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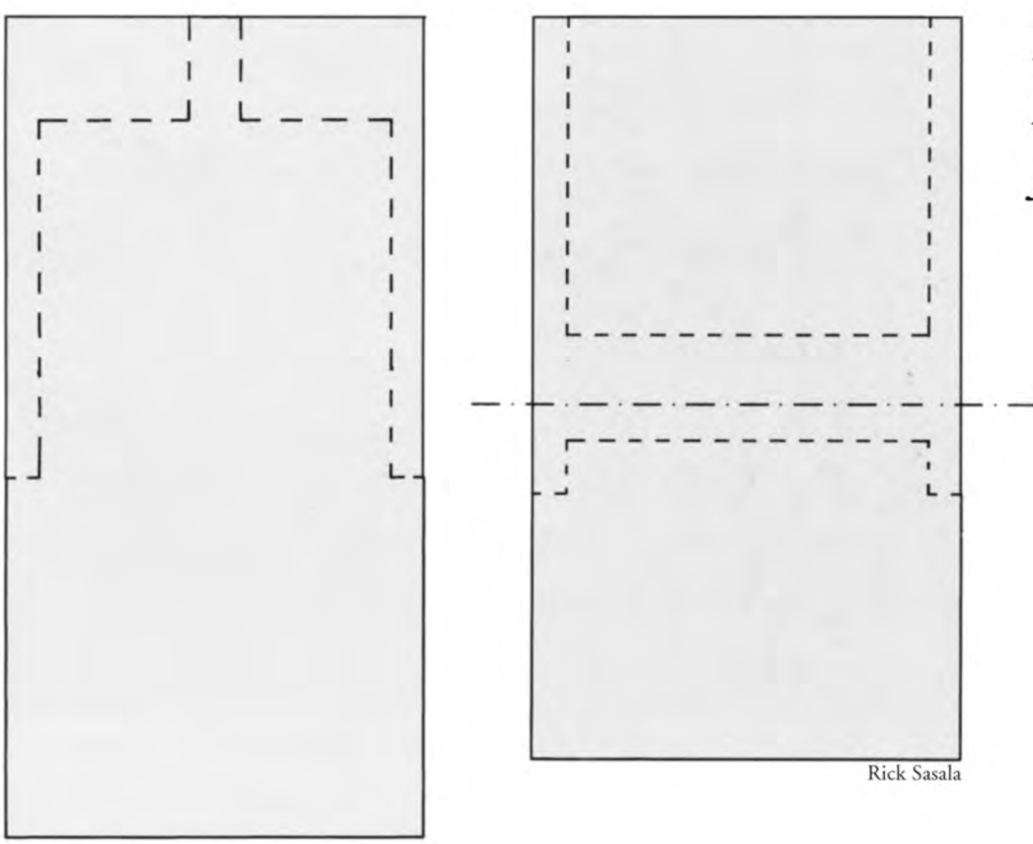
Michael Anderson

Learning from Sea Ranch



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Notched vs. Mortised Joinery

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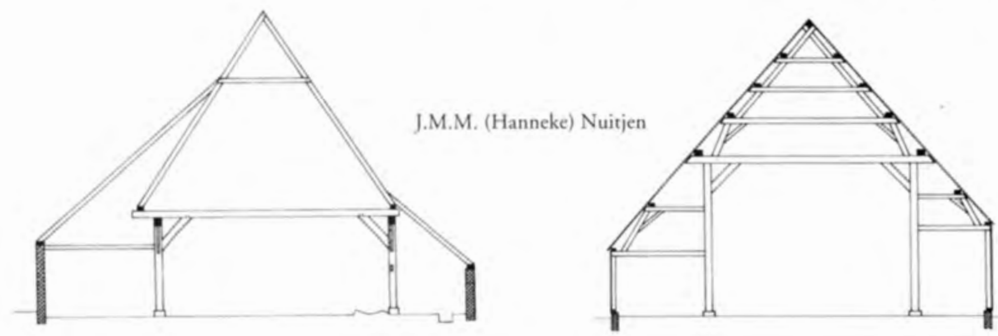

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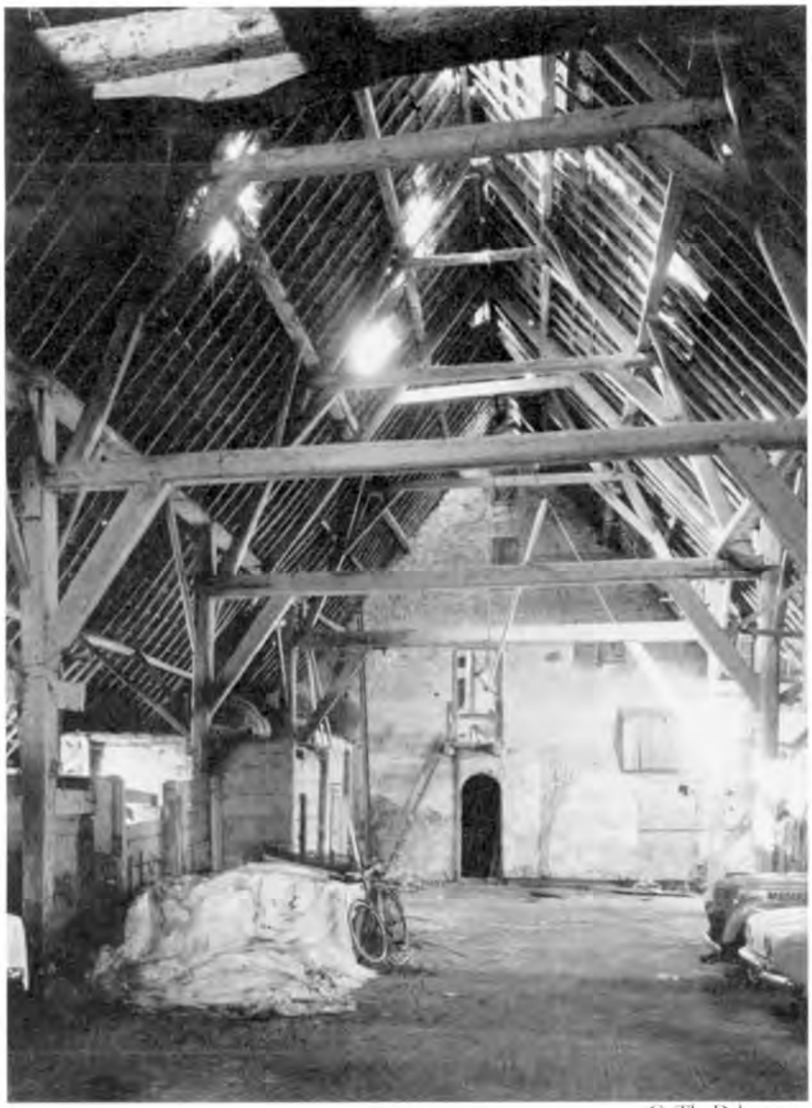
TIMBER FRAMING, Journal of the Timber Framers Guild of North America, reports on the work of the Guild and its members, and appears quarterly, in March, June, September and December. TIMBER FRAMING is written by its readers and welcomes interesting articles by experienced and novice writers alike. Contributions are paid for upon publication at the rate of $125 per published page.



G. Th. Delemarre

Photos above and below, G.J. Dukker

BOOKS

Dutch Farm Buildings

Historische houtconstructies in Nederland, by G. Berends. SHBO, Postbus 649, 6800 AP Arnhem, the Netherlands, 1996. 8.25 in. x 11.75 in., 142 pp., profusely illustrated. Softbound (signatures), $58.

SOME of you may remember a talk at the Guelph '92 conference on the historic farm buildings of Holland, given by Ellen van Olst (see TF 27), the director of the Institute for Historic Farm Research in Arnhem. The Institute has published numerous folios and books on Dutch farm buildings, of which the latest is geared specifically for the timber framing enthusiast. Although the text is primarily in Dutch, there isn't a lot of it, and the book is heavily illustrated with crisp black-and-white photographs and good line drawings. Spurred by the interest of American and English timber framers, the Institute has also included an English summary and glossary of building terms. The many joints and fastenings used in Dutch framing are shown in line drawings, and 26 different frame types are represented by cross-sectional drawings, with all components labeled. There is a great deal of information to be gleaned here about historic framing, and comparisons can be made with our New World Dutch architecture. The book (available from loftybooks@aol.com) also doubles as a rich source of ideas for those designers and builders wishing to try something a little different.

