THE AMERICAN SIDE-LAPPED SHINGLE ROOF

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Introduction

This thesis focuses on proving the cultural significance of the historic side-lapped roofing method with its unique *long* or feather-edged shingle. It explores the technological, material, economic and cultural aspects of the shingle from the eighteenth-century to restorations of today. The research expands upon the information found in the seminal article of 1969 on the subject, "The Long Shingle" by Robert Bucher[1]. In it he describes the process of making featheredge shingles and explores their cultural affiliation, but only provides a sketch of their actual installation onto a roof. Case studies of twentieth-century restorations of side-lapped shingled roofs are included to address these and other concerns pertaining to restorations of this roofing method on historic buildings. This research also examines the properties of the wood historically used to make these shingle to understand its preferred selection.

"A shingle is a shingle is a shingle..." is a prevalent attitude in the historic preservation field when it comes to interpreting wooden roofs on historic buildings. Many only know of one type of wood shingle technique that is called staggered joint or standard method. It involves placing shingles in overlapping courses and deliberately covering the seams between the shingles of the course directly below. Typically two nails fasten the shingle to the roof structure, which are then covered buy the shingles above. This stance may be partially due to a lack of published information on the subject, but is more likely the effect of a

[1]Bucher, 51.

modern disassociation with the building craft tradition of pre-industrial America. Even in historic preservation contexts a prevalent issue with roofs especially is that they are often considered primarily for their functional role and less for their value as material culture. Roofs impart a strong visual power to the character of a site. A roof provides considerable opportunity to make a statement of cultural affiliation, economic means, and the pride of the proprietor, amongst others. Unfortunately, the cultural and esthetic value of everyday utilitarian things like roofs are often forgotten and neglected, only given attention when something goes wrong with them. It is essential that preservationists appreciate and promote an understanding of the value of these cultural artifacts. That value as well as the recognition of the activities of common man must be included in the equation alongside cost and availability of materials when replacement of a roof is considered.

The post-industrial revolution application of sawn western red cedar shingles with a five to seven inch course exposure has become a standard for wood roofs on historic buildings in America. The act of applying this type of roof has become a "historicizing" measure in itself regardless of the building's age, type and location and despite documentary evidence that often questions its authenticity. *This common treatment is based on the assumption that wood is an* "old" material and that all old roofs were installed in this manner. Such a view disregards regional, cultural, and local traditions that influence the many variations of roof types and forms of wood shingles one would have encountered on historic roofs. This research is intended to provide information that is useful to promote and encourage the consideration of not only side-

lapped shingles, but also other vernacular elements that help define the character of an historic site.

Chapter 1: A History of Wood Shingles In America

Before reliable modes of transportation allowed for efficient distribution of materials, early American frontiersmen relied on locally available materials for their roofs. Historically, roofs have usually have been covered with the most economically available materials that would perform sufficiently for coverage on roofs. So, thatch could be chosen in areas near wetlands for water reed, clay for tiles in areas with abundant clay, and wood for shingles where trees are plentiful. Since the Industrial Revolution, numerous roofing technologies have been developed using manufactured products, from asphalt shingles to corrugated metal sheets. Improved transportation modes have virtually eliminated the factor of proximity in the choice of roofing materials. Today, nearly any roofing product is obtainable wherever desired and many more options, both good and bad, are accessible for consideration.

The abundance and availability of lumber may never have been greater than in Colonial American, considering the continent's vast inland virgin forests. European agricultural practices and building traditions that intensely depended on wood contrasted with the minimal harvesting of trees by the native Indians. The wood not only supplied the needs of Colonial Americans, but also those in Europe, for it was a key export. Groups of Europeans brought with them a variety of building methods that freely merged and influenced one another to create synthesized forms on the new American landscape. Among these were stacked log construction from Switzerland and Scandinavia, half-timbering from Germany and Britain, and various masonry techniques from throughout Europe. Side-lapped roofs are a physical example of this mixing of cultures and methods that

occurred extensively in seventeenth and eighteenth-centuries America. This is evident in the case studies of this thesis that represent Welsh, Germanic and English influences. In his seminal 1969 article, Robert Bucher proposes a continental European origin of the side-lapped technique, basing this on its widespread use not only in Pennsylvania, but also on Dutch houses on Long Island and in parts of New England[2]. The argument is plausible its extensive use was based on firmly established building traditions but fails to take into consideration the differences in the environment and availability of materials between Europe and America. The lack of a European prototype further suggests the possibility of an American adaptation, which shall be discussed in later sections of this paper.

The earliest wood roofs in America employed shingles made from native wood and attached with either hand forged nails or wooden pegs. Shingle-making was an essential craft of frontier settlers. In urban areas specialized craftsmen supplied shingles for both residential and commercial buildings. By the mid-eighteenth century, an industry for supplying shingles to coastal cities had developed. Newspapers such as the *Pennsylvania Gazette* carried ads for wooden shingles made in southern New Jersey near cedar and cypress swamps as early as 1729. [3] According to Alfred Heston, writing in the 1930 *South Jersey* journal:

> Before the advent of shingle mills, many persons earned a living by riving, a trade that is now extinct. The implements used were a wooden horse or bench, a drawknife, and an axe. With them, the river traveled from place to place, picking out windfall cedar trees

[2] Bucher, 55.
[3] Pennsylvania Gazette, Jan. 2, 1729.

> and converting them into shingles, which were packed into bundles of a hundred each and taken to the nearest market[4]

These coastal operations were clearly producing and supplying the square butt type shingles but no evidence has been found that they were producing the featheredged kind, which is used in the side-lapped technique.

In contrast, settlers near the frontier were by circumstance forced to be more self sufficient in building trades and in producing their own roof coverings. Here, shingles were produced on site with a few simple, specialized tools that could either be carried by the homesteader or made in the field. As a frontier community developed, the labor was divided into specialties where certain individuals began to make shingles for the group.

Shingle making was traditionally a wintertime event requiring an exhaustive amount of time and focused energy that the off-season allowed. Various sources point out that wintertime is the best time for harvesting the wood for shingles while "the sap is down."[5] Since wood is easiest to split while it is still green, the riving of the lumber into shakes or undressed shingles is best done immediately following the harvest. This activity filled out the agricultural calendar, especially for farmers and other rural settlers. According to Marshall Becker's 1975 article on shingle-making history:

> Shaved wood shingles were the successor to thatch and the universal roofing material for most early buildings, so there was a great and continuous demand for them. Almost any experienced carpenter or shingle maker could shave shingles when necessary,

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[4] Heston, *South Jersey, a History*.763-764.
[5] Becker," Shinglemaking."8.

and many times it was a job done for extra income during periods of inclement weather, particularly during the coldest months."[6]

A thriving shingle industry in Cape May County, New Jersey supplied cedar shingles to Philadelphia and the surrounding areas especially those accessible by waterways. Special orders were made like that for the re-roofing of Independence Hall in 1840 from Cape May County, NJ: also at the turn of the twentieth century mined cedar wood was used from the same swamps.[7]

"Dug-up" or "mined" refers to extraction of logs from previous lumber felling that had sunk into the muck of the swamp and were preserved in that environment. It became a common practice to mine these first growth logs to utilize their exceptional lumber for shingles and other applications. This supplied the eastern shingle industry the raw materials - white cedar and cypress - for an extended period of viability. Because of the efficient transportation of waterways and ready supply of white cedar, the industry could deliver shingles to the coastal markets. But different economic circumstances prescribed a different solution beyond the reaches of navigable waterways and into the forests of the piedmont and beyond. These economic factors influenced the development of the side-lapped shingle as a standard roofing practice of the inland region, which became an aspect of their material culture.

Despite the reported improved durability of split shingles, the significant cost difference between sawn and split shingles accounts for the preference for sawn shingles and the decline of the use of the costlier split shingles. This shift reflects the changes in cultural preferences that occurred as a result of the

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[6] Long, 55-56.
[7] Charles Tomlin, *Cape May Spray* (Philadelphia, 1913) 22.

industrial revolution for making products cheaper using machinery and mechanized technology.

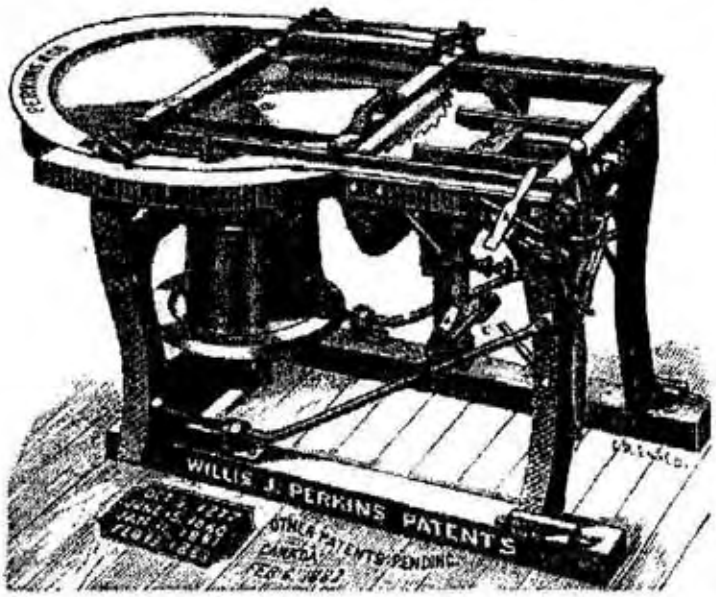

Figure 1: A typical advertisement for shingle-making machine used to cut shingles from nineteenth trade catalogs.
-Willis J. Perkins & Co. c.1885

A presumed unlimited supply of raw materials made available by an improving transportation system in the nineteenth century allowed for manufactured products, including sawn shingles, to be made available to more people at lower costs. Consumers began to favor the lower cost of these readily available manufactured sawn shingles choosing the better quality but higher-cost hand-split kind. This preference for sawn shingles follows along with other building trends of post- industrial revolution that relied more heavily on the

production benefits of mechanization in return for less expensive and readily replaceable parts.

This affect of mechanization was also seen in nail manufacturing in the nineteenth-century, when cut nails replaced wrought nails and later wire nails replaced cut nails, making them much easier to obtain. Peculiarly, though even into the twentieth century in some remote areas where lumber was plentiful and shingle splitting was still commonly practiced locally, modern wire nails replaced the cut nails. So the value of the split shingle was retained while adjusting to the developments in nail technology.

This preference for hand-split shingles persisted in certain rural areas, while a boom was occurring for sawn shingles and wire nails to apply them in some instances to every surface of a building such as seen in American shingle style architecture. Sawn shingles installed in the standard technique without side-lapping became the overwhelmingly predominant method by the end of the nineteenth century and has remained that way still today.

