Dwelling Houses

A Code of Suggestions

FOR

Construction and Fire Protection

RECOMMENDED BY

THE NATIONAL BOARD OF FIRE UNDERWRITERS

NEW YORK

TO SAFEGUARD HOMES AND LIVES
AGAINST THE RAVAGES OF FIRE

SECOND EDITION

1920

PART IV.

FLOOR AND ROOF CONSTRUCTION.

Section 28. Wooden Joists or Floor Beams.

1. Wooden joists for buildings with masonry walls should be 3 inches thick (commercial size). Most Building Codes specify that thickness, and it is recommended for reasons explained in Section 59, paragraph 1, which is applicable to all types of dwellings where wooden joists are used. For fireproof first floor construction see Section 38, par. 2, 3, and 4.

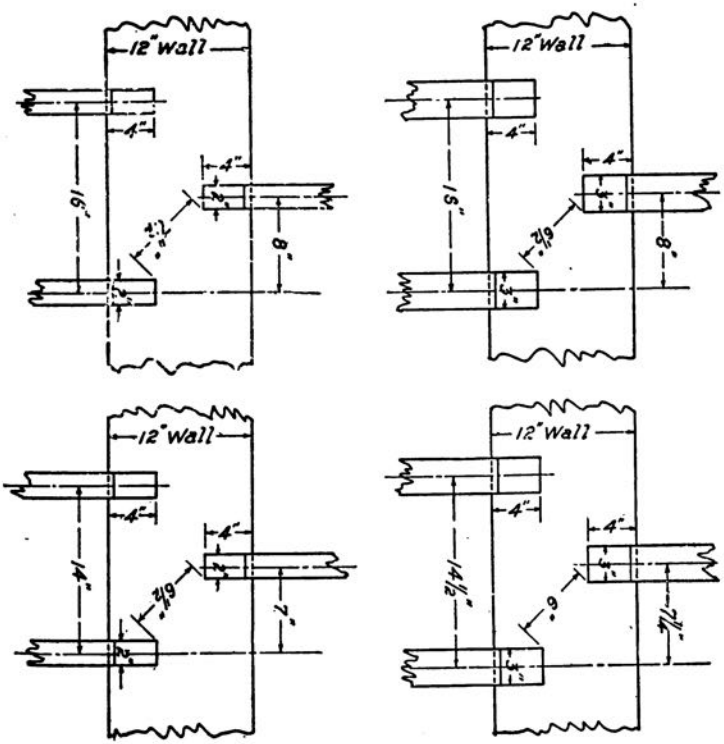


PLATE I.

Diagram showing placing of floor beams in a wall to secure a separation of at least 6 inches between ends.

2. Every wooden beam which rests in a party or fire wall shall be separated from any other beam in the wall by at least 6 inches of solid masonry. Such separation may be obtained by staggering the beams, corbeling the wall, or by use of steel wall hangers arranged to make the beams self-releasing. No wall shall be corbeled more than 2 inches for this purpose. If the beam ends are opposite each other in the wall the separation shall be not less than 8 inches. Plate I indicates spacing and arrangement of beams of different thickness in a 12-inch wall which will meet the requirement of this section. The spacing could be reduced if the walls under the beams were corbeled. Figure 1 in Plates VI and VII shows how a proper separation of beam ends may be obtained around a fireplace or chimney. Offsets in the masonry work can be avoided by use of steel wall hangers.

NOTE.—Staggering the beams distinctly lessens the danger of transmission of fire through a wall, because the fire or highly heated air must travel through two joints at right angles to each other to pass from one beam to the other. The probability of two right angle joints being open is much less than in the case of one straight connecting joint. See Note to Section 22, par. 2, on mortar joints.

3. Trimmer and header beams over 4 feet in length shall be hung in approved metal stirrups or hangers.

4. Every wooden beam, except header and tail beams, shall have bearings of at least 4 inches.

NOTE.—In designing wooden floor constructions to carry heavy loads, it is important to take into account the resistance of wood to crushing perpendicular to the grain. Frequently the area allowed for support of the ends of wooden beams is so small that crushing occurs while other proportions are ample for the load. The allowable load on yellow pine and Douglas fir should not exceed 325 pounds per square inch, and on spruce and hemlock not in excess of 250 pounds per square inch.