—Jack A. Sobon

Notched vs. Mortised Joinery

IN preparing for the session "Advanced Timber Frame Joints: An Engineering Perspective" at the Bethlehem Conference last fall, I found several people who were interested in seeing an engineering analysis of notched joints for drop-in members, typically joists or purlins, compared with mortised joints for tenoned ones. This article provides the general analysis technique for determining the section modulus of a beam with notches or mortises, and then compares several specific examples.

A timber frame designer may have to decide whether to use a drop-in joint or a mortised joint for letting floor or ceiling joists into a summer beam or girder and common purlins into principal rafters. The first step in the process is to quantify the loads and calculate the reactions at the joint. For the purposes of discussion, I will pick a somewhat arbitrary, yet plausible, 16-ft. summer beam that supports 6x9, 14-ft. joists on each side, spaced 4 ft. center-to-center. The design loads for the problem include a dead load of 15 pounds per sq. ft. (psf) and a 40-psf live load. Therefore the reactions R at the ends of the joists equal

$$R_{psi} = \left(15\,psf + 40\,psf\right)\left(4\,ft\ o.c.\right)\left(\frac{14\,ft}{2}\right) = 1540\,lbs.$$

The 14-ft. joist length is divided by 2 because the joist is uniformly loaded, so the reaction of one end is for the weight on half of the joist. Using this reaction and the fact that joists bear on both sides of the summer beam, the loading is as shown in Fig. 1.

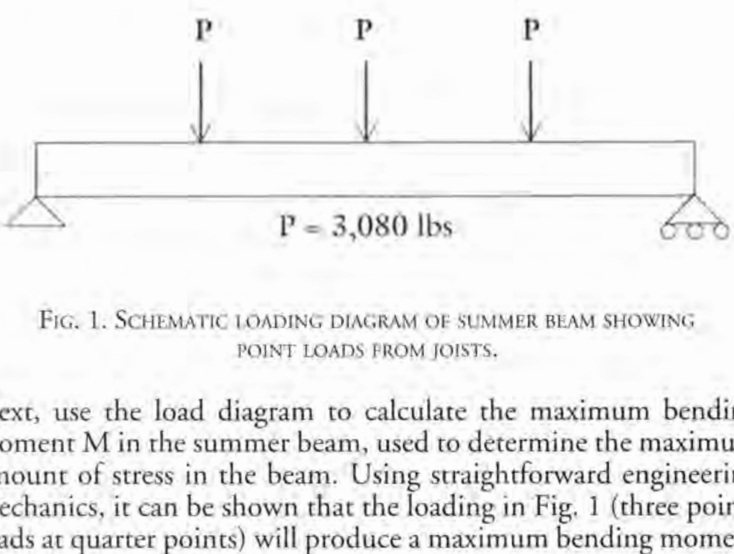


FIG. 1. SCHEMATIC LOADING DIAGRAM OF SUMMER BEAM SHOWING POINT LOADS FROM JOISTS.

Next, use the load diagram to calculate the maximum bending moment M in the summer beam, used to determine the maximum amount of stress in the beam. Using straightforward engineering mechanics, it can be shown that the loading in Fig. 1 (three point-loads at quarter points) will produce a maximum bending moment M at the center of the summer beam equal to

$$M = \frac{PL}{2} = \frac{\left(3080\,lbs\right)\left(16\,ft\right)}{2} = 24640\ ft\ lbs = 24.6\,ft\ kips$$

where M = bending moment, P = point load and L = beam length. A *kip* is a kilopound, or 1,000 pounds, of force.

Moments for many other common loading situations are tabulated in the American Institute of Timber Construction *Timber Construction Manual,* published by John Wiley & Sons, or in the *Manual of Steel Construction,* published by the American Institute of Steel Construction. The maximum design bending stress in the summer beam is given by the following relation:

$$f_b = \frac{M}{S} \qquad (1)$$

where f_b is the design bending stress and S is the section modulus of the beam, defined as

$$S \equiv \frac{I}{c}\ \ \text{[units are length cubed]} \qquad (2)$$

where I = the moment of inertia about the neutral axis (zero stress plane) of the beam and c = distance from the neutral axis to the farthest fiber of the beam cross-section.

Using integral calculus, it can be shown that for a rectangular beam of width b and depth

$$S = \frac{bd^2}{6}\ . \qquad (3)$$

In practice, a designer knows the allowable bending stress F_b for the species and grade of wood used in the frame, and will therefore usually solve equation (1) for the required section modulus rather than bending stress. Design stresses are tabulated for many common commercial lumber species in the *National Design Specification for Wood Construction (NDS) Supplement,* published by the American Forest & Paper Association, 1991. Rewriting equation (1) and assuming the use of No.1 Northern Red Oak (NRO) give the required section modulus S for the summer beam if no notches are made in the beam:

$$S = \frac{M}{F_b} = \frac{\left(24.6\,ft\ kips\right)\left(12\,in\right)}{1.35\,kips/si} = 219\,in^3.$$

Suppose we want to use an 8-in.-wide beam, then the smallest member with the required section modulus is an 8x13, since

$$S = \frac{bd^2}{6} = \frac{8\left(13\right)^2}{6} = 225\,in^3 > 219\,in^3.$$

An 8x13 without any notches will be strong enough. In sizing a beam for construction, one must consider the amount of deflection as well as the stress in bending. It can be shown that an 8x13 will not pass the length-divided-by-360 deflection requirement for many applications, and as a result an 8x14 would be the minimum size 8-in. member to meet that specification. However, notches and mortises typically have a small effect on deflection, and since it is not the main topic of the article, deflection will not be discussed for the examples.

WITH the loads calculated and a minimum member size determined, we can now consider the joinery and its effect on the summer beam. For this comparison, we will house both kinds of joinery to eliminate any problems of horizontal shear in the ends of the joists. The depth required for the 6-in.-wide housing is governed by the value for compression perpendicular to the grain $F_{\perp}$ or 885 psi for No.1 NRO Beams and Stringers. The required housing depth D then equals

$$D = \frac{1540\,lbs}{6\,in\left(885\,psi\right)} = 0.29\,in\ .$$

Adding a similar amount of depth to allow for shrinkage of the summer beam, a ⅝-in. housing would serve.

To calculate the effect of the notched joint on the summer beam, it does not matter if the notch is straight-sided or dovetailed, and I will simply refer to the joint as the notch. For this example the notch is 2 in. deep and 2⅞ in. long. Since we are essentially removing 2 in. of material from the top of the beam, it is logical to try first an 8x16 beam to see if it will work. There is no pegging, as either the dovetail or ceiling or floor boards will hold the joint together. (If there is a reason for a tensile force on this joint, it should be given more careful consideration. Here it is assumed that no tensile force is present.) After notching, the remaining cross-section of the summer beam is shown in Fig. 2.

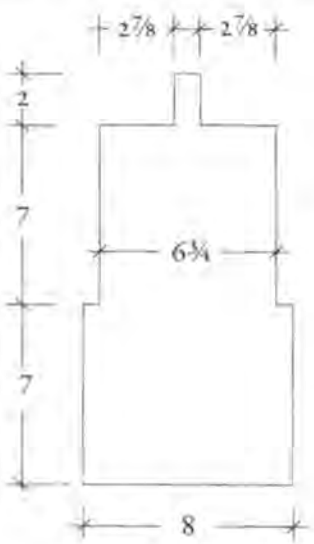


FIG. 2. NET SECTION OF SUMMER BEAM AFTER HOUSING AND NOTCHING FOR JOIST.

Note that a carefully cut and wedged joist in dry timber can initially support compressive stress at the top of the summer beam. But since the width of the joist will change much more than the notch width because of seasonal changes in moisture content, the joist cannot be relied upon to support compressive stress across its grain, and the cross-section shown in Fig. 2 must be used for stress calculations. If the joint is cut in green timber, dimensional changes are even greater.

Since material has been removed from the summer beam, the stress calculation done earlier is no longer valid and must be redone. Further, as is obvious from Fig. 2, the remaining section is no longer rectangular and the section modulus must be derived. Recall that the section modulus is defined in terms of the moment of inertia I about the neutral axis and the distance from the neutral axis to the extreme fiber c in equation (2). Therefore, the first thing that we need to find is the neutral axis. Since the neutral axis must pass through the centroid (the geometrical center) of the section, we will calculate the centroid position. Actually, since the section is symmetrical about the vertical axis, we already know that the centroid must lie along it somewhere, and we only need to calculate the vertical position.

BEFORE jumping into the mathematics, let's first explore a perhaps intuitive way to think of the centroid of a body. Begin by realizing that the centroid of an object is in the same location as the center of gravity if the object has a uniform density. Also, the center of gravity of a simply supported object in static equilibrium is always between points of support. For example, if you support a yardstick (set flat-wise) near its ends with your forefingers extended, and then move your hands toward each other, your fingers will always meet at the 18-in. mark because that is the location of the centroid and center of gravity.