Origins of Side-lapped Shingled Roofs

Side-lapped roofing is a unique method of wood shingling technology and once a common method of shingling in the Mid-Atlantic and other parts of America. Examples of this technique have been noted in many parts of the country from the Del-Mar-Va lowlands through Eastern Piedmont, down the spine of the Appalachian mountains and even as far west as Oregon and the Pacific Northwest as noted by Alan Keyser, side-lapped shingle enthusiast. Originally thought to have been solely a colonial and early American roofing craft,

evidence has shown that such shingling techniques were still in prominent use in the late nineteenth century. Several accounts revealed in this thesis show that they have also been available well into the twentieth century, as late as the 1940's.

Klaus Wust, a German-American architectural historian and author, attributes the origins of the side-lapped technique to the Palatinate Region of Germany, located in the Upper Rhine Valley.[8] Bucher concurs but suggests further investigation into the matter of cultural origins. He remarks that England may be another possible place to consider, although without naming specific examples of roofs. Neither has this research uncovered an actual location where these shingles have existed in Europe despite numerous attempts at correspondence with leading German architectural historians and other research.

Dr. Klaus Freckmann of the Frieluft Museum in Bad Sobernheim, Germany was unable cite an example of this roof type, although he does say, "the technique was only sporadically used in Western Germany."[9] He refers to Hans-Gunther Griep's book on German roofing, *Das Dach in Volkskunst und Volksbrauch*, 1983. Unfortunately, his book does not include any information on the side-lapped technique either, but focuses mainly on the various decoratively shaped butt shingles. Attempts to contact Mr. Griep for further inquiry were unsuccessful.

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[8] KlausWust interviewed February 22, 2003. Edinburg, Virginia.
[9] Dr.Klaus Freckmann to Eric Hutchinson, December 18, 2003 (See Appendix G)

One historic German source, David Gilly's *Handbuch der Land-Bau-Kuns,* 1798, describes two side-lapping methods. These examples are the only other varieties of side-lapping wood shingles uncovered, but have distinct differences from the American variety. Illustrations of these roofing methods appear alongside other traditional roofing techniques like thatching and clay tiles, which lead one to assume that all these were well-established techniques of roofing by the end of the eighteenth century in Germany. These examples show enough similarity that they beckon a comparison to the American versions. Overlapping vertical joints and exposed nails or fasteners are seen in Gilly's illustrations. One is tapered from side to side but not tapered lengthwise and has a groove that runs along the thick edge of a shingle like a clapboard. This groove is designed to accept the tapered edge of the adjacent shingle. (See Figure 2)

The size of Gilly's shingle measures two feet long by three inches wide by three-quarter inch at its thicker edge, which is much thicker than the American samples. The increased thickness allows enough material for a groove to be carved along the edge that receives the thin edge of the adjacent shingle. Another difference is that a shingle in this technique covers just beyond one span of lathe as compared the American version that covers two spans. So, at least 2/3 of the shingle length is exposed in Gilly's method whereas less than half of the length in the American technique is exposed. The location of the single fastener appears in the lower butt end of the shingle in roughly the same position as the American version missing the depth of the tongue and groove joint. The nail

fasteners go through just two layers of shingles in this tongue and groove technique as compared to six in the American technique.

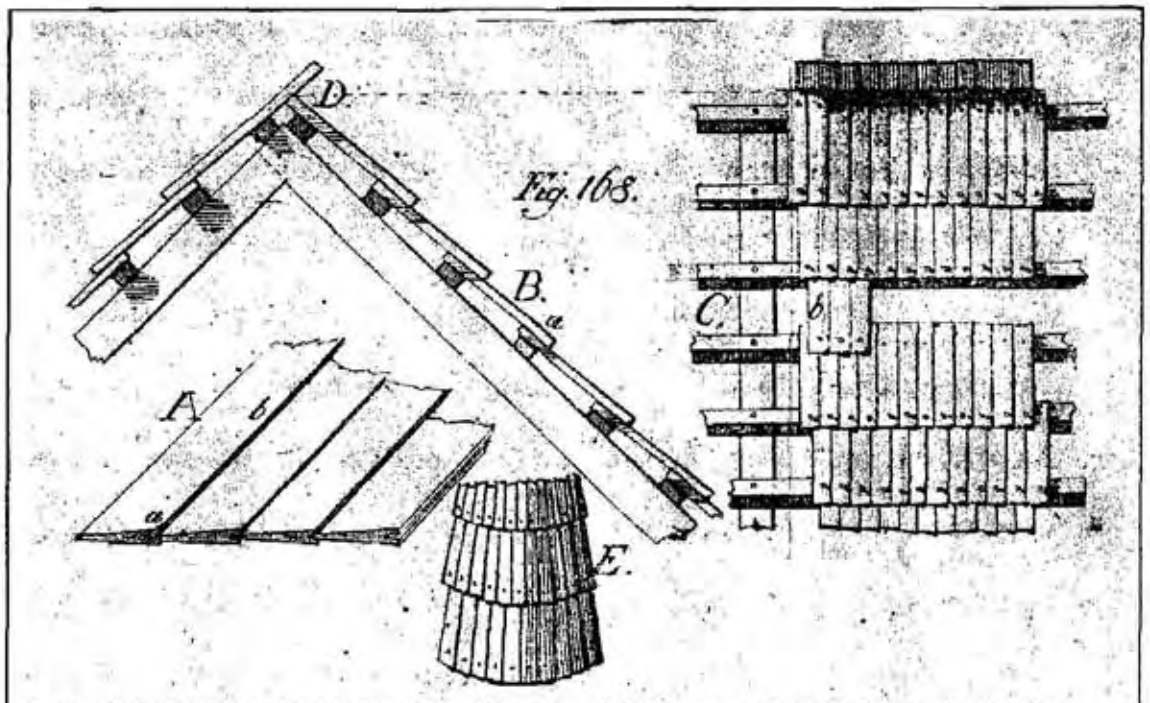

Figure 2: Detail of illustration showing a German eighteenth century roofing method using shingles tapered only widthwise and not lengthwise and whose narrow edge inserts into a *groove of the adjacent shingle. Note the minimal vertical overlap and staggered jointing.*

-Gilly, Handbuch der Land-Ban-Kunst, 1798

The other illustrated technique with side-lapped characteristics shows two singly tapered shingles pinched together along one vertical edge and fit into the open edges of the adjacent shingles like a sandwich. The "V" opening along the other side accepts the pinched edges of both of the adjacent shingles. The course exposure spans two lathe rows and is fastened at each with a nail. Only minimal vertical overlap between the courses is a key difference between this method and the American technique. Essentially, the lower and upper members of each shingle position form a double layer of shingles across the roof.

The redundancy of two layers surely helps to compensate for the reduced vertical overlap. (See Figure 3)

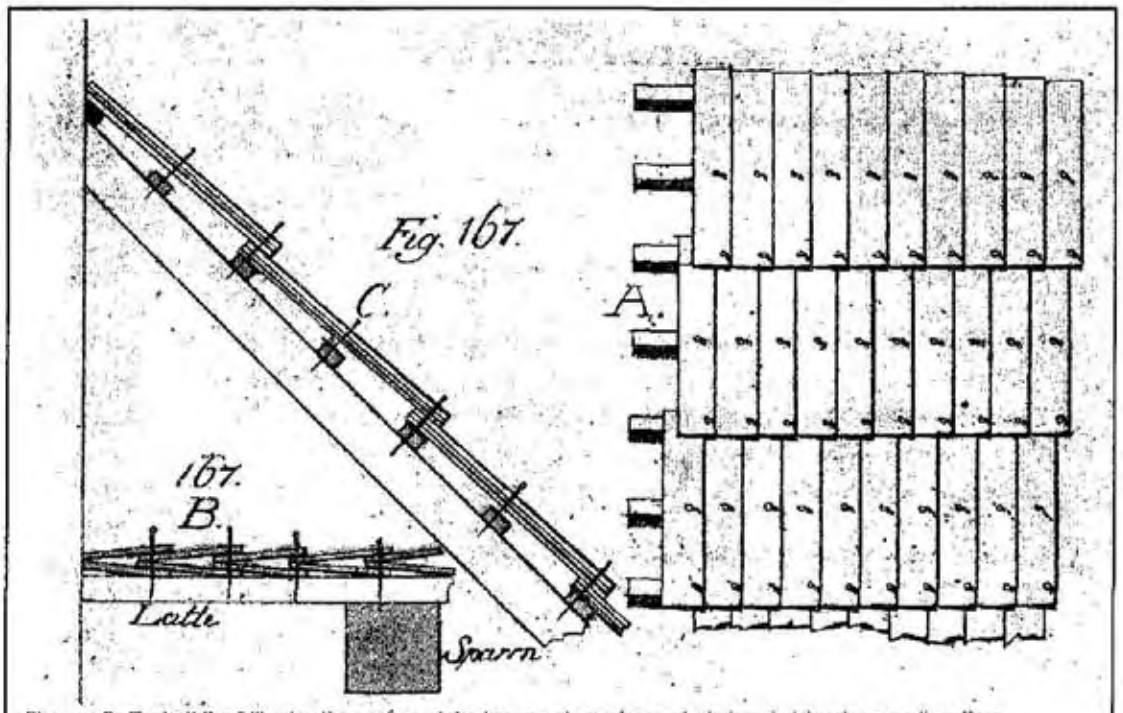

Figure 3: Detail II of illustration of a side-lapped and sandwiched shingle application. Note the staggered vertical joints an minimal vertical overlap of this technique and also the need for two nails per shingle.

-Gilly, *Handbuch der Land-Ban-Kunst*, 1797

Another important deviation of this technique from the American versions is that the joints are not aligned vertically but staggered like that of the standard technique. One reason for this could be that with the shorter lengths of these shingles, splitting caused by stresses along a single grain of wood may be lessoned. It would take much less wood to install a roof of shorter shingle length and less overlap but at the expense of loosing the redundancy necessary to resist water penetration. Also, two nails are needed to install each shingle in this technique, whereas the American method needs only one per shingle. Again

this may reflect the higher cost of wood as compared to nails, which is the reverse of the situation in America. Gilly does not include information for either of these side-lapped roof forms, as to how they perform or the types of buildings onto which they were applied.

Other research on possible places of origin for side-lapped roofing was unfruitful. Although references to oak shingled roofs dating to Classical times were uncovered, nothing about side-lapping was even alluded to any source. One exception is the mention of "oak tiles" being installed on substantial buildings on medieval English castles in L.F Saltzman's book *Building in England Down to 1540,* which hints at a possibility of a side-lapped technique. Further information could not be found but is worthy of investigation. Does this lack of information indicate that this was not a technology practiced in Europe or could merely mean that this kind information was never recorded, which could very well be the case.