5. The ends of all wooden floor and roof beams which rest in walls shall be cut to a bevel of ¾ inch for each 3 inches in depth, but need not exceed a total of 3 inches.

NOTE.—This is to make the beams self-releasing in case they should collapse from fire or other cause, and so avoid throwing down the walls.

6. All wooden floor and roof beams shall be properly braced with cross bridging. The distance between bridging or between bridging and bearing should not exceed 8 feet.

7. Each tier of beams running parallel to enclosing walls shall have approved 4-inch anchor strips dovetailed into the beams diagonally, crossing at least four beams.

Section 29. Wooden Flooring.

1. Wooden flooring should always be double, and it is recommended that a layer of heavy asbestos or other incombustible

floor felt be placed between the rough under flooring and the upper finish flooring.

NOTE.—The felt will not only make the floor warmer, and assist as a sound deadener, but it will aid somewhat in resisting the passage of fire through the floor.

2. Where wooden flooring is laid over a fireproof construction, the space between the wooden sleepers should always be filled level with underside of flooring with cinders or other dry porous incombustible filling. This avoids air spaces through which a fire might travel.

NOTE.—It is important that timber used for interior construction be thoroughly seasoned, especially if it is to be encased in a manner to prevent free circulation of air about it. Otherwise, there is danger of dry rot attacking the timber, and causing great expense for its replacement within a few years. Dry rot also increases the fire hazard, as rotted wood is more combustible than sound wood. Furthermore the shrinking of green woodwork in a building always produces ugly disfigurations. Another advantage of using seasoned timber is that shakes and checks will have reached their ultimate development. Consequently, there will not be the danger that a joist or beam selected green will develop dangerous checks and shakes in seasoning.

Sapwood is very susceptible to dry rot, and should be avoided in locations where the timber is liable to be subjected to dampness. In timbers used in such locations, if the species used shows a marked difference in color between heartwood and sapwood, it is a good rule to specify that three-quarters heart shall show at any part of the narrow faces of joists or posts. From a strength standpoint alone, sapwood is no defect.

Very wide-ringed wood of the conifers (popularly known as "softwoods") is likely to be considerably weaker than that which is intermediate. It is well to avoid the use of joists and posts of coniferous wood in which the yearly growth rings are fewer than six to the inch.

In southern yellow pine and Douglas fir each annual growth ring is composed of a dense, dark and heavy band of summerwood, and a lighter and softer band of springwood. In these two species the greater the proportion of summerwood in the ring the greater is the dry weight and strength of the timber. The proportion of summerwood in timbers of either species ought not to average less than one-fourth the total width of the ring. If the summerwood in a piece of southern pine or Douglas fir grades off gradually into the springwood, this piece should not be used, unless the proportion of summerwood is considerably over one-third.

In other species, such as spruce, hemlock and Norway pine, if timbers are exceptionally light when dry they should not be used as they are not strong, hence not so reliable.

The number, character, and location of defects in timber has much to do with its strength. Checks and shakes in joists are most harmful in the middle half of the height; that is, in the portion showing white between the shaded areas of the beam indicated in Plate II. The best place to judge such defects is on the ends of the timber. The measurement, out to out, of a ring-shake, measured parallel to the width of the timber, should not exceed one-half that width. Shakes and checks need not be considered in selecting a post or column.

The weakening effect of knots likewise depends upon their position, as well as upon their soundness, tightness, and the amount they distort the grain of the wood from a straight line. A comparatively small

knot near the lower edge of a beam at its middle is far more harmful than a large knot near the same edge but close to the end. The size of sound knots (those securely attached to the surrounding wood) when located in the portions of a beam indicated by the shaded areas in Plate II, should not be greater in diameter than one-half the width of the face on which they show, and should never exceed 3 inches.

If the knot is loose or surrounded by pitch or bark its diameter should not be greater than one-fourth the width of the face on which it shows, and should never exceed 1½ inches.

No timber with a rotten knot however small, should be used, since the interior of such a timber is likely to become badly decayed.