To extend this experiment a little further to locate the centroid of a non-rectangular object, support a non-rectangular shaped panel (maybe a triangle) with forefingers extended from each hand, one near the narrow end of the piece, the other near the wide end, and move your hands slowly together. When your fingers touch, you have found the centroid. Note that it is not halfway between the ends of the panel. To see how the centroid changes when the panel is notched, mark the centroid before notching and find the new centroid after notching.

A comparison of this sort for a triangular section and two "notches" of equal area is shown in Fig. 3, above right. Note the change in the vertical position of the centroid in object c compared to object b because the removed area is farther from the centroid shown in a.

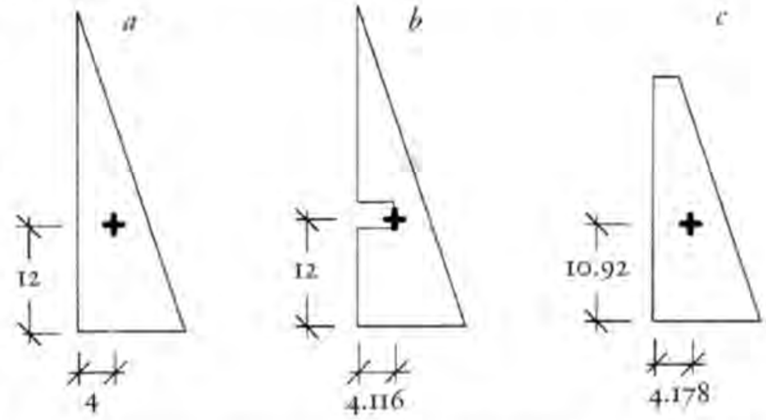


FIGURE 3. EXAMPLE OF CENTROID POSITION FOR NON-RECTANGULAR SECTIONS SHOWING EFFECT OF POSITION OF DIFFERENT NOTCHES WITH EQUIVALENT AREAS.

While the experimental method for determining the centroid could always be used, it is not very precise nor very convenient. Therefore, there is a need to generalize the technique with mathematics. While the most general case requires the use of integral calculus, most situations that timber framers will encounter can be solved with straightforward algebraic sums. When an object can be broken down into simple geometric shapes (squares, rectangles, triangles, etc.), the centroid can be found with the following sequence:

1. Determine the distance y_i from the centroid of each shape to a common point.
2. Multiply each distance by the area A_i corresponding to that shape.
3. Sum $\sum$ all of the products together.
4. Divide this sum by the total area of all of the shapes.

In mathematical notation, this procedure is written as shown in equation (4) for n shapes, where $\bar{y}$ is the distance from the common point to the centroid of the whole object

$$\bar{y} = \frac{\sum_{i=1}^{n} y_i A_i}{\sum_{i=1}^{n} A_i} \tag{4}$$

and $i = 1$ means that all shapes from 1 to n must be included.

Returning to Fig. 2, the cross-section can be broken down into three rectangles. If we use the midpoint of the top of the beam as the common point to determine the individual centroid distances, the distances y_i will be as shown in Fig. 4.

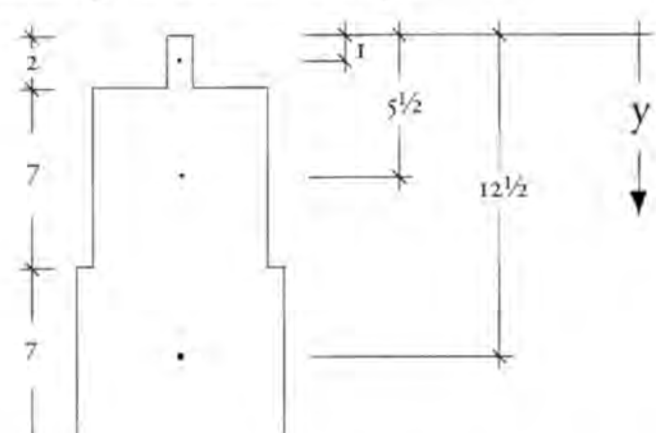


FIG. 4. LOCATION OF Y-POSITION OF CENTROID FOR EACH SUBSECTION OF NOTCHED BEAM.

Note that the centroid of a rectangle is at the half-length and half-width point.

Using equation (4), the centroid position of the beam equals

$$\bar{y} = \frac{1(1)(2) + 5\tfrac{1}{2}(7)(6\tfrac{3}{4}) + 12\tfrac{1}{2}(7)(8)}{(1)(2) + (7)(6\tfrac{3}{4}) + (7)(8)} = 9.14\,.$$

The centroid before notching was located 8 in. below the top of the beam, and the notching has caused it to move 1.14 in. lower in the beam. As with the example of the triangular sections in Fig. 3, removing a fairly small amount of area has a significant effect.

NOW that the centroid is known, the next step in determining the section modulus S' of the notched summer beam is to calculate the moment of inertia I of the section about the neutral axis. This can most easily be done by using the parallel axis theorem, from introductory statics. This states that the moment of inertia of an object composed of smaller objects is equal to the summation of moments of inertia of each smaller object, plus the summation of the area of each smaller object times the distance squared between the centroid of the smaller object and the centroid of the larger object. In equation format,

$$I = \sum_{i=1}^{n} I_i + \sum_{i=1}^{n} A_i d_i^2 \qquad (5)$$

where I_i = Moment of Inertia of part i
[= $bd^3 \div 12$ if part i is a rectangle],
A_i = area of part i and
d_i = distance from centroid of complete object to centroid of part i.

Now apply this equation to the summer beam with the assistance of Fig. 5 below, which shows the position of the neutral axis and

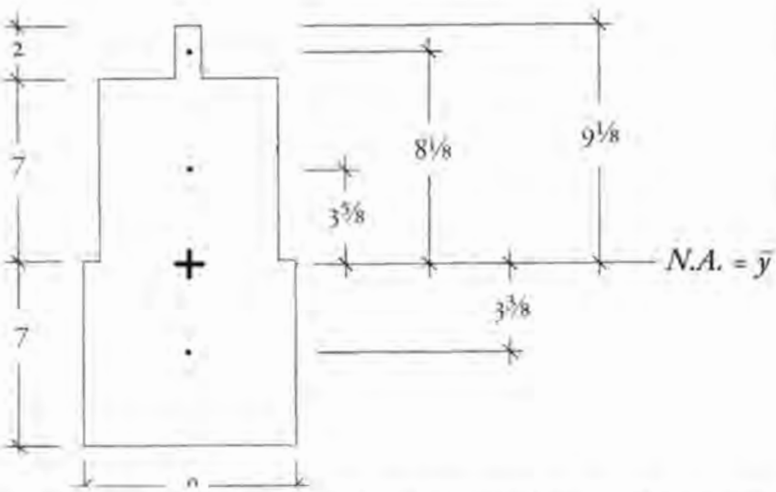


FIG. 5. LOCATION OF THE NEUTRAL AXIS AND CENTROID DISTANCE FOR THE NOTCHED BEAM.

the centroid separation of the three areas from the neutral axis. The calculation is as follows:

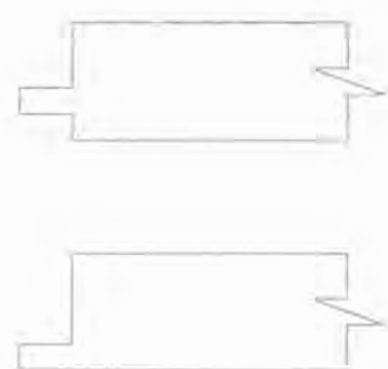
$$I = \frac{1(2)^3 + 6\tfrac{3}{4}(7)^3 + 8(7)^3}{12} + 2(8\tfrac{1}{8})^2 + (7)(6\tfrac{3}{4})(3\tfrac{5}{8})^2 + (7)(8)(3\tfrac{3}{8})^2$$
$$= 1813\,.$$

To find the reduced section modulus S', use equation (2) with c equal to the distance from the top of the beam to the neutral axis:

$$S' = \frac{I}{c} = \frac{1813}{9\tfrac{1}{8}} = 199 < 219.$$

Since the reduced section modulus is less than the required 219 cu. in. calculated earlier, an 8x16 is not strong enough with the 2-in. deep notch, and one must use an 8x17. In other words, the assumption made at the beginning of this section that the beam should be made 2 in. deeper to make up for the 2 in. removed is not correct, and even more wood is required. It is instructive to compare the strength of an 8x16 beam before and after notching to quantify the strength reduction that occurs with the notched joint. For the 8x16 before notching, $S = 8\,(16)^2 \div 6 = 341$, which shows the relative strength of the notched 8x16 to be 199 ÷ 341 or 58.4 percent of the unnotched member, a substantial reduction. Comparing this percentage with the nearly 82 percent of the wood remaining at the joint, one can safely conclude this joint is not a very efficient use of wood in the summer beam. Also note that holes drilled for any pegs to hold the joint together will result in an even weaker summer beam and less efficient use of wood.