One could argue though that, because of the presumed scarcity of wood in parts of Europe in the eighteenth century, such a wood intensive product would not be economically practical. It takes more wood to lay a side-lapped roof as it does a standard roof. If that were the case then an American adaptation of a similar techniques like those found in David Gilly's illustrations is very plausible, considering the abundance of wood available in Colonial America. Further research to find European antecedents is surely necessary to verify the origin of this technology.

A few early references distinguish the side-lapped shingle as a distinct 18th century roof type tied to the Germanic peoples of the southwest Pennsylvania.

An anonymous traveler gives a description of the land in the Tulpehocken Valley in 1829 on his travels to Lebanon, PA from Philadelphia. His term "lapped" shingles is thought to mean side-lapped, since all types shingles are lapped vertically and are rarely ever referred to that way.

> The whole face of the country looks German - all speak that language, and but very few can speak English. Almost all their houses are of squared logs neatly framed - of two stories high. They look like the 'Wilmington stripes' for the taste was to white-wash the smooth mortar between the logs but not the logs themselves, thus making the house in stripes of alternate white, and dusky wood colour. Much I wanted to make every house entirely white, with the white-wash of their abounding lime. Their barns were large and well filled, generally constructed of square logs or stone, but all the roofs were of thatched straw - a novelty to my eye - said to last fifteen years. *Their houses were shingled with lapped shingles.* Saw no stately or proud mansions, but all looked like able owners. This character of houses and barns, I found the same throughout my whole range of tour.[10]

The term "feather edge" is a historical term referring to the used in eighteenth century documentary sources noted in Pennsylvania, Delaware and Maryland. "A dwelling house 24 feet long and 16 feet wide well covered with good feather edge shingles" is quoted from a Queen Anne County, Maryland Deed of 1751. [11] This term accurately describes the form of the shingle with its very thin edge that runs along its length on one side like a feather. Bucher refers to them as "long" shingles because of their exaggerated length, although other types of shingle of similar length were historically produced. One other

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[10] John F. Watson. *The Annals of Philadelphia in the Olden Time; Vol. 1&2.* Philadelphia, Pa: J. M. Stoddard & Co., 1877. p.529

[11] Queen Anne County, Maryland. Deed No. D, f. 28 to Henry Sharp dated April 13, 1751.

contemporary article on these shingles by Reed Engle calls them shingles, "bi-axially tapered shingles" describing the their compound angular surfaces.[12]

The side-lapped roofing is likely depicted amongst the 1757 sketches of Nicholas Garrison, a Moravian seaman and artist who traveled and sketched scenes of German settlements in Pennsylvania. Close attention to detail in his drawings of architectural subjects provides a rare opportunity to study building characteristics. A comparison of the roofs in two of his drawings shows a deliberate distinction of roof types. "The Donegal" features a log cabin with pent roofs and dormer windows. The pattern of rounded roof members strongly resembles the scalloped clay roofs tiles common to the Lancaster area in the eighteenth century.

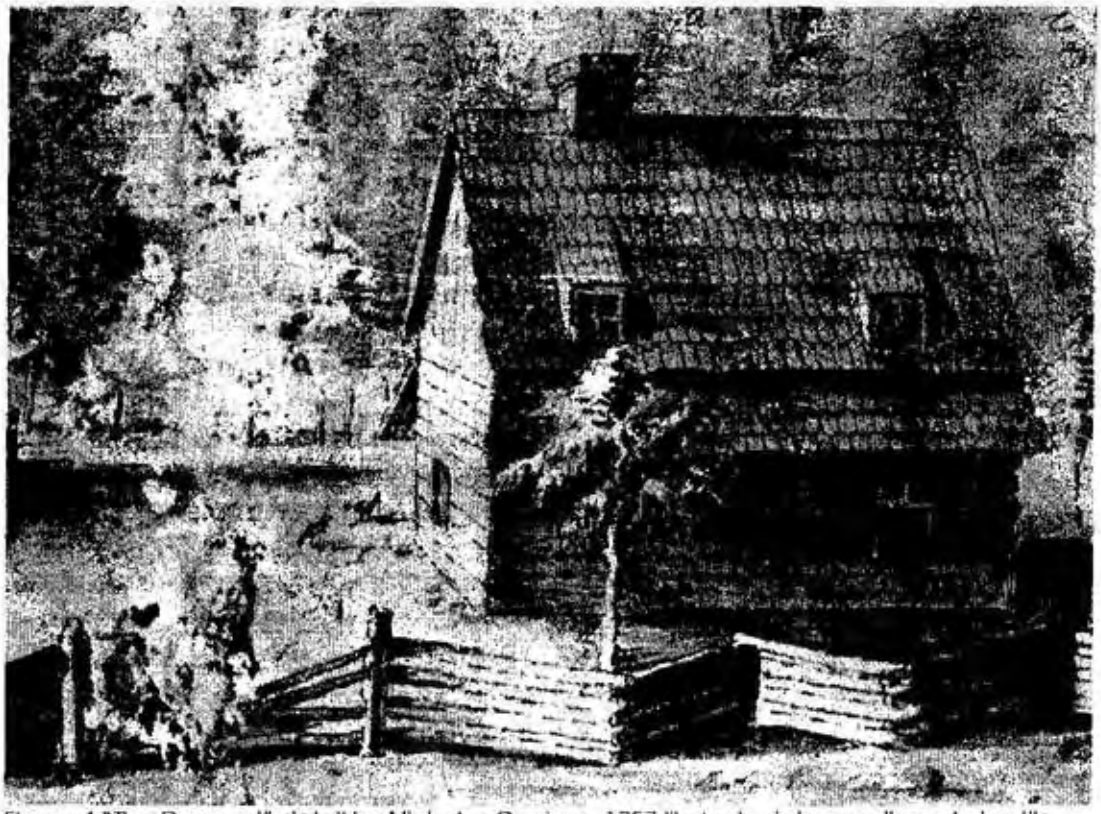

Figure 4: "The Donegal" detail by Nicholas Garrison, 1757 likely depicts a scalloped clay tile roof -The Moravian Archives – Bethlehem, Pa

[12] Engle, 5.

The roof in another of Garrison's drawings, "The Gemeinhaus," shows a markedly different roof type. Its textural appearance and the rectilinear regularity of the shingle members lead one to conclude that this is a side-lapped shingle roof. The steep pitch of the gable also indicated of this roof type. One might argue that the image is merely a representation of a generic shingle pattern, but when considering Garrison's attention to detail and the building's Germanic associations, it is likely that he has depicted a side-lapped roof.

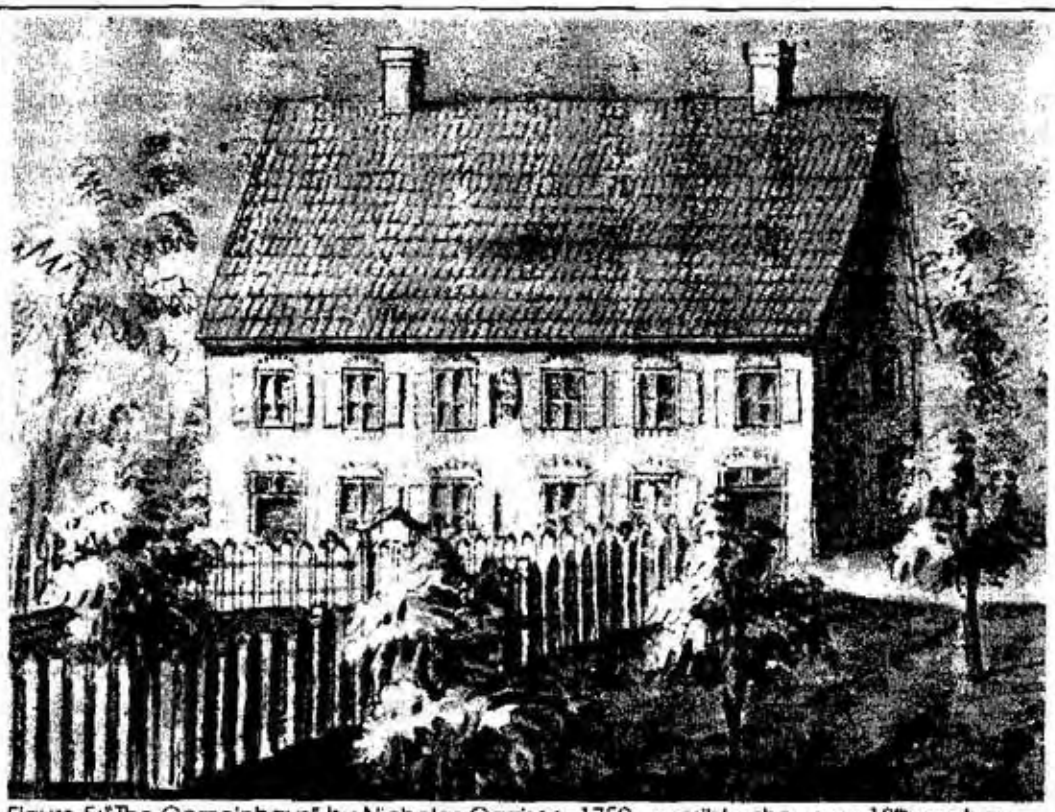

Figure 5:"The Gemeinhaus" by Nicholas Garrison, 1759. possibly shows an 18th century side-lapped roof.

-The Moravian Archives.Bethlehem, Pa.

A number of photographs from the second half of the nineteenth century document the prevalent use of this roofing technique during that period in America. Besides identifying the existence of the side-lapped roofs, valuable information can be drawn from these photographs to help reveal the aspects of their installation and types of buildings utilizing the roofing system. Many construction details are distinguishable from these images showing not only structural and technological information, but also material and stylistic characteristics.