Cross-grain timber should be avoided when the cross-grain occurs in the lower of the two shaded areas shown in Plate II.

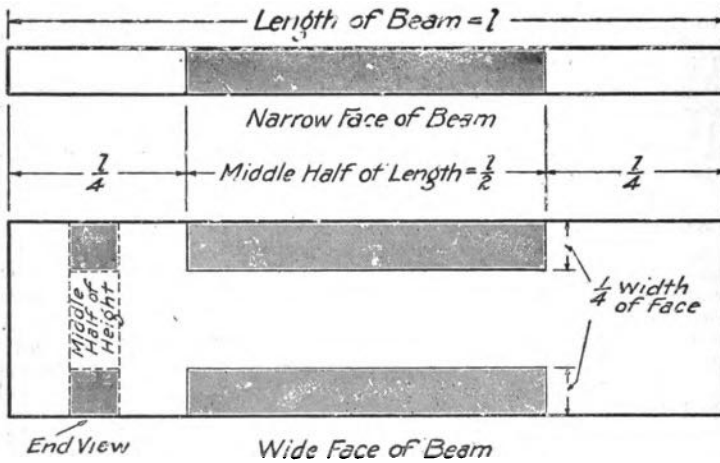


PLATE II.

Plan and elevation of wooden beam, with shaded areas indicating portions in which certain defects should be excluded.

Section 30. Approved Roofings.

1. Whenever possible use a fire-resistive roof covering. The safety which it offers is well worth the additional expense. There is a variety of approved roofings on the market which will afford satisfactory protection and service; a number of them are but little more expensive than first class wooden shingles. The first cost of a roofing material must be averaged with the years of service it will render in order to ascertain the real expense of maintaining the construction. The life of the best fire-resistive roofings is considerably longer than that of the wooden shingle, and this fact should be considered in selecting. Among the recommended roofings are tile, tin, slate, asbestos shingles, and other

composition shingles and prepared roofings which have been tested and approved for fire-resistance and durability.

2. The fire-resistance of ordinary roofs can be considerably increased by covering the rafters on the underside with metal lath and plaster, asbestos mill board, or asbestos building lumber, gypsum plaster board or any other incombustible heat insulating material. Such coverings add much to the comfort of the house by making the attic cooler in summer and warmer in winter. The insulation can be further improved by a 2-inch layer of mineral wool placed between the rafters and supported by any of the board materials above mentioned. Gypsum plaster blocks could also be employed for this purpose. Such construction owing to its resistance to heat and cold, is particularly advantageous when sleeping rooms are located in the attic.