THE analysis of the notched joint showed a significant reduction in the strength of the summer beam. Can we do better using a mortised joint? And would there be a difference between the tusk tenon and soffit tenon (bottom drawing) configurations? The approach and calculations are very similar to those already done, so only the results will be presented here. Since we saw earlier in the case of the triangles (Fig. 3) that removing material from the middle of a section has the smaller impact, we will first consider a 2-in. tusk tenon without pegs and with the tenon centered on the neutral axis of the section before mortising. (Again, we assume that floor or roof sheathing holds the joint together and eliminates the need for pegs. Note that temporary restraint may be required during raising.) Since we expect this joint to be a more efficient use of the summer beam, we will first try an 8x14. The section after mortising is shown in Fig. 6. Also included are the centroid-to-neutral axis dimensions for the new section modulus calculation.



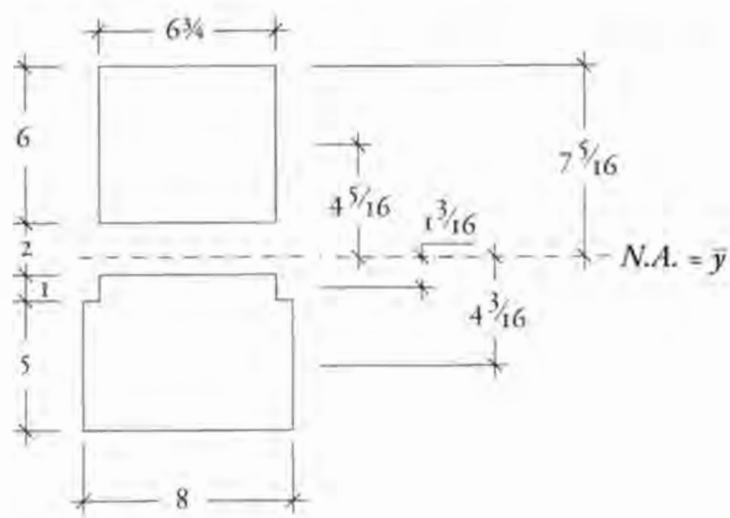


FIGURE 6. NET SECTION OF SUMMER BEAM WITH 2-IN. TUSK TENONS THROUGH MIDDLE OF BEAM

Notice that the neutral axis has only moved ⁵⁄₁₆-in. from the original position before mortising.

The new section modulus S' for this section equals 228, safely greater than the 219 required for bending. As was expected, this joint has only a minimal effect on the summer beam. Comparing the section modulus before and after mortising, we can calculate that the mortised member retains 87.4 percent of its initial strength while only 77.9 percent of the wood at the joint remains. Therefore, this joint yields an efficient use of wood; the same size member can be used as if no material had been removed.

To preserve even more strength in the summer beam, the housing could be diminished as shown in Fig. 7 for the soffit tenon with pegs. If a diminished housing were used for the tusk tenon mortise, the section modulus would be 250, thereby maintaining a remarkable 95.6 percent of the strength of an 8x14 before mortising.

THERE are circumstances in which it is desirable to peg the joist to the summer beam, such as when a small tensile force is present or if no sheathing is available to hold the joint together. Since for the pegs more material must be removed far away from the neutral axis, it is expected that a larger member for the summer beam will be required than for the tusk tenon joint just described.

First, what size pegs should we use? Given the 8-in. width of the summer beam, we can allocate about 1⅜ in. of relish from the center of the peg hole to the end of the tenon, and it is probably satisfactory to use ¾-in. pegs, thereby minimizing the amount of material removed from the summer beam. Note that the use of ¾-in. pegs does not allow one to meet NDS standards for edge distance in the summer beam (four diameters) or end distance (five diameters) in the tenon. Consequently, one should not expect to develop the full strength of the pegs. If the joint needs to withstand a substantial tensile force, an alternate design should be considered.

Calculations for an 8x15 with square housings give a section modulus of S'= 216, slightly less than the required 219. If, instead, the housing is diminished as shown in Fig. 7, the new section modulus becomes S'= 245, which provides adequate strength. In fact, it provides a margin for error in cutting the housing. The new section provides 82 percent of the strength of the section before notching while using 72 percent of the original wood and thus is also an efficient use of wood. Even though the beam depth required is 1 in. larger than without a mortise, this configuration is still an improvement over the notched joint while providing some tensile rigidity from pegging.

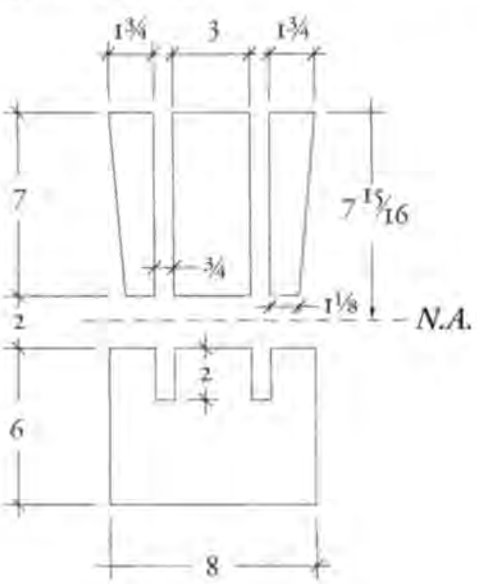


FIG. 7. NET SECTION OF AN 8X15 SUMMER BEAM WITH 2-IN. SOFFIT TENONS, DIMINISHED HOUSINGS AND ¾-IN. PEGS.

TO summarize the findings so far, the summer beam must be an 8x14 if it is either not notched or is mortised through the neutral axis for tenons without pegs. The addition of ¾-in. pegs into soffit tenons requires the summer beam to be increased to an 8x15 and the housing to be diminished. If a notched joint is used as shown in Fig. 2, then the required beam size is an 8x17. Since this size increase is so much larger than that for the soffit tenon joint, it deserves further consideration. Notice that there is a small amount of wood left between the joists at the top of the summer beam. As we have discussed throughout the article, the amount of material far away from the neutral axis is very important for handling the stress in the beam. Therefore, one might think that more material far away from the neutral axis would be better to resolve the stress and that the narrow section between the joists would make the summer beam stronger. To test this theory, we can calculate the required beam size if the material between the joists at the lap is *removed.* The new section for an 8x16 summer beam is shown in Fig. 8. Going through the calculation gives a section modulus of 229, adequate for the load and 15 percent *larger* than when the small piece of wood is left between the joists.

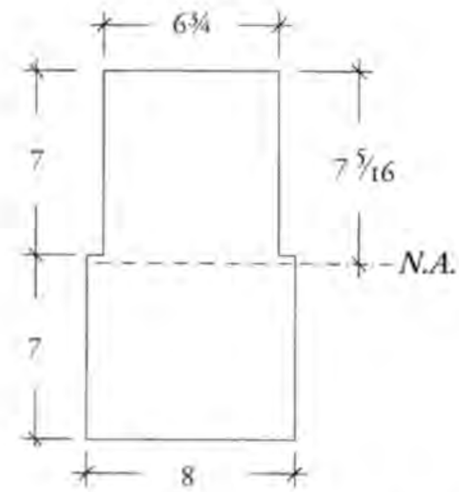
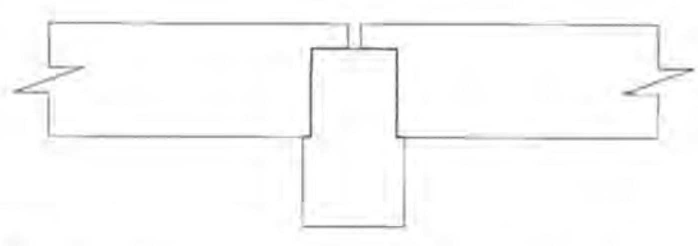


FIGURE 8. ABOVE, NET SECTION FOR A NOTCHED JOINT WITH MATERIAL REMOVED BETWEEN THE JOISTS AT TOP OF BEAM. BELOW, THE PLACING OF JOISTS ON SUCH A BEAM.