Photos taken during the Civil War at both Gettysburg and Antietam show side-lapped shingles on both residential and utilitarian buildings. An image of the Lydia Lester taken by house reveals both a side-lapped roof and a standard

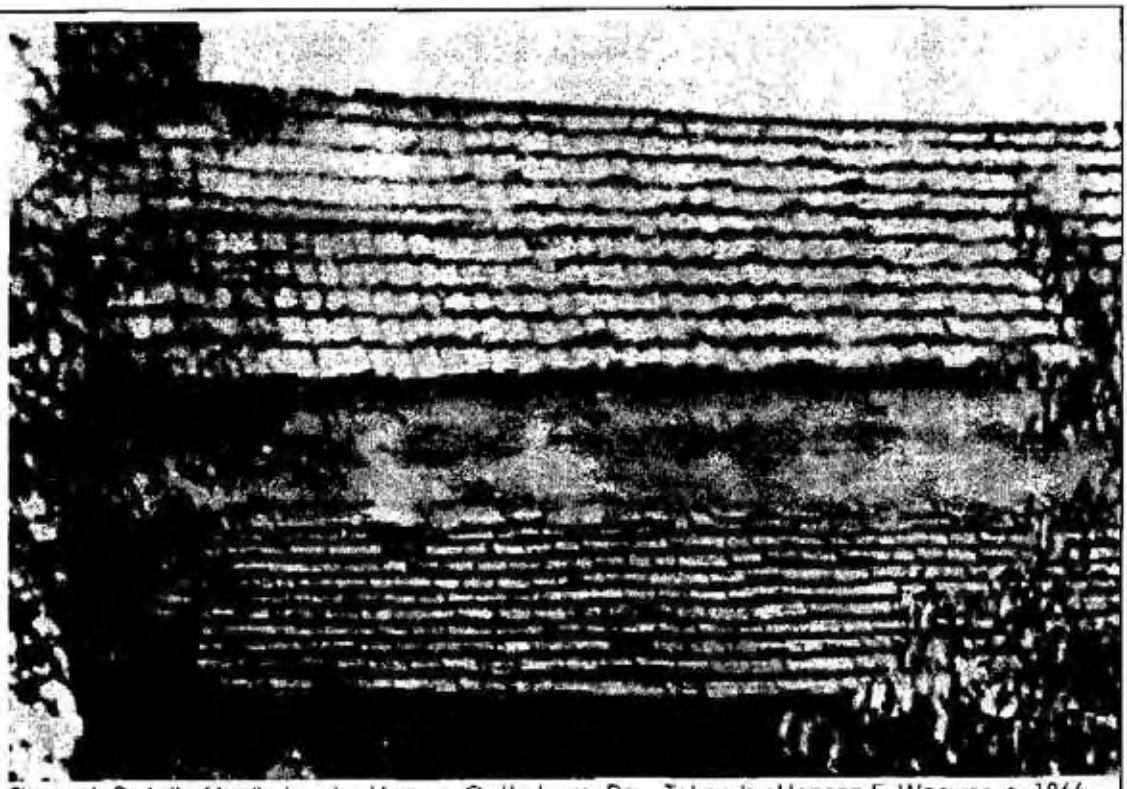

Figure 6: Detail of Lydia Leyster House - Gettysburg, Pa. Taken by Hansen E. Weaver, c. 1866. Shows side-lapped technique on upper roof and standard method on lower roof.

Frassanito. *Early Photography at Gettysburg*. 1995

shingle application on the same structure. One can easily see distinctive differences between the look of the two roofing methods. The photo begs the question, why were two types of roofing chosen for the same building? Is one of the roofs a replacement? And what is the significance of the placement of the side-lapped roof on the main structure while the standard form was employed on the porch? Perhaps, the side-lapped technique was the more trusted version to protected finished interiors, while the standard form was placed on the porch for less intensive protection.

Notable details of this image include some sort of flashing or cant strip around the chimney and the commonly found combed ridge on the main structure. Combed ridges are a simple way of closing the seam of the adjoining

Figure 7:George Washington's headquarters in Frederick, Maryland (demolished c.1960) Shows side-lapped shingle on left side.

-Courtesy of Frederick Magazine

roof planes by fashioning the shingles on the top course of one side to protrude above the other side a few inches. The right-sided overlap tells that the prevailing westward wind was likely from the left to right of the image since the singles were reportedly oriented to side-lap away from the wind.

An image of the building credited as being George Washington's Headquarters in Frederick Maryland reveals a side-lapped shingle roof on the left side of the small duplex structure. Although in an advanced state of deterioration, the roof shows the characteristic details of this system, including tall course height (shingle exposure) and, aligned vertical side-lapped joints. (See Figure 7)

Stereoscope images by traveling photographer, Jean Vier, of buildings in Stephens City, Virginia show the widespread presence of the side lapped shingle in this northern Shenandoah Valley community. Although mostly homes and storefronts are featured in these images, they even show a large church having a side-lapped roof. Shingle splitters living in the heavily forested mountains surrounding the town likely produced the shingles for these roofs.[13] These images provide evidence to the common use of hand made shingle extending long after the development of mechanized shingle sawing techniques and better modes of transportation in the first half of the nineteenth century. Unfortunately, the degree detail of the roofs that is clearly visible in the original stereoscopes is not distinguishable when reproduced digitally.

[13] Stephen City, Virginia located in the northern Shenandoah Valley is in close proximity to both the Blue Ridge Mountain and the Allegheny Mountain where side-lapped roofs were employed widely.

Wood shingles have covered roofs of buildings throughout American history. Various factors influenced local and regional practices including the types of locally available wood, the cultural background of the builder, the access to transportation modes and the availability of nails. The industrial revolution of the nineteenth century either lessoned or eliminated these factors that affected wood shingle production. The result was almost a universal standard for wood shingle production that is still practiced today using sawn cedar shingles.

American tastes shifted to prefer the less expensive sawn shingles over the more costly split shingles, despite inherent performance issues. Mechanized, high-volume production methods threatened the continuation of unique roofing methods like the side-lapped shingle. In certain rural areas the local economics permitted the continuation of the split shingle tradition well into the twentieth century. Investigation by architectural historians like Robert Bucher uncovered the critical information making possible to make and install these shingles and carry on this craft tradition. More has been learned about the side-lapped technique through historic images and field observation to enhance the knowledge recovered by Bucher. Although a revival of usage of the side-lapped shingles is highly unlikely, it is important not to loose this valuable information about the technique, which is an important aspect of America's cultural heritage.

Chapter 2: Long or Feather-edged Shingles

Like other shingle roof systems, the side-lapped roof is comprised of an array of unit members or shingles. This roof system uses a unique a shingle whose form dictates their arrangement and function. These shingles are tapered in two directions, lengthwise and widthwise, whereas all other shingles are tapered only along there length. Bucher refers to them as "long shingles" but other terms have been used to describe them. The term "feather-edge" has been used on deeds, insurance records and other historic documents.[14] Reed Engle refers to them as "biaxially-tapered" referring to their complex form in his 1985 article "The Restoration of a Roofing." Another reference to these shingles in Henry Foreman's 1967 book *Old Buildings, Gardens and furniture in Tidewater Maryland* calls them "up- and-down clapboards" drawing from their similarity to clapboards used on walls.

Splitting and Dressing Shingles

The manufacture of split shingles requires a few specialized tools, an abundant supply of clear, straight-grained wood, and one with strong riving skills Large logs in the length of the desires shingle and at least 18" in diameter are needed. The wood must not only be clear of knots, but also be straight-grained, which dictates the final flatness of the shingle. The type of woods that were historically used included red, white and shingle oak, which are discussed further in later sections of this study. Chestnut, pine and poplar were also employed in much lesser frequency. A frow and mallet along with a shingle buck (see Figure

[14] Engle, 4.

11) were used to split the log radially into thinner and thinner sections until the desired shingle width were produced.

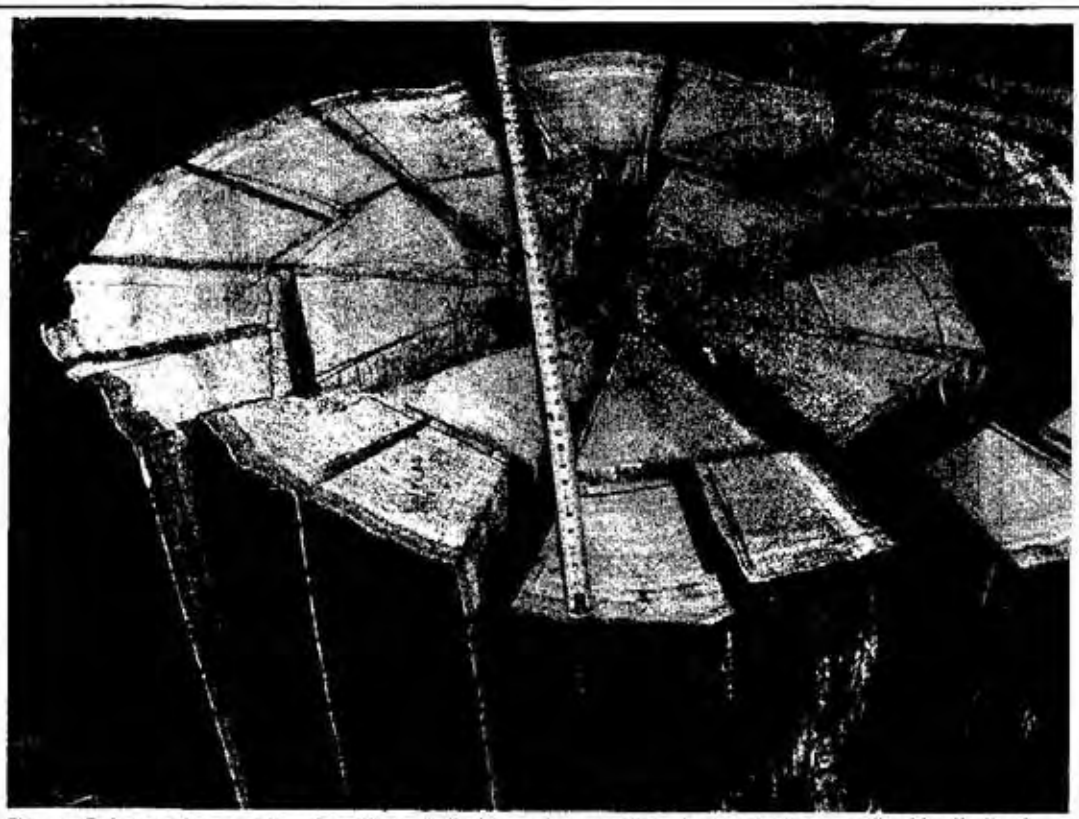

Figure 8: Large log section is split radially to make wedge shaped piece called bolts that will each make a number of shingles upon further splitting. Photo taken by David Doughty.

In order to finish or dress the shingle, a shingle horse or schnitzelbank is used to clamp the blanks in order for drawknife finishing or dressing. Without this final dressing the shingles are technically considered "shakes" or rough undressed shingles. Smoothing the exposure surface of the shingle improves the durability of the shingle and its effectiveness to shed water. The featheredge shingles are also pre-punched with pilot holes to minimize splitting during installation. This featheredge is typically removed in the dressing of standard shingles, but remains not only to provide extra width for the side-lap, but also to minimize the total thickness of the roof due to the multiple layering.