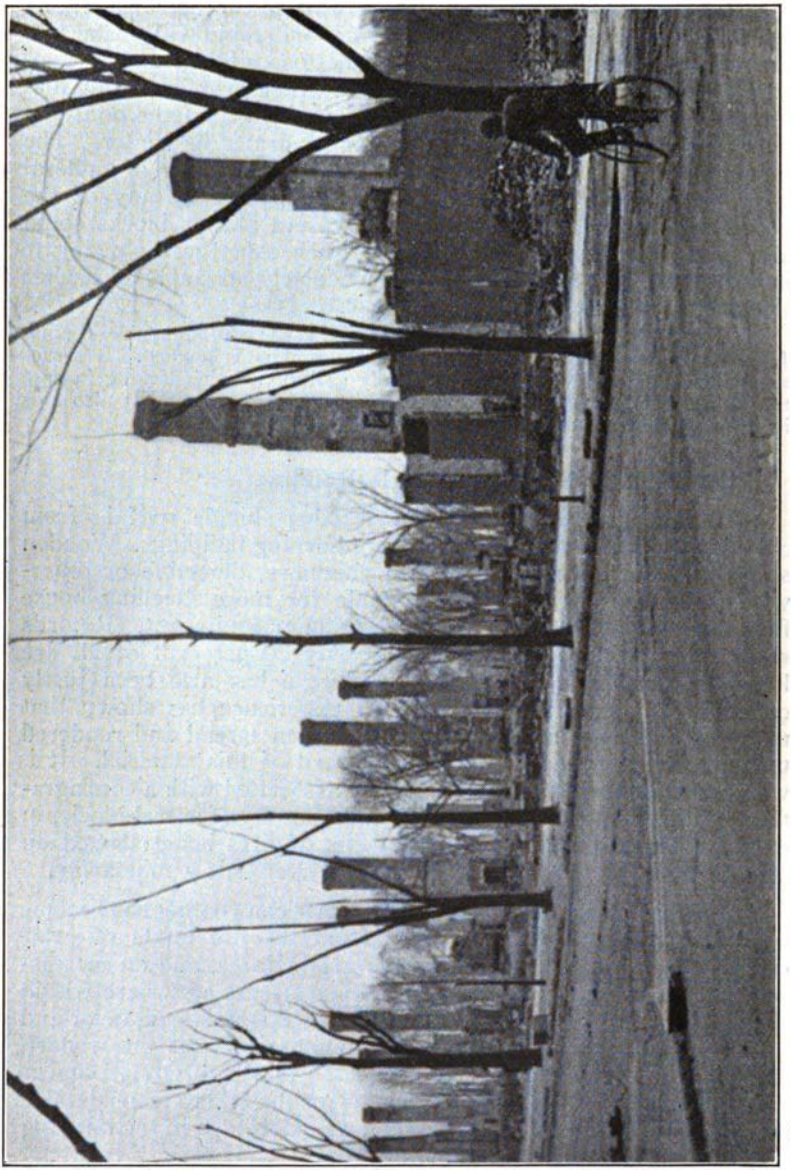
NOTE.—It is recommended that a layer of non-flammable roofing felt be laid on the roof decking before tin roofing is applied. It serves as an insulator and would prevent ready ignition of the decking in case the tin were subjected to fire brands or severe radiant heat. It also aids in keeping the attic cool in hot weather.

Section 31. Wooden Shingle Roofing.

1. The great danger of the wooden shingle roof is from chimney sparks, or flying brands from burning buildings. Wooden shingle roofs in combination with chimneys, defective or otherwise, have probably been accountable for more dwelling house fires than any other defect in construction or equipment. Records show that they are responsible for over 20 per cent of all fire losses in dwellings. The wooden shingle has also been justly called a "conflagration breeder" for experience has shown that many of our large conflagrations have been spread and rendered uncontrollable by the flying brand hazard of this material. It is well known that the high wind usually associated with a conflagration will distribute blazing shingles over an area several blocks in extent. There are numerous incidents of fires being started on shingle roofs by the burning of another over half a mile away.

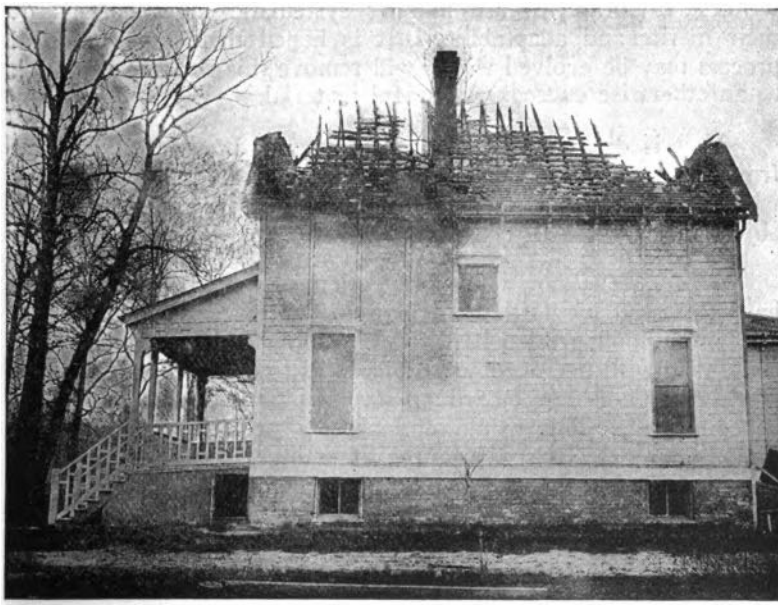
2. The hazard of this typically American roofing has become so well recognized it is excluded from the fire limits of practically all cities where building laws are in force, and an increasing number are enacting laws forbidding its use anywhere within the corporate limits. However, in spite of this public disfavor and its "criminal record," it is an unfortunate fact that the wooden shingle roof is still extensively used for isolated dwellings, and in many towns and real estate developments where considerable building congestion but no building laws exist; also in the outlying areas of the majority of our cities.