Why does this happen? All of the calculations performed here assume that the material behaves elastically and, as a result, the force in the beam is proportional to the distance from the neutral axis. Thus, in the small section far away from the neutral axis, the force is large but the area is small, which results in a high stress level (stress is a force per area). In practice, if the small section of wood were not removed between the joists, it would likely suffer a compression failure, causing the remainder of the section to carry the full load as discussed in this last example. This example should reinforce the point that the proper design of a beam requires careful calculation and a knowledge of the source and assumptions of equations used in the calculations. —RICK SASALA

Rick Sasala, Ph.D.(rsasala@accesstoledo.com), is a thin-film solar cell researcher in Toledo, Ohio, with keen interests in timber framing, structural engineering and building science.

Cantilevered Dutch-American Barns

THE exterior appearance of the three-aisled Dutch-American barn is simple and uncomplicated. Proportions are often nearly square. Except for the typical *pentices*, or short roofs over the gable-wall threshing-floor doors, walls are straight without any projections, extensions or offshoots. Neither eaves nor rakes overhang the walls. Rafter ends are flush with the wall frames so that exterior siding runs straight up and rake boards run over the ends of the siding at the upper gable edge. The broad roof is symmetrical over the entire framework below. Dutch barns appear as tight, unembellished "packages," as shown above by the Wemp barn, relocated in 1990 to Feura Bush, New York.

In stark contrast to the standard Dutch barn, Pennsylvania Swiss-German forebay barns are so diverse in configuration that Robert Ensminger, in his 1992 book, *The Pennsylvania Barn*, has identified fully 18 subtypes. Besides the characteristic cantilevered second story or forebay on the barn front, there can be numerous other structural elements such as diverse forebay support systems, symmetrical and asymmetrical roof outlines, outshot extensions at the back, multiple-cantilevered sides at gable and rear walls, ramp-shed extensions and attached original third gable front sheds.

Photos, except Brooklyn barn, Greg Huber

The only protrusions beyond the straight walls of Dutch barns are the aforementioned pentices, as seen in the photo at left.. They cover the full width of the threshing-floor doors in the gable wall and reach out about 3 to 4 ft. In the Schoharie and Mohawk River Valleys of New York State, they are supported by arms that tenon into the gable-wall anchorbeams, rarely seen (photo, below left). In Ulster County, New York, a few original pentice arms have been found, sapling poles that extend from above the first interior anchorbeam, over the gable-wall anchorbeam and out through the siding. Pentices protect the doors and floor sill below from deterioration and help somewhat to reduce snow buildup. Pentices have been found on many New Jersey barns.

Of 600 known Dutch barns, only four have been positively identified that contradict the rule that, except for pentices, there are no extensions beyond the regular walls. On these four, the enlargements appear as cantilevered projections above the main threshing-floor doors and cover the entire upper gable wall except for the small areas that front the side aisles. From an examination

of two of the four barns that still stand, it is apparent that the extensions are integral parts of the original framing. They supplant the pentices and may provide extra storage space for crops.

A brief recognition of these cantilevered barns appears in Helen Reynolds' classic 1928 book, *Dutch Houses in the Hudson Valley before 1776.* She cites the Verplanck-VanWyck barn in East Fishkill, Dutchess County, New York (probably built about 1768, the date of its associated house). The 4-bay barn, which measures 50 by 44 ft., appears above in a recent photo; the interior framing of the cantilever is shown at the top of the facing page. While Reynolds says, "The overhang of the second story is typical of the Dutch barns of the eighteenth century," she cites no other examples in the 200 homesteads she discusses. Her photo shows the original exterior appearance and location of the barn, moved in 1974 to the Mount Gulian-Verplanck homestead at Beacon, N.Y.

Reynolds' photo reveals a broad roof and a north-facing overhang, its lower edge immediately over the threshing-floor doors and covering the width of the 28-ft. central aisle. The 63-in. side walls of the cantilever are in line with the H-frame columns inside, and the height of its walls coincides with the column tops. The upper edge of the cantilever is framed by rafters on either side of the roof peak; these are footed in a tie beam that houses the tops of the cantilever front wall studs and is itself supported by purlin plates extending 18 in. beyond the plane of the threshing-floor

doors. Three large sapling poles stabilize the base of the cantilever and stretch from above the first interior anchorbeam, over and beyond the gable-wall anchorbeam and then into a mortised cross beam that frames the base. The exterior form of the cantilever is a five-sided figure, a proportionally reduced outline of the entire gable end of the barn itself. This structure is discussed in John Fitchen's 1968 book, *The New World Dutch Barn*, where he challenges Reynolds' claim that the "second story" overhang is typical of Dutch barns by reporting that the Verplanck-VanWyck barn was the only cantilevered example discovered in his 75-barn survey.

A second cantilevered Dutch barn, shown below in an old photo (source unknown) and reputedly built in 1663, stood at the Lorenz Jansen Vanderveer homestead near what is now Flatbush Avenue in Brooklyn. It was demolished before the Second World War. Photos reveal an exceptionally wide gable front and a five-sided cantilevered section almost identical in layout to the upper gable wall of the Verplanck-VanWyck barn. No interior shots exist to show the joining and support of the timbers in the cantilevered area. It is not known if the opposite gable wall was similarly cantilevered.

A third cantilevered Dutch barn formerly stood at the circa 1690 Van Pelt homestead (at what is now 18th Avenue at 82nd Street) in New Utrecht, Brooklyn. In Maude Dilliard's 1945 book, *Old Dutch Houses in Brooklyn*, a photo of this barn reveals a definite five-sided cantilever with its base just above the top of the threshing-floor doors. It too has a broad roof with low side walls.

I happened to chance upon the fourth and last known cantilevered Dutch barn last April, in Ho-Ho-Kus, Bergen County, New Jersey. Two months later, it was dismantled and discarded, except for five columns and a few beams saved to incorporate into a new structure. This barn was 48 ft. long with a 26-ft., 6-in. central aisle and four bays. The side aisles were not in evidence. Its 11x18 anchorbeams of tulipwood were the biggest among the 25 barns so far discovered in Bergen County, and their size could rival those in many of New York State's all-pine Dutch barns. All other structural elements were of oak. It had a very short 30-in. *verdiepingh* (extension of the columns above the anchorbeams), probably indicative of pre-Revolutionary War vintage. The massive 11x5 H-frame braces were lap-dovetailed to anchorbeam and column. The barn stood about 175 ft. from the circa 1770 Terhune Dutch stone house. The north upper gable wall showed evidence of cantilevering, but it was distinctly different in outline from the first three examples. The form here was simply triangular, like a pediment, and the projection only 12 in., as shown in the photo below. In addition, the very short *verdiepingh* did not allow height for side walls. In the Verplanck-VanWyck Barn the *verdiepingh* was about 5 ft., allowing height enough for side walls and a five-sided form.

THERE are reasons to believe that a fifth barn may have had a cantilever. This circa 1780 three-bay Dutch-Anglo structure, with roof rotated 90 degrees from its original position, measures 34 ft. wide by 46 ft., 6 in. long and stands in West Windsor, Mercer County, in central New Jersey, rather distant from the other examples. Inside are timbers stretching from the first interior anchorbeam to the wall anchorbeam, arranged exactly as in the Verplanck-VanWyck barn, as well as post configurations at one end that would allow a cantilever and at the other end gunstock posts that would not, and empty notches in one wall anchorbeam that could have housed parts of a cantilevered structure. This barn also has a 70-in. *verdiepingh*, certainly leaving plenty of room over the doors for a useful cantilevered storage space.

The original number of these curious and distinctive cantilevered Dutch barns is anyone's guess. However, if we know of four out of a total population of 600, and if we accept a conservative figure of 50,000 for the number of Dutch homesteads in 18th-century and early 19th-century America, the ratio would yield about 335 original cantilevered barns, assuming our central New Jersey example suggests a broad range. Thus a few builders chose to build Dutch barns with permanent framed projections to protect main doors and sills below and increase storage capacity. Possible prototypes may be seen in a number of examples from the Netherlands photographed in Malcolm Kirk's 1994 book, *Silent Spaces.* Most seem to date from the second half of the 18th century.

—GREG HUBER

Greg Huber is publisher of the Dutch Barn Research Journal in Wyckoff, New Jersey.

Of Sapwood and Water

ON those mornings when I wake up to the pitter-patter of rain on my roof, I don't have the usual impulse to roll over and grab a few more winks. As an architect and builder, I am often troubled by rain. For just as it is the life-giver for plants and animals, so is it the nemesis of the built environment. I have watched what water does to wood—how that old chair left outside quickly lost its paint and its structural integrity, how that pile of firewood left uncovered and stacked on the ground grew moss and became forest duff, how my roof shingles under the shade of the shadbush tree turned green and disintegrated. In fact, I have far more than my share of wood decay happening here. Living in the forest, heating with wood and framing wooden buildings as a profession mean that I'm surrounded by the stuff. Twenty years of watching wood rotting has at least one advantage. I am a decay expert, not in the scientific sense, but in a practical, hands-on way. I've learned some valuable lessons.