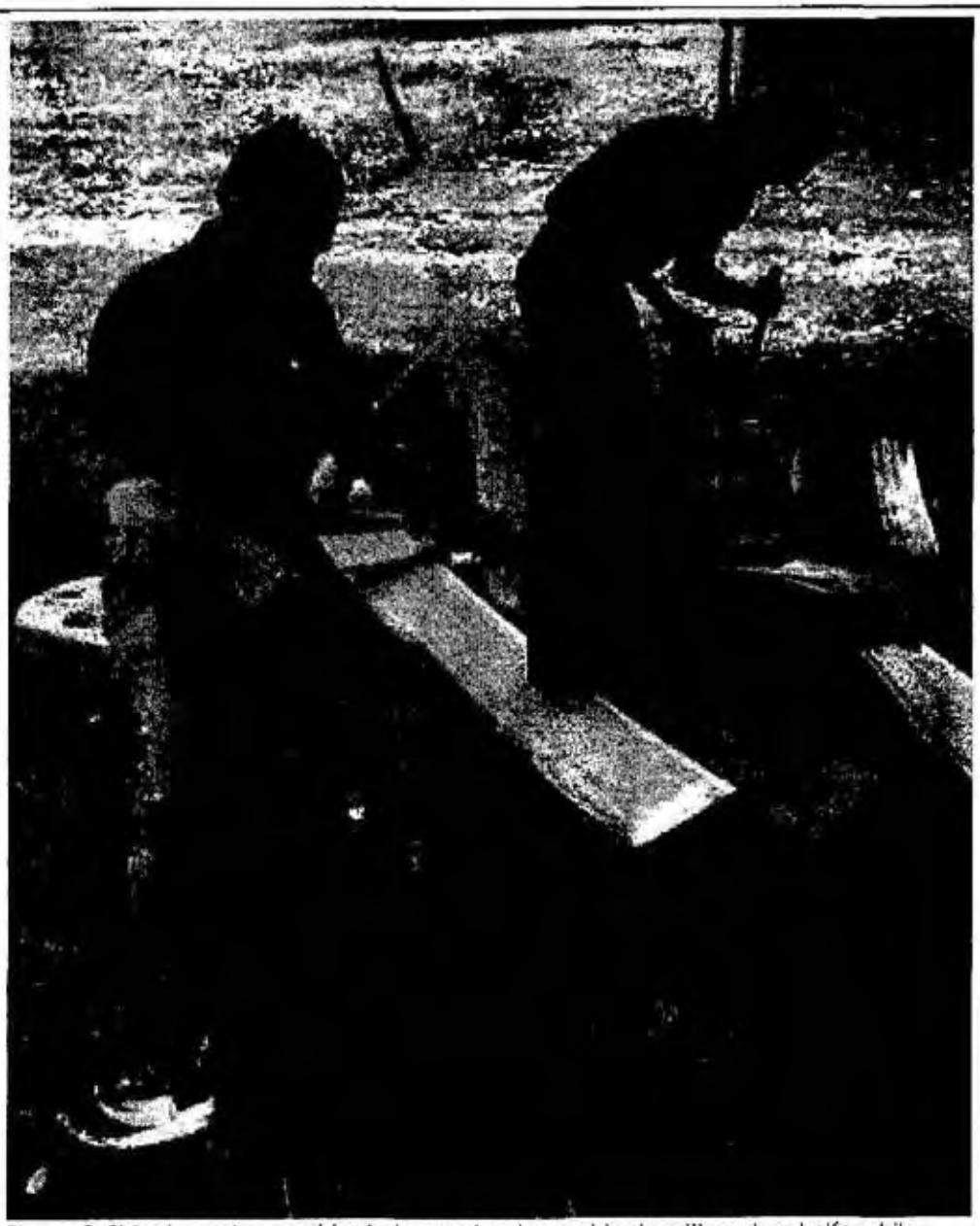

Figure 9: Shingle-maker on shingle-horse dressing a shingle with a drawknife while another rives shingle blanks with a frow.

-Courtesy of John Milner Architects

Twentieth-century accounts of shingle-splitting operations have been recorded, first by historian/author Robert Bucher who interviewed a man who had assisted an itinerant shingle-maker who replaced a roof on his father's barn in western Pennsylvania in the 1930's. A similar account was that of Malcolm

Brumback, a life-long resident of Belle Grove Plantation, an eighteenth-century northern Shenandoah Valley historic site who recalled from his childhood memories of a similar sort. A third account, by sociologist John Witthoft, describes the shingle- making operations of an unlikely group, the Cherokee Indians in North Carolina at the turn of the century.

Bucher's interview occurred after writing his article on the long shingle. It provides additional information about shingle making. His raw notes obtained from his daughter are a bit jumbled but provide a wealth of details about not only shingles, but also the life of a shingle maker in western Pennsylvania. In 1973, Bucher and fellow historian and shingle-making demonstrator, Clarence Kulp, interviewed, Hugh Friedline, [15] whose father employed Abe Enos, a shingle river, to make shingles for their barn in 1932. Enos' family was from the Stahlstown, Westmoreland County southwest of Pittsburgh, Pennsylvania. Friedline recalled that Enos had no home but lived at the place where he was making shingles.

Some of the details of the interview are unclear, but generally it verifies that the shingle craft was being practiced well into the twentieth century and that this type of roof was preferred for its superior durability. Enos said that people came from Pittsburgh, 30 miles away, to order shingles for their barns, and hauled them on wagons called a "stake box." Beyond a preference for "lap shingles" as he referred to them, Enos claims that people in the county only knew how to make lap shingles and that mills for sawing shingles were not necessary because "no one wanted any joint shingles" – meaning those installed

[15]Hugh Freidline interview by Robert Bucher and Clarence Culp in December, 1973 in Laurel Mountain, Pennsylvania. Notes obtained from Catherine Bucher Eckert, Bucher's daughter.

in the standard way. Also he said that it was cheaper to install a lap shingle roof because it covered more area with fewer shingles. This may be true because of the larger exposure surface area of individual shingles despite that need for a larger volume of wood because of the additional layering of the side-lapped technique.

Enos' account verifies other claims of how a skilled shingle maker could dress 500 or more shingles in a day. This high number is thought to be an exaggeration by shingle splitters today, but several references to those kinds of numbers have been noted, including that in a chapter of the *Foxfire Book* that instructs on how to build a log cabin and shows how a mountain craftsman in North Carolina produces hundreds of shingles in a day.

The manuscript of John Witthoft documented the wood crafting activities of the Cherokee Indians on reservations in North Carolina at the turn of the twentieth century. His manuscript discusses and compares the handcrafts of basket-making and shingle-making that both use oak for their raw material. He refers to the shingles as "planks" or "boards" and describes a similar installation technique:

> Most boards (shingles) are thirty-six inches long, and in roofing they are nailed to only one (or two) lathe. A thirty-six inch board is much harder to make, but a good board maker takes pride in turning out the longer board, which is nailed into two laths and has more of its length exposed beyond the over lap.

Although he does not mention side-lapping adjacent shingles, Withoft later says that nails were not placed on the butt ends but does point out an exposure of a foot or more for thirty-six inch boards. This variation seems to concur with the shingle installation techniques featured in "The Foxfire Book" and

possibly to the method spoken of by Friedline.[16] The two sources also agree on the process for splitting the shingles using oak, and also calls them "boards."

One main point that was stressed by Friedline is that the shingles were deliberately laid so that their vertical seams did NOT align, although they were side-lapped. This contradicts all shingle samples observed in research for the present study. This may have been a point of confusion with Friedline, who like many roof installers of today are so reluctant to violate the nearly universal shingle practice of covering the joint of the row below. This might also indicate a regional variation in the installation. To his credit no historic shingle samples were observed from the area about which he was speaking to verify the alignment.

Figure 10: Cornshucking below a wood shingle roof Lumpton County, Georgia. c. 1900
May show a varietal form of side-lapped technique that is more loosely applied.
-(LUM-142) The Georgia State Archives -Morrow, Ga.

[16] Elliot Willington, editor. *The Foxfire*. 1972. 45-52

A historic photograph taken around the turn of the twentieth from Lumpton County, Georgia (See Figure) may show the practice of random placement of side-lapped shingle. It appears as though the vertical seams of these shingles do not align in a consistent fashion, as though there was not a deliberate effort made to align them. The building that these shingles cover is an open-walled shed farm structure. Does the variation suggest that on certain unfinished utilitarian buildings effort was not taken to align the singles? By not aligning the vertical joints, the installers do not have to pay attention to the varying widths of the shingles to assure alignment, simplifying the process. The step of the process of sorting the shingles into similar widths would not be necessary. This approach would both save time and effort. It may also indicate an approach that was applied on buildings with unfinished interiors that might not be so susceptible damage caused by incidental leakage.

Coincidentally, one of the restoration case studies at the John Dickinson Plantation, followed this deviant model as a result of misinterpretation of the shingling technique. Although the drawings for the roofing plans show aligned joints, when the shingles were installed on the roof the vertical seams were allowed to "drift" from alignment. The project manager said that the reason was because the width of the shingles was not considered when laying the courses. They were not sorted into groups of similar width prior to installing, which makes the process of aligning the joints very difficult. The deviation from aligning the vertical joints did not apparently result in a failure of the roofing system, although a number of shingles had cracked, possibly during installation.

One outstanding photographic image of a side-lapped shingle roof provides important information about the roof system. Clarence Kulp, fellow shingle enthusiast, discovered and obtained the photo of a log cabin at a flea market in Franklin County, Pennsylvania. This remarkable image of an anonymous family in front of their home presumed from that area of South-central Pennsylvania captures minute details of the people and the architecture. The newspaper backing of the framed image carried the date of 1887, which corresponds to the clothing worn by those in the photo. The sharpness of focus of this image is striking. Not only can one see the larger details of the two-part log cabin, but also, one can see clearly the individual shingles and even some of the exposed nail heads. It shows two differently aged roofs of the side-lapped variety covering the two sides of the house. The closer (right) roof side looks in better condition than the left side, which definitely indicates the a newer roof campaign. The seamless transition between the two roofs is quite remarkable and not effectively accomplished in standard roofing. The side-lapping allows for this to be done. (See Appendix B)

One telling detail of interest for restorations of this roof type can be seen at the bottom of the roofline along the edge of the lowest shingle course. It shows two different techniques of underlayment for the starter course. On the left hand side, the side lap of the under course is laid in a direction opposite to the field shingles above it, while on the right- hand section the side laps of the under course follow the same direction. This shows that both ways were practiced, even on the same building, and that either could be considered historically acceptable methods of installation. Unfortunately, vegetation blocks

the raking edge of the gable end of the house, obscuring any valuable information obtained from that area. (SeeFIgure 14)