3. The reasons for the continuance of this evil are several, first of which is habit. It is easier and more natural to do the



A once beautiful street in Augusta, Georgia, as it appeared after the conflagration of 1916—a graveyard of handsome houses. Behold a sacrifice to the wooden shingle!

thing we are accustomed to do, than to start something new. The second primary cause is low first cost of wooden shingles; third, the ease of application—skilled labor not being required; and fourth, the general distribution of the product—they being on sale in practically every town in the country. There are other reasons for their use, but all their advantages are overshadowed by their one great discrediting feature—their fire hazard. This menace is always present, and no sophistry or argument can remove it. Therefore the National Board of Fire Underwriters urges that wooden shingles shall not be used where a safer roofing can be secured.



Courtesy of N. F. P. A. Quarterly.

Typical result of sparks falling on a wooden shingle roof. Danger increases with the age of the roof.

4. When wooden shingles are used, their fire hazard should be recognized, and every precaution taken to make them as safe and efficient as possible. The life of the shingles can be considerably increased by treating them with preservative compounds. This can be done at the building, or treated shingles can be purchased in the market. Most of such compounds are in the nature of stains, which do not directly increase fire-resistance. However, indirectly they assist the shingles to resist fire in this way: A newly shingled roof offers much better protection from fire than an old one, because the shingles lie closely together and

present a smooth, hard surface upon which sparks or embers are not likely to lodge permanently, but will roll or be blown off. On an old roof where the shingles are badly weather-worn and have curled and broken edges, the chances of sparks being held and igniting the roof are very greatly increased; therefore any treatment which will preserve the shingles and prolong their existence as a smooth roof surface will incidentally improve its fire-resistance.

5. Various methods of fireproofing wooden shingles have been proposed, and the U. S. Forestry Service and the Underwriters' Laboratories are making systematic investigations of their merits and adaptability. It is hoped that some practical process may be evolved which will remove this serious drawback to an otherwise exceedingly useful material.

If it is desired to collect rainwater for household purposes from roofs, it will be necessary to choose treated shingles which will not contaminate the water. Some preservatives have this objection.

6 A well known fire prevention expert in New England has expressed his faith in a plan to protect a wooden shingle roof from conflagration hazard by installing a dry pipe along the ridge pole with perforations so placed as to spray the whole roof when water is turned on from a service pipe with which it would be connected. This would undoubtedly protect the roof from sparks or embers from any source, or extinguish an incipient blaze provided the occupants knew of the danger and turned on the water.

Section 32. Skylights.

All skylights should have metal frames and sash and be glazed with wired glass, or be protected above by heavy wire screens.

NOTE 1.—The purpose of this requirement is to prevent possibility of fire brands carried by the wind from some burning building breaking through a skylight and setting fire to the interior of the house.

NOTE 2.—Building Codes usually require that a skylight over any shaft passing through a building directly to the roof, such as elevator, stairway, vent and light shafts, shall be glazed with thin glass. The idea being that if a fire occurred in the building and worked into the shaft, the heat would break out the thin ordinary glass, and so give vent to the heat and smoke. This would prevent the fire being forced sidewise through other portions of the building and at the same time give firemen a chance to control it. Such construction would scarcely apply to dwellings except those having considerable size and height, and presumably within the radius of public fire protection.

Section 33. Roof Structures.

All structures built above the roof surface, such as bulkheads, scuttles, tank houses, etc., should either be of fireproof construction or be covered with incombustible material.

NOTE.—Such structures are liable to be forgotten in the confusion during the burning of some nearby building. If they are not protected and the wind is in the right direction, the danger of their ignition from radiant heat and consequent firing of the upper story of the house before discovery is well known. The fact that such a fire would be in the most inaccessible place to fight increases the risk. A prudent person will make all the roof surfaces of his house at least non-flammable, and economize elsewhere if necessary.