All wood is not created equal! With all the computer modeling going on, it is tempting to think of wood as a predictable, homogeneous material, though we all should know it isn't. Within the forest, and even within the tree, there is immense variation. As an example, take a log of Eastern white pine (I've taken many). You could cut two boards from this log for use on your house, say for exterior trim. One board could last, exposed to the weather, for 200 years. The other could begin to decompose immediately, lasting only five years. What is the difference in these boards? They were cut from the same log at the same time, handled identically and applied on the same part of the building. One is *heartwood*, the other *sapwood*.

Sapwood is the storehouse of sugar, the tree's food. When a tree is cut, it is this sugar that decay organisms find so inviting. Though not actually alive, the sapwood is involved in the movement and storage of sap. When a pine tree is cut, the cut surface of both stump and trunk will start to ooze sap, making the sapwood area easy to identify. On my trees, it's usually the last 12 or so growth rings. On woods such as red oak, black cherry and black walnut, the sapwood is the lighter colored band of wood on the perimeter that has little value.

Photos Jack A. Sobon

Above, sections cut from young, healthy Eastern white pines. At left, the oozed sap has crystallized on a log-end cut. At right, on a cut farther along the log, the sapwood has been attacked by stain fungi. Below, section cut from one of the "Cathedral Pines" in Cornwall, Connecticut, after a tornado leveled the stand. At more than 80 ft. off the ground, the tree was still mostly heartwood.

The heartwood is the inner and older part of the tree. Its chemical and mechanical properties are different from the sapwood's. It may dry, shrink or work differently. In some species, extractives found in the heartwood make it resistant to decay. In woods known for their rot-resistance, such as the cedars, redwood, black walnut, black locust, black cherry and white oak, only the heartwood is rot-resistant. I don't know of any species with rot-resistant sapwood. In my woods there are fallen black cherry logs that appear to be nearly gone. But, if kicked, the rotted sapwood comes off, exposing a purplish core of sound heartwood.

In Eastern white pine, our example, wood cut from the sapwood will not dry in uncovered piles out of doors. In fact, it seems to absorb water like a sponge. If you look at boards after a good rain, you might notice that the heartwood areas are dry after an hour in the sun, while the sapwood takes days or weeks without rain to dry. The sapwood is also the area attacked by "blue stain," a sap stain fungus that many find objectionable. The Pine Sawyer Beetle lays its eggs in the bark of pine logs and in waney timbers with bark on their edges. The grubs that burrow into the wood stay mainly in the sapwood. To avoid blue stain and borers in pine lumber, cutting is preferable in the colder months when these organisms are dormant. Immediately after cutting, the boards must be stickered and covered with sheets of metal roofing panels that allow good air circulation beneath but keep all rain off. The stack should be 2 ft. off the ground as well. When dry, these boards should not be used for exterior applications! Remember, that tree sugar is still in there.

On the other hand, heartwood of the white pine is much more forgiving. It can sit in piles outdoors for five to 10 years if re-piled occasionally. Heartwood doesn't degrade in logs through the summer. It air-dries nicely, doesn't ooze sap or suffer from stain. Its wood, when used properly on a building's exterior, will not rot. It will wear from the action of sun and weather at about ¼ in. per century. Knots in heartwood, as we see in old barn boards, don't seem to wear at all. White pine stumps have sound heartwood after 15 years in the dirt!

This essential difference between heartwood and sapwood, *durability*, should be common knowledge in the wood and building industry, but, sadly, it isn't. I have occasionally had graduates of forestry and wood technology programs visit my shop, and I have posed this question to them—what is the most important difference between heartwood and sapwood for building purposes?

Their answers covered the spectrum: weight, machinability, color, moisture content, shrinkage. All are differences, yes, but no one answered the question correctly. Decay resistance is the most crucial, and always has been. No doubt it was in their lectures and texts, but apparently it wasn't emphasized.

IT shouldn't come as a surprise, then, that sapwood shows up in most of the wood products used on the exteriors of buildings. All windows, even the best-crafted ones, are mostly sapwood. They won't last. Sapwood doesn't hold paint, but paint holds in the moisture that penetrates through cracks. It is no wonder vinyl windows and siding are popular. Doors, moldings, trim, siding, porch posts and railings are all loaded with sapwood (hence the rise in the use of pressure-treated lumber). What about shingles? A surface that sees the most water would of course be made of all heartwood, right? Wrong! I have used white cedar shingles on a couple of my buildings. I used the best grade made; the label said all heartwood. Some had a little bark on the edge, which didn't make sense to me if they were all heartwood. The problem is that the heartwood and sapwood of white cedar are indistinguishable in color, both to me and to the saw operator. An hour after a good rain, I could see all the sapwood on the roof. Though the heartwood sections of each shingle were sound, both roofs needed replacing after five years. That was a unnecessary waste of material and labor. White cedar shingles have gained a reputation for not lasting. But it isn't the wood that's to blame, it's human ignorance.

One problem is that the clearest wood of a tree is nearest the outside surface, the same place as the sapwood. Since clear wood is the norm for window and door parts, trim, molded items and shingles, sapwood predominates in these pieces. Even if manufacturers demanded heartwood, there just isn't enough clear heartwood in second-growth trees to provide it. In my 60-year-old pines, the sapwood band is about 3 in. wide. This dimension remains fairly constant for the height of the tree. Thus, where the upper part of the tree diminishes to 6 in. diameter, it is all sapwood above. I have done a volumetric study of these pines and found the heartwood to average around 48 percent of the trunk volume. Very little clear heartwood here!

In old-growth forests, the heartwood volume percent must average in the high 90s. On some 34-in.-wide old boards with a waney edge, I've noticed that the sapwood was a mere ⅛ in. wide. You might say it was nonexistent. No wonder that buildings constructed from old-growth and durable species will last centuries. There are numerous wooden structures (temples in Japan, stave churches in Norway, for example) that are over a thousand years old. In my second-growth pines, the densely crowded or stunted ones have much more heartwood—they have only an inch or so of sapwood.

Old-growth Eastern white pine, 152 ft. tall, Florida, Massachusetts. Pines of this age and stature yield abundant, high-quality, all-heartwood material. Surrounding woods were much denser when tree was young.

LET'S look at the logic of the situation: 1. Sapwood is not suitable for exterior use. 2. Fast-growing, full-crowned, healthy trees are predominantly sapwood. 3. We should either stop using wood on a building's exterior, or modify current forestry practices to provide more heartwood.

How could we manage trees for more heartwood? If we let them grow into old-growth, and then selectively thinned using individual tree selection methods, we would get what we are looking for. But the overall volume production would diminish somewhat, and Americans are just too impatient to wait that long. A more workable situation would be to use current practices to keep the growth rates up until the trees reach maturity. Then, let the trees crowd naturally as they get larger and the crowns close in so that for the last 15 years or so of their life, their growth is stunted. On these trees the lumber will be of higher quality with less sapwood.

What about economics? Is a board that will weather for upwards of 200 years worth more than one that won't last 10 ? I think so. If a tree takes 1.25 times longer to grow but yields wood that will last 20 times longer, that's good economics. If a window company advertised windows made of only heartwood and then explained why heartwood is better, their sales would undoubtedly increase. There isn't a lot of board footage in a typical window. Even doubling that material cost would hardly affect the total cost. There doesn't seem to be a choice here. If we want wooden house building to endure as an industry, we *must* make our wood products more durable.

—JACK A. SOBON

Learning from Sea Ranch

FROM San Francisco, stretching north as far as Washington's Olympic Peninsula, runs a most unlikely public works suc cess: the incomparably beautiful Highway 1. Were this road to be proposed today, it would be slammed endlessly by ecological interest groups seeking to keep the California coast a wild and natural domain. But, ironically, without such public access to this extraordinary coast line, it's debatable whether concern for its preservation would ever have entered California's political equation.

For most of this run, clear to the Oregon border, buildings are few, far between and of a typically humble demeanor: Bodega bay sheep ranches, the miniature Russian Orthodox church at Fort Ross and the Ocean Cove Grocery (1860), below, just beyond the pastoral town of Jenner, to name a few. Some miles further, the rakishly leaning edifice of the Stewarts Point Store (1868) appears briefly on the left, signifying an abrupt change in the character and lay of the land. From here the road levels out some, inspiring the heavy of foot to lean on the gasæto their own cost. For lean too hard, and you'll drive right through one of the northern California coast's most elegantly envisioned communities.