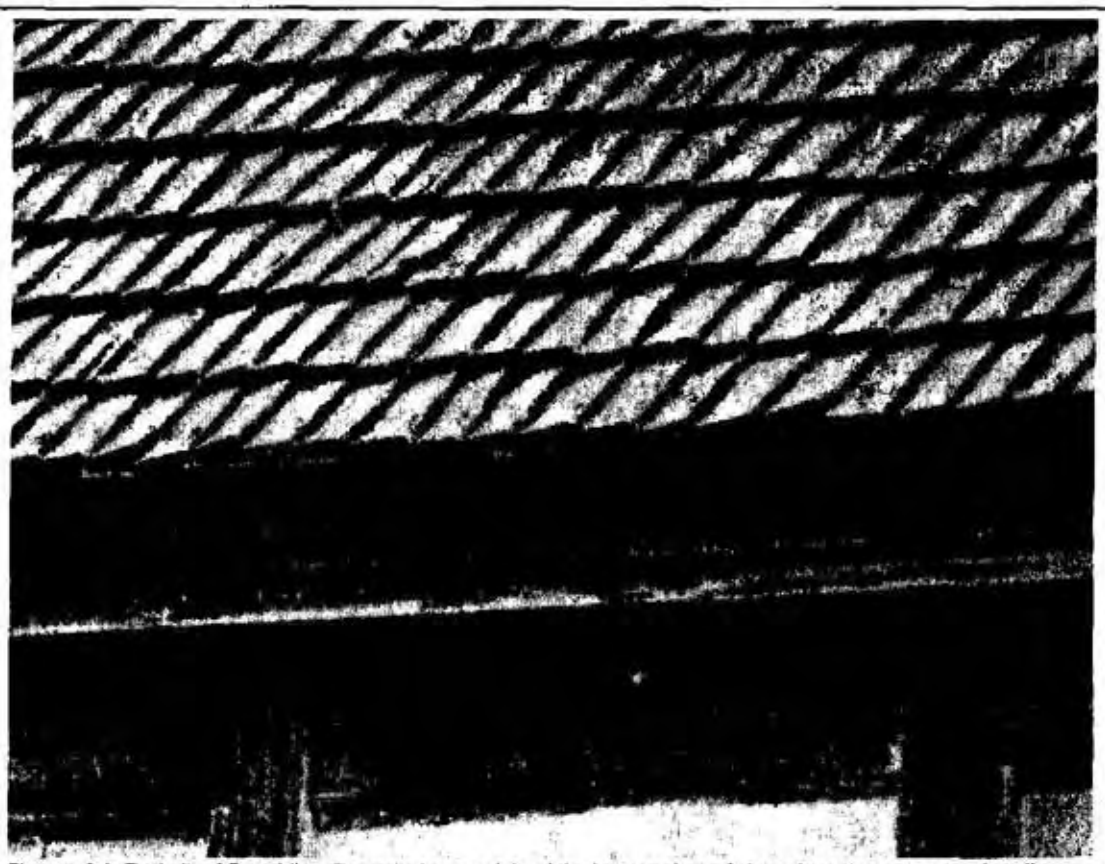

Figure 14: Detail of Franklin County log cabin side-lapped roof showing the exposed nails that are unique to this method of roofing. -Photo courtesy of Clarence Kulp

Nails: Key Elements of Side-lapped Roofs

One of the distinctive features of the side lapping technique and a key reason for its proliferation in Colonial times is the need for only half of the nails that the standard staggered joint method requires. Because the adjacent shingles in a row overlap vertically, the nail in the thicker butt end also penetrates the thinner butt-end of the next shingle in the course and along with layers beneath. So one nail goes through a total of six layers of shingles if the shingle lengths are long enough to extend past the second course of lath, which is typically the case. Shingle samples of this roof technique have three rows of paired nails aligned that penetrate them. These are all aligned at an equal distance from the outside edge of the shingle. This can only mean that the vertical shingle joints were also aligned instead of being staggered.

The availability of nails was a limiting factor to the choice of roof material. This was particularly the case in remote areas away from commercial blacksmiths. Nail production required either a blacksmithing forge operation or a supply of raw iron. Nails were commonly recycled/reused from other buildings because they required so much effort and energy to produce.

Prior to the establishment of iron forges in America, imported iron and nails were readily purchased in cities, whereas, in the frontier nails had to be carried until a forge operation was established. In cities like Philadelphia, the standard two-nail staggered joint application was the predominant method of shingling.[17] This corresponds to the lower cost of obtaining nails in cities. In rural

[17] This two-nail method, which is still currently today's standard installation method, is found on eighteenth century buildings in Philadelphia including Independence Hall and at Carpenter's Hall.

areas away from efficient transportation the higher cost of nails would have influenced a preference for techniques using fewer nails. Some of these alternative methods included thatch, which uses wooden pegs and tying bundles of water reeds, or wood shingle and clay tile roof techniques that did not require nails as fasteners. Clay tiles hung from a nib on the underside of the tile; their heavy weight resisted the wind from moving and shifting. Wood shingles could be either fastened with wooden pegs or weighted down with either weight poles that are a grid of large branches set atop the roof or merely rocks.

One other nail-saving roofing method is side lapping. By overlapping one vertical edge of adjacent shingles in a course they share the holding forces of nails. Side lapping is used in some clay tile applications as well as in the long shingle application. Side-lapped wood shingles having nails in the lower exposed corner reduced by half the number of nails necessary for installation. This could be the key reason why side lapping became a predominant roofing technique in rural areas, which had an abundant supply of large first growth forest in the frontier and the scarcity of nails.

Not only does the nailing procedure used in the side-lapped technique save on the number of nails needed and contribute to the esthetic appeal of the roof, but it also help secure the roof more effectively than the standard method does. By locating the nails on the lower edge of the shingle, the bottom edge is secured unlike the methods where the shingle is typically nailed higher on the shingle and covered by the course above. A lower nail position holds

down the bottom edge from lifting and warping of individual shingles. This lifting can occur more readily in the standard technique, especially if they are sawn.

Table I: How to Distinguish Feather-edge from Standard Shingles

	Feather edge shingle	Standard shingle
Length	24"- 40+"	Typically less than 24" but some up to 36" depending on exposure length
Width	4" - 8"	3" - 12"
Butt end	Triangular or wedge shaped	Rectilinear
Nail pattern	3 pair of holes along length (6 total) 2 on lower end near butt	2 or 4 with none below exposure line
Exposure	Greater than 10"	4"-12" (typically 5"-7")
Side-lap	Around 1" wide along length of thin edge	None
Side bevel/ hounds tooth	Along length of thick edge wither the entire length or just exposure length	None

Jim Groff, project leader of the Kauffman barn restoration in Kulpsville, Pennsylvania, suggests that the reason for the vertical seam alignment is to minimize splitting of the shingles during installation. Since all the layers come in direct contact with the others below they are supported as the driven nail penetrates. Staggered joints would cause weaker areas where they bridged across the gaps the tapered surface of the shingles, making them susceptible to breakage by the hammer's action.

The multiple overlapping provides the redundancy necessary to prevent water from penetrating through the roof. Also, the effectiveness of the roof is enhanced by the excellent air exchange allowed by the rising gaps created between each shingle and the ones below it. It promotes an efficient air exchange between inside the building and outside that can readily equalize the air pressure. In standard roofing applications, an atmospheric imbalance commonly occurs during a storm and often can cause a vacuum to draw water into the building.[18] By increased ventilation through the gaps between the shingles this imbalance is mitigated and the vacuum effect avoided.

The unique esthetic appearance of the side lapped roof created by the aligned vertical joints and raised side lapped joints casts lively shadow patterns on the roof that change in the passing sunlight. The exposed nail heads add textural interest and the dark shadows from the voids created under each shingle create pronounced horizontal lines in bright direct overhead light. The larger exposure area ten to eighteen inches when compared to other shingle application's typical five to six inch exposure defines the course height and differentiates the side-lapped roof visually from the others.

Another visual characteristic resulting from the exposed nails of the side-lapped technique is the staining of the shingles. This staining is caused by a chemical reaction between the iron of the nails and the tannins in the wood of the shingles and is activated by the presence of water. Oak has especially high

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[18] The mechanics of shingled roofs and the air pressure imbalance phenomenon is further discussed and explained in Chapter 5 "Horizontal Closure Systems" of Samuel Y. Harris' *Building Pathology: Deterioration, Diagnostics, and Intervention*. John Wiley & Sons: New York, 2001. p.489-615.

concentration of tannins whose main ingredient is tannic acid. A bluish-black substance called iron tannate is the substance formed that causes the staining to occur almost immediately after contact with rain. This reaction is especially pronounced on the exposed of the shingle on freshly laid roofs because of their direct contact with environmental moisture. This water-soluble substance washes off over a period of months on the exposed surfaces but can be seen on protected areas of shingles on historic examples observed. This apparently occurs over time to the protected areas of the shingle from enough residual moisture coming through the top layer to trigger the reaction but not enough to dissolve and wash away the iron tannate. Curiously, iron tannate is actually the key component of modern commercial rust inhibitors.[19] When iron tannate is present iron less rusting occurs, which may add to the longevity of the nails.

[19] Susan L. Maltby, "Rust Converters," Old-House Mechanic (November/December 1998): 20-21.

Chapter 3 -Oak: The Preferred Wood for Feather-edged Shingles

Wood has been used on roofs at least as early as Classical times in Rome and Southern Europe and likely much earlier, considering its common use as an ancient building material. Wood's water resistance, ability to be split or sawn and relative light weight, especially when compared to slate or clay tile, make wood an appealing choice for roofing. Another beneficial characteristic of wood is that it is a renewable and abundant resource. Also, certain types of wood are remarkably resistant to biological decay, which makes them better candidates for shingles.

As with other aspects of feather-edged shingles, the type of wood selected varies depending on the types of wood available in a particular area, local building traditions as well as preference of the shingle maker. Before improved transportation means allowed efficient distribution of materials, choice typically fell on the most easily obtainable wood that met durability requirements and had desired characteristics for splitting. Oak is the most commonly found wood used for historic feather-edged or long shingles. Considered a durable kind of wood, oak is often used in outdoor applications. It is abundant not only in the mid-Atlantic region, but also various oak species can be found in most areas of the United States. Pine, cedar, chestnut and cypress are other wood species historically used for side lapped shingles but much less frequently.[20]

There seems to be a direct geographical relationship between the prevalence of oak in an area and the use of feather-edged shingles. The further removed from water transportation and access to the tidewater cedar shingle

[20] Bucher, 54.

operations, the more likely it is to find oak being used to feather edged shingles. This might explain why no side-lapped roofs have been identified in or near Philadelphia, but that they are much more commonly found inland. .

One might expect to characterize a single prototype for side-lapped shingle - a standard length, exposure size and wood type and dress detailing. The reality is that because of the limitations of the locally available timber and local tradition and even personal style of the shingle maker, many variations exist. Which kind of wood makes the best shingle has been discussed and argued with mostly inconclusive results and there is no single appropriate wood used.

