# HISTORIC AMERICAN TIMBER JOINERY

## A Graphic Guide

### *VI. Scarf Joints*

*THIS article is last in a series of six to discuss and illustrate the joints in American traditional timber-framed buildings of the past, showing common examples with variations as well as a few interesting regional deviations. The series was developed under a grant from the National Park Service and the National Center for Preservation Technology and Training. Its contents are solely the responsibility of the author and do not represent the official position of the NPS or the NCPTT. Previous articles, which appeared consecutively in TF 55-59, covered Tying Joints: Tie below Plate, Tying Joints: Tie at Plate, Sill and Floor Joints, Wall and Brace Joints, and Roof Joinery Excluding Trusses.*

WE are often amazed at the lengths of timbers found in old American structures. Plates 40 ft. long are common. Fifty-footers are encountered occasionally, and timbers 60 and 70 ft. long are not unheard of. In the great old-growth forests that once stood on this continent, trees of sufficient straightness and height were in abundance. The older structures in a given area reflect the original forest. Unbroken straight timbers run the length of the structure. For example, in a typical 18th-century New York State Dutch barn measuring 50x50, there would be 13 timbers 50 ft. long. Such timbers were obviously not difficult to procure from the original forest.

However, as the original forest was replaced by second-growth forest, and sawmills, especially those with the new, faster circular saws, replaced hewers and the relatively slow up-and-down mills, it became more economical to join or *scarf* timbers together to make the necessary long sills, plates and purlin plates. Scarfing had been common practice in Europe for several hundred years, where the original forest was long gone.

STRUCTURAL CONSIDERATIONS. Two timbers joined end to end cannot match the strength and stiffness of a single member of the same dimensions. Some ingenious scarfs have been devised that aim to do so, but the majority of joints are fairly simple, and they are limited in the forces they can resist. Scarf joints can be subjected to a number of forces.

*Axial Compression.* This force, acting parallel to the grain of the member and along its axis, is perhaps the easiest to resist. A simple butt joint will work. A scarfed post would sustain axial compression.

*Axial Tension.* Plates and tie beams must resist moderate tension. Some truss components, such as lower chords, are subject to heavy tension loading. Tension-resisting scarfs are typically longer and more complex than others.

*Shear.* Rarely a concern in solid members, this force becomes a consideration when timbers are notched, as in scarf joinery. A shear force develops when one side of a scarf, for example the lower part of a simple half-lap, supports the other side. Shear forces cause splitting at the notches. Splayed scarfs, which taper to produce greater depth of material under the notches, generally handle shear forces better than halved ones.

*Torsion (Twisting).* Scarf joints are typically subjected to only minor torsion loads. Spiral grain in an unseasoned member causes twisting as it dries. A scarf joint that is not capable of resisting twisting will open up as the timbers season. As its abutments disengage, its ability to resist other forces will be diminished.

*Bending.* This is the most difficult force for a scarf to resist. Members subject to bending would include plates, tie beams and spanning beams supporting floor or roof loads. Sometimes a member must resist bending from two directions. A plate, for instance, is subjected to bending in the horizontal plane from wind loads and bending in the vertical plane from the roof load. The conscientious builder locates the scarf where bending forces are low.

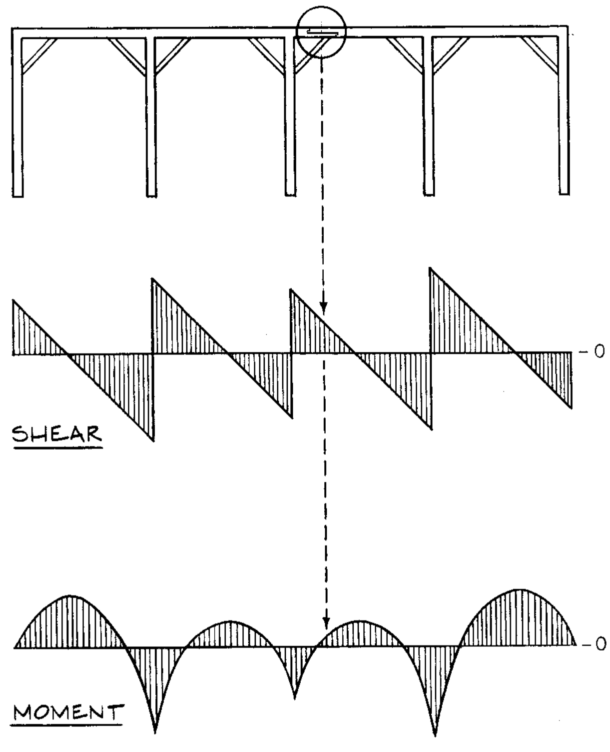


*Fig. 1. Elevation of a plate continuous over five posts, showing a typical scarf location. Diagrams show resultant shear and moment values, both positive and negative, with horizontal line at zero force.*