The 5,200-acre residential development of Sea Ranch was first proposed in the early 1960s by the Castle & Cooke company of Hawaiian pineapple fame. The property stretches on both sides of Highway 1 for nine miles to the far northern edge of Sonoma County. To the west of the highway, the land falls gently through meadows and random clumps of wind-twisted cypress toward the Pacific Ocean. To the east, the turf quickly shrugs its pastoral character, lunging forest-crowned and hoary up the slopes of the California Coastal Range. Some of the youngest mountains on the continent, they continue to move westward at a rate of about 1 in. per year, pushing before them a gray mass of sandstone and shale for the ocean to carve as it fancies (one 19th-century visitor saw satyrs, genii and bearded giants from the deck of his ship). Occasionally, the mountains suddenly *slip!*—causing the great quake of 1906, and, more recently, the catastrophic temblor of 1989.

The native Pomo Indians lived in this area for millennia before the Mexican government granted 20,000 acres of the land to Ernest Rufus, a German captain in the army of settler John Sutter. The so-called "Rancho de German" cattle and sheep ranch was later re-named Rancho del Mar. The developers Castle & Cooke purchased the ranch in 1964, renaming the area Sea Ranch, a literal translation from the Spanish. The architect and planner Al Boeke was hired to conceptualize possibilities for an environmentally responsible rural residential development, a daunting task given the delicate nature of the flora and fauna, to say nothing of the intimidating grandeur of the land itself.

It was not until San Francisco landscape architect Lawrence Halprin was brought onto the project under Boeke's direction that a strongly felt guiding vision began to take form. In 1961, Halprin was asked to develop a master plan of the area. For the next several years he camped on the area, studying the weather, the seasons and the local inhabitants (still largely sheep, a colony of harbor seals, migrating gray whales and an occasional fisherman or diver). The Pomo Indians still lived on their reservations in the hills together with their shaman Esee Parrish. Of architecture, there were little more than farm houses and barns (like the sheep farm below, five miles from Sea Ranch), and a few country stores.

Photos Michael Anderson

HALPRIN and his wife, Anna, began conducting workshops there along the beach. These "Experiments in Environment" used driftwood, stones and kelp to erect primitive "villages," and basic dance and "Jungian archetypes" to study the relationships of environment to community process. Charles Moore, one of the first architects to build at Sea Ranch, and author of one of the most distinctive, successful and enduring Sea Ranch "looks," often participated in these workshops with his students. Halprin continues to this day to conduct his workshops, now called "Sea Ranch Taking Part Workshops," aimed at preserving awareness and exploration of the concepts he and his colleagues developed out of the original experiments nearly thirty-five years ago.

One key environmental influence on their thinking was the strong and nearly constant wind from the northwest. Early settlers in the area had planted hedgerows of Monterey Cypress which the wind had molded into tightly packed green wedges. The ample shelter afforded in the lee and the nearly constant angle of these wind-warped natural and manmade hedgerows suggested the roof lines for the first structures built at the Sea Ranch, like Condominium One (top of facing page), built in 1965.

Halprin was drawn to memories of the hilltowns of the Chianti region of Tuscany. Obviously the buildings themselves at Sea Ranch would *look* quite different from the Tuscan houses; what Halprin and his associates gravitated toward, as he wrote in his *Sea Ranch Diary*, self-published in 1995, was the holistic quality of "an almost mystical oneness with the earth out of which they seemed to have grown . . . they all breathed together. . . . The whole place, rather than any one building or house, had a memorable and unified personality." At all costs, what they wished to avoid was a sprinkling of "pretty little houses" across the wild landscape; house and land must meet as a single ecology, neither one drawing too much attention or sustenance from the other.

The group rejected the development patterns used in communities south of the Sea Ranch where large tracts had been merely subdivided into typical suburban lots. "To build suburbia here," thought Halprin, "would be like caging a lion." Similarly, the competing idea of dividing the land into large parcels, or "ranchettes," was also rejected. They chose to develop the land for about 2,000 families, arranged in tight outward facing clusters situated like "islands" amidst large common areas owned and enjoyed by all members of the community. In all, 50 percent of all open space was set aside as commons, with beach access similarly belonging to the entire community.

By 1963, Halprin had incorporated his ideas into a graphic sketch above outlining his conclusions. To provide for a degree of architectural harmony, and yet forego the odiousness of a plan overview committee, a simple set of zoning restrictions was adopted. Plantings and tree types were limited to indigenous species. Height and roof slopes were determined to deal with the winds. Houses on the bluff overlooking the ocean with the best views were laid out in 'T' formations so that no views were blocked (a pattern later abandoned in favor of the more suburban 'S' pattern, leaving many houses with little or inadequate connection to the landscape and its vistas). Fenced-in gardens were discouraged in favor of letting the natural flora come right up to the building edge. If a builder added a fence to his property, it was asked to work as an architectural element to further stitch the building to the land and adjacent structures, rather than to simply separate public from private property. In their basic forms, these ideals are generally applicable to nearly any suburban development. As Richard Sexton has pointed out in his 1995 study, *Parallel Utopias,* "Sea Ranch offers an environment at a density comparable to that of automobile suburbia, but it is far more compelling and has a far greater shared purpose among its residents. It is what automobile suburbia had the potential to be, but isn't."

INSIGHTFUL and life-affirming as they are, these dreams and images would probably have soon been set aside had they not been so poetically and forcefully embodied in the area's first built structure. In 1965, the firm of MLTW completed the first model structure, Condominium One, shown at left. Principals Charles Moore, Donlyn Lyndon, William Turnbull and Richard Whitaker designed a thoroughly modernist, fortress-like cluster stepped and stretched parallel to the natural slope almost to the very edge of the bluff. Local vernacular details were borrowed from the timber frames of nearby farms, the weathered siding of local shacks and the unassuming geometry of the Black Point Barn.

Most famous of the ten units is Unit 9, designed by Moore for his own use. The roughsawn cedar interior contrasts dramatically with the "large furniture" in the center, consisting of stacked kitchen, bath and skylit sleeping loft, a feature duplicated in all the other units. Built-in seating creates the illusion of floating in air above the crashing breakers below. Careful articulations of view through alternately cutting out or blocking characterizes much of the firm's better work of the period, and its influence is readily visible in the exterior opening of the nearby Sea Ranch Lodge below. Seen from Black Point, the harmonization of the saw-toothed building, the slope of the land and the crags along the shore below is truly breathtaking, inviting favorable if not superior comparison with Wright's Falling Water in Bear Run, Pennsylvania.

Along the northern boundary of Condominium One runs a planted windbreak of cypress trees screening it from the Sea Ranch Lodge. A bit of an architectural mutt of a building, the lodge comprises a number of structures added onto each other by at least three different architectural firms. A garden and walled court addition is currently underway on the northeast corner. Nevertheless, the overall harmoniousness of the complex and its fit to the terrain are ample testimony to the power, flexibility and openness to interpretation and appropriation of the original ideas of MLTW and Halprin. The structure began as a modestly scaled country general store designed by Joseph Esherick. When the store proved financially non-viable in the sparsely populated region, a restaurant, office space, elegantly proportioned covered porch and, finally, a small cluster of hotel rooms were added. Most striking in the design is a long, free-standing wooden wall connecting the restaurant-store complex with the hotel cluster. Running along an open boardwalk and blocking a view of the ocean, the wall is suddenly pierced by a simple, untrimmed rectangular opening, about 8 ft. square, offering a perfectly framed and riveting view of Black Point and the sea beyond.

JOSEPH ESHERICK, who went on to become one of the designers of the school of architecture at University of California, Berkeley, and eventually the dean, also designed some of the first and most successful of Sea Ranch's private residences. Roughly contemporary with MLTW's Condominium One is a group of six houses designed by Esherick in 1965. Known as the Hedgerow Houses, they are arranged about a cul-de-sac and connected along their back sides by a continuous board fence. Along with MLTW's Condominium One, they came to define the Sea Ranch style. Roof lines, angled into the wind or parallel to the immediate terrain, were eaveless to prevent wind flutter, a feature which until recent years was actually required by the area's zoning regulations. (An unexpected result of easing this latter restriction by allowing built-out roof cornices has recently appeared. As this greatly lengthens the time needed for the wooden exteriors to weather evenly, recent homes have chosen to stain their siding a silvery gray color to mimic naturally weathered cedar. The result is hardly pleasing, especially when viewed side-by-side with older, untreated exteriors.) Esherick's windows were either massive, opening an entire wall to a view of the meadows and the ocean beyond, or else narrowly proportioned horizontal or vertical slits framing a small portion of the view. Located near interior traffic areas, the slits would pan across the view with peculiarly cinematic intensity. Only the former, less subtle treatment has been regularly carried out in recent structures by other architects.