In the Shenandoah Valley in Virginia white oak (Quercus alba) is the predominant wood that had been historically used, according to the surviving shingle samples. In southeastern Pennsylvania a traditional preference for red oak (Quercus rubra) exists. In western parts of Pennsylvania and into the Midwest another type of native oak may have been preferred. This type of wood was actually named for its widespread use for making shingles - shingle oak (*Quercus imbricaria*). Each has characteristics that make it suitable for making shingles. Generally red oak is easier to split than white oak, whereas white oak is believed to be more durable than red oak.

Roughly an equal number of instances of red and white oak are known for historic side-lapped shingles. Examination of known historic samples shows a general regional preference for red oak (*Quercus rubra*) in southeastern Pennsylvania and a preference for white oak in the Shenandoah Valley of

Virginia and areas south. Exceptions have been noted in each area that violates this general rule.

Another difference that follows similar geographical boundaries is the length of the bevel along the edge of the thicker side of the shingle, also called a "hounds tooth" by one Shenandoah Valley source.[21] In Pennsylvania samples the bevel runs only the length of the exposure of the shingle or about half the full length. In the southern samples it ran the entire length of the shingle side. This regional variation may be due to the characteristics of the species chosen in each area. Since it is easier to cut across grain in red oak than white oak, it allows a starting point further down the shingle into a thicker section of wood. In white oak it might be easier to start the drawknife slice at the end grain at the top of the shingle and follow along grain the entire length instead of cutting across the tougher cross grain, despite the longer distance.

The ability to distinguish between types of oak is helpful for understanding shingles, although techniques offer various levels of reliability include. Some information can be gotten from the color of the wood but with limitations. It is a useless technique if the wood is weathered and gray. Generally red oaks have a rosy tint, while white oak is more yellowish or greenish. A chemical spot test exists that uses a solution of sodium nitrite to distinguish between red and white oak but it too is unreliable in weathered wood.

A simple way of testing between red oak and white oak is by blowing into the end grain of a section of wood with the other end submersed in water. If bubbles are formed then this is indicates that the sample is red oak and not

[21] Linden Fravel Interviewed January, 2002.

white oak. Red oaks have open pores and typically lack a substance called tyloses that crystallizes in the vessels of certain types including white oak. Tyloses prohibits the passage of water and air. So it blocks the passage of air when blown through a white oak sample. It also contributes to the durability of white oak in outdoor situations by preventing moisture related deterioration from occurring.

The most accurate way to distinguish between red and white oak is by observing a tangential section under magnification using a simple field loop of 5X magnification is sufficient to determine the existence of late season pores that are found in red but not white oak. (See Figure)

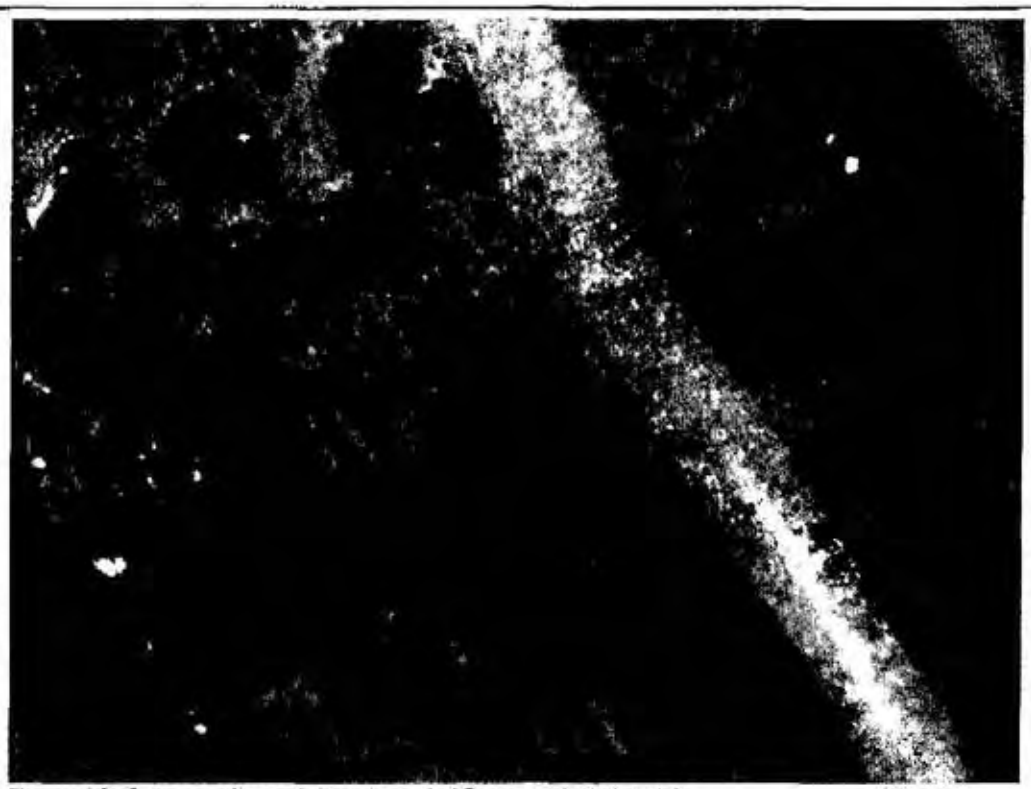

Figure 12: Cross section of shingle oak (*Quercus imbricaria*) 5Xmag
Note: latewood pores diminish towards bottom of frame typical of red oak group.

A simple and fairly accurate way one of distinguishing between red and

An especially effective way to determine oak type on a shingle sample is by examining the ray cells which are seen as irregular, iridescent patterns found on the radial section of oaks. The length of these rays can be used to distinguish

Figure 13: Comparison of Red oak ray cell (on bottom) typically shorter than white oak ray cell (on top.)

between red and white oak. Because shingles are split radially then it gives an ideal opportunity to observe the ray lengths. Red oak group's rays are usually never longer than 1-1/4" while white oaks rays can be several inches long. Red oak and white oak are not only species names but also are terms used to classify the many species of oak in the commercial lumber arena. So each species of oak is classified and sold as either red or white oak whether or not they are actually *Q. rubra* and *Q. alba*. As for determining beyond the red and white oak group to a particular species of wood, it is nearly impossible, says Alex Weidenhoeft, a botanist with the USDA-Center for Wood Anatomy Research.[22]

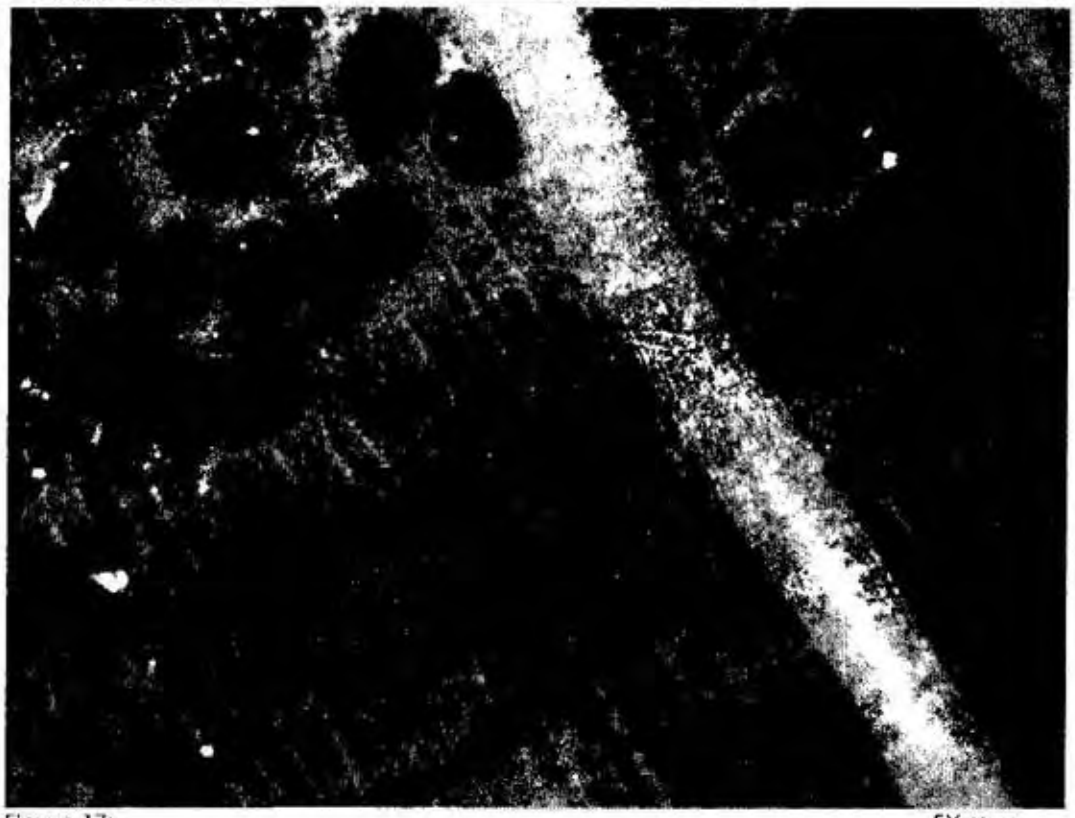

Figure 17: 5X mag.
Cross grain section of shingle oak cell structure shows diminishing late-wood pores and no tyloses characteristic of red oak group.

So attempting to distinguish whether a sample with in a red oak group was either Quercus rubra (red oak) and Quercus imbricaria(shingle oak) is futile. (See Appendix E) A sample of shingle oak was not even available by the several laboratory sources contacted. A slide sample of shingle oak identified by the author was prepared for this research. The sample shows many characteristic of the red oak group as expected including existence of late pores and lack of tyloses.

A point of confusion when interpreting the term "shingle oak" could refer to any oak tree with the necessary properties to produce shingles - ample trunk girth and straightness of grain instead of the species *Q. imbricaria* specifically. Laurel Oak is another common name for *Q. Imbricaria* tree but is technically incorrect since there is another distinct species called *Quercus laurifolia* that grows only in coastal regions of the Southern United States. Both have leaves with no lobes like a typical laurel leaf, which makes the confusion understandable.[23]

Besides the type of the wood, another critical aspect of selecting wood for shingles is the grain quality. Large diameter, clear of knots and straight grain are all requisite attributes. In virgin forests, trees with these qualities were abundantly available whereas today they are much more scarce. The straightness of split shingles is dictated by the straightness of the grains in the tree. Environmental and presumably genetic factors cause some individual trees to twist when they grow. Shingles split from timber from these trees would be

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[22] Correspondence with Alex Weidenhoeft, Botanist with the Forest Products Laboratory dated February 27, 2003. (See Appendix D)
[23] Dirr,218.

warped and not suitable for installing on roofs. It is important that the shingles lay flat on the roof in order to allow efficient flow of water from the building.

