most important ways of making a façade last long. The better a façade is cared for and maintained, the better it withstands structural errors or solutions that are susceptible to damage.

Rough boards should not be used on façades. Repain-

ting is difficult because it is almost impossible to clean the old paint surface well. This type of façade also gets dirty quickly

The characteristics of different types of paint and different types of damage should not only be examined from the standpoint of damage, but also from the standpoint of repainting. Oil paint begins to flake with age, allowing moisture to penetrate the wood. Flaking oil paint does not prevent even evaporation of moisture from the boarding. On the contrary, latex paint is characterized by tearing along the grain and loosening of the paint coat from the base. This allows moisture to gather into "pockets" formed by the loosened paint film, and the impenetrable paint film does not allow moisture to evaporate. This process quickly damages the wood. Because damage caused by latex paint is one of the most typical types of damage in wooden façades, latex paints should be avoided in buildings intended to be permanent. Paints should not only be examined when new; it is more important to take into account how the paint will behave several years after painting. Although the recommended interval between paint jobs is shorter for oil paints than for latex paints, oil paint can be applied on top of an old paint surface. The problem with repainting using latex paint is the thorough preparation of the surface that is required. If the old paint surface is not removed correctly, the new coat will quickly begin loosening from the base.

It is no surprise to find from the present data that the older a facade is, the less damage is to be found in it, and although an old facade may appear to be in poor condition because it has not been painted in time, its true condition beneath the paint will usually be quite good. It is important to spread information on the true durability of timber facades, so they won't be renewed without a proper reason and also so the new facades could be build to last as long as the old ones have.

Typical damage is caused if…

- façade boarding is in contact with the ground or near the surface of the ground, allowing splash water and snow to dampen it.
- capillary flow of water from adjoining structures (e.g., concrete) into the wood is not prevented.
- structural protection is not taken care of. For example, the building's eaves are too short or missing completely, allowing rainwater to wet the façade.
- no ventilation space is made behind wooden façade facing, and the facing is covered with too impenetrable and thick a coat of paint, preventing the facing from drying after getting wet. As a result, the wood rots and the coat of paint loosens.
- weather-susceptible wooden facings are made from too thin wood material, allowing boards to warp and split.
- façade facings are made so water is not able to flow freely and drip off, and the water is absorbed by the wood.
- wooden facing extensions, joints and corners are not protected well enough, allowing water to penetrate the wood in the direction of the grain.
- straight, unbeveled extensions are used in vertical facing, and the bottom ends of the boards are not beveled.
- allowance is not made for changes in shape caused by moisture in the wood, resulting in swelling damage or cracking when the wood dries.
- nails are nailed too close to the ends of the boards, causing the boards to split.

Wood lasts long if…

- sufficiently thick material is used; at least 25 mm, preferably 28 mm.
- nails are nailed far enough from the ends of boards; min. 70 mm, preferably 100 mm.
- board joints and extensions, and preferably nailed places, are protected.
- structural protection is used, such as adequate eaves, at least 500 mm, and sufficient distance from the façade to the ground, recommended foundation height is at least 300 mm, preferably over 500 mm.
- rainwater is able to flow freely and exit from the surfaces.
- the correct paint is selected for each location, and impenetrable, thick coats of paint are avoided.
- repainting is taken care of and the paint surface is not allowed to deteriorate.

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