Most of the original principals of MLTW went on to design further Sea Ranch buildings together or independently. The residential commissions of William Turnbull are distinguished by an occasionally literal reliance on vernacular precedents. One of his low income "Worker Housing" units, for example, is taken directly from a southern sharecropper's cabin. Later works of the 80s and 90s would draw on the more nearby imagery of turn-of-the-century local stores discussed above.

The Sea Ranch most widely known, if only for its greater visibility, is that part of the community built along the bluffs, particularly along the meadow at Walk On Beach. Hidden in the trees on the opposite side of Highway 1 are a number of homes of considerable sensitivity hugging the steep wooded slope. Most notable among these are the "walk-in" cabins designed by Obie Bowman in the early 1970s. This set of 15 organically clustered cabins must be reached by foot, car access being carefully and well advisedly controlled in this ecologically delicate domain.

The adjectives that spring to mind when thinking of Sea Ranch and its intended aesthetic invite immediate though curious comparison with architecture on the opposite side of the Pacific: "simple," "rustic," "functional," "in harmony with nature," "asymmetrical," "unadorned," "humble." Are these not the same words used to describe typically "Japanese" architecture (though often incorrectly)? Indeed, many of the architects involved with the earlier projects acknowledged the influence of Japan on their designs. (Moore incorporated, for instance, a bold checker pattern in his own Unit 9 which is borrowed almost intact from a famous tea room at Katsura Rikkyu.) I can't help wondering how a development of this scale and intention would be handled along, say, the northern coast of the Sea of Japan, an area of scenic beauty bearing a remarkable resemblance to the Sonoma and Mendocino coastline. I imagine rusting pipe rails and bright yellow signs planted along the bluff (probably explaining why coastal access was "too dangerous to be allowed"), boxy houses propped up on unsightly foundations surrounded by prefab steel storage sheds and propane gas tanksæa sort of Asian Appalachia. Although the occasional house would feature some fine (perhaps overly fine) natural materials and maybe a nice gesture toward its immediate environment, on the whole, the "connection to nature" would be little more than a slogan in Mitsui Corporation's sales brochure, individual houses ignoring both each other and anything beyond the immediate environment.

Where Sea Ranch clearly presents a superior embodiment of "Japanese" ideals is in scaling their implementation through to "the big picture." This consistency of vision and intention from constituent detail to encompassing milieu seems more of a western idea, perhaps based on a fundamentally different way of asserting one's—for lack of a better word—*gaze*. Japanese approaches to development tend to be more ad hoc, less rooted in an all-encompassing vision. At root is an apparently endemic difficulty the society has with establishing deeply shared convictions *across disparate groups*. Here architectural thinking has more in common with Diet politics than is generally recognized.

IN contrast to the more consistent appearance of works by MLTW, Esherick and other early designers at Sea Ranch, Obie Bowman's continuing output has been considerably more eclectic. He thus provides a convenient, almost archaeological chronology of not just the rise but the *fall* of the original community. A walk along the meadow above Walk On Beach offers a particularly informative slice through the inception, development and atrophy of Halprin and company's early ideas. Halprin reflects in his *Sea Ranch Diary*, "The entry of the earliest new settlers was encouraging and ecologically synergistic. But as time went on, the succeeding waves of people flawed the experience for me."

In the morphological character of the individual structures, the change seems to have occurred in the middle to late 80s, and it is graphically apparent in works by Bowman at either end of this period. One of the most strikingly beautiful and mysterious buildings in the entire development is Bowman's "Boomerang" home, designed in the mid-80s. Entirely bermed beneath the meadow and a sod roof, its boomerang-shaped plan nestles perfectly in the lay of the land, establishing one of the most lyrical comminglings

of man and nature to be found in recent architecture. Only a few years later, the first disproportionately tall and symmetrical facade reared its head above the bluff. This, Bowman's Windhover house, (facing page, bottom) is crowned by a clapboard-sided gable perched atop two massive columns. Its extraordinary top-heavy massing (not to mention its rather silly postmodern pretenses to classicism) all but tears the building away from the meadow it faces. In the following years, more buildings like the one below would follow suit, cluttering the meadow with oddly assertive facades, adopting forms entirely unlike the humble geometries found in the best of the earlier work.

It is difficult precisely to describe what happened (and is continuing to happen) in recent works. Most obvious is the relaxation of the rules originally set out by Halprin and followed nearly letter-perfectly by Esherick, Moore, Turnbull and others. Cultivated, depressingly suburban gardens are starting to buffer the zone where nature once came right up to the house. Fences are now often built to lasso the house and its private properties rather than to link it more firmly into the land. Artificial irrigation and mowing surround the houses in doughnuts of green, again accentuating a depressingly suburban feel. Particularly regrettable is the abandonment of the original clustering concept for house placement, resulting, over a period of time, in the impression of large "ranchette" parcels the original designers had fought so hard to avoid.

At a far more subtle level, the very sensuality of the buildings at Sea Ranch has changed. The finest of the earlier works possessed a languid yet responsive geometry in volume and line which caused a melting of landscape and architecture, neither the one nor the other claiming ascendancy. The best examples recall the delicate strokes of a pastel artist's smudge stick blurring two chalks together, or, in this case, blending the built with the given. Though undeniably distinctive visually, these buildings never seemed to lay too heavy a claim to being separate objects in themselves. Interestingly, the often far more *vigorous*, even *aggressive*, geometries of the earlier projects did not generally have this effect. The key word here is indeed "separate." Works from the late 80s on seem to pull away from the land, asserting themselves as singular objects on, though not *in* the landscape. Recent work like that above, particularly on the meadows, is more concerned with containing its own volumes than with directing its energy outward toward nature. This distinction is further emphasized by the sheer mass of some of the structures, often many times larger than their earlier neighbors. One wonders why, since most of these are second homes and used for only short periods, such cavernous volumes were necessary in the first place. Subtle occupation has passed to conspicuous consumption.

And if these ill-at-ease recent arrivals are not cause enough for concern, residents now ponder the possibility of the planned community eventually approaching its full capacity of 15,000 homes. With a potential population of nearly 50,000, this would make Sea Ranch the largest coastal town north of San Francisco. Were the highly original visions of the first planners being properly lived out, this impact might actually rest with considerable grace within this rugged and uncommonly accommodating land. Obie Bowman's wood-hidden walk-in cabins and earth-bermed structures, Esherick's humbly land-hugging forms, the first MLTW configurations whose geometry appeared to rise from the very geology itself . . . these are rapidly becoming a minority expression within an increasingly suburbanized tableau.

Furthermore, should the development continue to grow toward its 15,000-unit projection, a more pressing issue will soon need to be dealt with: throughout 30 years of continuous building, this area of literally hundreds of homes has yet to develop any true sense of community. Partly to blame are unfavorable demographics. Despite the large number of structures, the officially registered population of Sea Ranch is only 280 people! Development has been either as isolated clusters of homes or (now) entirely haphazard. An organic center has failed to emerge out of these successive acts of building. The idealism of 60s and 70s theorists is partially at fault. Give a community enough freedom, a beautiful location and an identifiable physical character, and the very nature of the human equation, it was thought, would produce community and all the necessary accouterments for its health and survival. Unfortunately, narrow-sightedness and occasional dearths of imagination and inspiration are also part of that equation.

However, one area in which the original visionaries of Sea Ranch were successful was in the creation of not just a human-with-nature development, but a persisting *ecosystem* as well. Naturally occurring ecosystems are self-correcting. The negative feedback from deteriorative tendencies, such as overgrazing a field, circle back and ultimately exert a restorative effect. As a human system, Sea Ranch, despite recent digressions, is undeniably imbued with this life-sustaining mechanism. And it is here, more so than in any one building, ground scheme or concept that Halprin, Moore, Turnbull and their compatriots succeeded in creating a work of unique and enduring value.

LIKE the original Del Mar timber-framed barn shown in its field above, the nature of "place" eludes adequate description in words (though words may form their own deeply felt "place"). I would urge any architect eager for more than a merely academic understanding of the architecture and suburban planning of the last four decades to visit Sea Ranch, even to stay a few days. The Lodge provides free material for a self-guided tour of some of the area's landmark structures. More information may be found on the Sea Ranch home page at: www.mcn.org/searanch.

—MICHAEL ANDERSON

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TIMBER FRAMING

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