Although the only sure way to know if the grain is straight is to visually examine an exposed section and to split a piece to see how the wood splits. One field technique practiced by experienced lumbermen involves examining the texture and pattern of the bark. This is reportedly not a very reliable method and requires a trained eye to make a determination. Another traditional method for determining the straightness of the wood on living trees is to remove a section of the bark and examine the heartwood to check the grain orientation. According to John Witthoft's observances of Cherokee Indian shingling practice:

> Two notches are cut into the standing tree, one generally about two feet above the other, and a large chip, more than three inches thick, drawn between them with a n axe. If the grain is perfectly straight, not "fuzzy" in splitting, and cleaves are readily along grains with the axe, the tree is suitable and is felled; if not, the mutilated trunk is left and eventually heals, but the distinctive blaze can be seen as long as the tree lives, and it will not be tried for board material again.[24]

This seemingly destructive measure is reportedly not fatal to the trees. Abe Enos claims that one can find mature trees with healed wounds in the woods where this testing was performed.

Old Growth Verses New Growth Oak

One issue in using oak for replacement shingles results from a peculiar characteristic of ring porous hardwoods that develops pore cells to transfer food more efficiently throughout the tree early in the growing season, but stops

[24] John Witthoft. "A Cherokee Economic Botany from Western North Carolina: Man and Nature in the Southern Appalachians." Manuscript on file at the American Philosophical Society, 1960. 86-87.

making them later in the season. Dendrologists and lumber men have discovered that oaks and other ring pores hardwoods are denser, harder and unlike most types of wood, which are weaker and less dense than when rapidly re-grown.[25] Fast or new-growth oak timber from these trees is actually harder and denser than the slow-growth virgin timber. This is because oak has a larger proportion of the late season wood to early season wood that comprises a single growth ring. Late season wood has a higher density than the early wood, so the net result is that the wood as a whole is denser and harder. This necessitates extra effort for splitting and shaving the wood into shingles and ultimately slows the process down. This helps to explain why contemporary shingle splitters find it hard to match the high daily production levels of 300 to 700 shingles that could reportedly be made in a single day by a shingle splitter riving softer wood.

A high number of growth rings, 30 per inch, more than twice as many as new growth samples, means they grew slowly each year. Modern replacement lumber used for the shingles at Belle Grove has 13 per inch. Fewer and larger rings result from rapid growing conditions typical of reforestation of clear-cut timbering practices and especially of irrigated crops. Shingles split with fast-grown wood can be a third thicker than historic samples due to it's denser properties . Modern shingle splitters and roofers marvel at the paper-thin section of historic shingles due largely to the quality of the wood.

[25] As discussed in a conversation with Joseph Loferski, biologist with the Virginia Polytechnical Institute November, 2002.

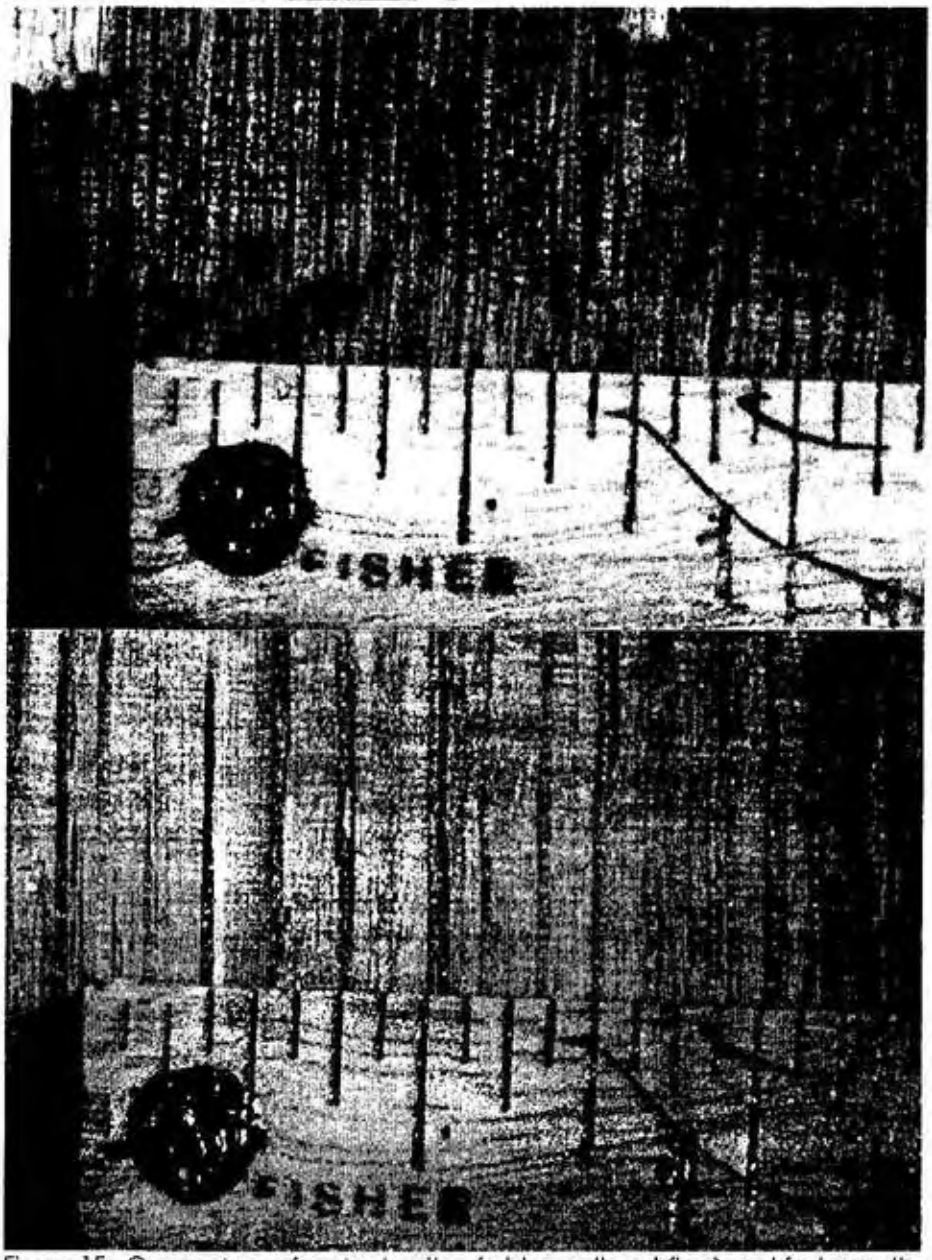

Figure 15: Comparison of grain density of old growth oak(top) and fast growth oak (bottom) Despite fewer growth rings per inch new growth is denser by weight because it is less porous.

Table II: Summary for Identification of Red Oak and White Oak

Feature	In Red Oak	In White Oak
Rays (a)	Tallest less than 1 in. high, mostly 3/8 in. to 5/8 in. high.	Tallest more than 1 ¼ in. high; can be up to several inches high
Tyloses (a)	Absent or sparse or sporadic	Abundant in heartwood
Latewood Pores (b)	Distinct with lens; few enough to be counted	Grading in size to indistinctly small; too numerous and indistinct with lens to be counted
	Vessel walls thick (thicker than early wood vessels)	Vessel walls thin (not thicker than early wood vessels)
(a) Less reliable feature (b) Most reliable feature		

Information obtained from Hoadley's *Identifying Wood* p.104

Chapter 4: Case Studies

One of the main purposes of this thesis is to provide information about installing a side-lapped shingle roof. Since few have been installed and the techniques are so different than standard wood shingle applications, it is worthwhile to look at the challenges that others have resolved during their roofing project. Most of the case studies included here are restorations of museum buildings except for the Kauffman Farm Complex that is privately owned. Each of the roofing projects has gone through a phase of documentation to determine the appropriateness of this roof on their buildings. Either actual shingles samples were found or a strong indication of their use was noted for the property. While some of the projects follow strictly the historic techniques of installation as determined by examining intact roofs or other evidence, others make adaptations to allow for added protective measures or to ease the installation process. These variations will be looked at in each case study more closely.

Kauffman Farm Barn - Oley, Pennsylvania

Figure 16:Barn of the Kauffman Farm Complex - Oley, Pennsylvania
Shows the completed side-lapped roof of red oak after restoration.
-Photo taken by Jim Groff, 2003

The Kauffman farm complex is a wholly intact grouping of buildings in the heart of a colonial-era German settlement in the Oley Valley of Berks County, Pennsylvania. It represents more than a 250-year of Kauffman history. From 1733 to 1997 they owed and maintained the property and buildings. The current owners, Frank and Carol Szarko, have courageously taken on the challenge of restoring the farm complex to a very high degree of authenticity. An organic approach to the investigation and restoration of the property involves a team consisting of historical architect, a construction technologist, and craftsman specializing in traditional and preservation methods

The barn was one of the first structures to be restored because of its accelerated state of deterioration and precarious condition. A layer of metal

roofing covered the remains of the wood side-lapped roof, protecting them from moisture and exposure to ultraviolet light and other environmental degradants. Although much of the exposed part of each shingle was deteriorated, most of the lapped parts or upper half was in better condition. Samples were removed and salvaged for further investigation and documentary purposes. These shingles were sorted according to their widths in half-inch incremental groups. The proportion of each size group was followed when ordering new replacement shingles. In addition to the loose shingles, the team careful dismantled the roof as to study the construction aspects and properties of the structure. The cut nails used to fasten these shingles date them to the second quarter of the nineteenth century.[26] The lack of additional nail holes in the rafters other than those of known roof layers indicates that these shingles were the original roof covering for the barn.

Preservation specialist Jim Groff directed the barn's careful and methodical dismantling. The project team examined each part for evidence of its construction methods. They systematically tagged pieces to allow accurate reassembly. One objective of the disassembly involved salvaging a section of intact roof to show the historic shingling method. A panel of the original roof shingles attached to the roof lathe measuring eight feet square is mounted on a steel frame for display inside the restored barn. This panel is hinged at one edge like a door so that both the top and the bottom surface details can be viewed.

[26] This date is the most reasonable date for the construction of the building based on chronological evidence uncovered in the investigation. A possible reason for the use of these few rose head nails found in the nailer strips may indicates reuse from earlier buildings. It is unlikely that they were made specifically for the nailers in this building phase since they served the same purpose as all the other cut nails.

Figure 17: Kauffman Farm Complex
Section of intact side-lapped roof of which a panel is m0unted and displayed inside restored barn. -Photo taken by Jim Groff, 2002

The exposed underside of the roof structure showed widely spaced lathe or nailers for attachment of roof covering. The team considered the possibility that the 12" course spacing indicating a thatched roof system based on the common knowledge of the usage of thatch in the Oley Valley. Both the side-lapped technique and thatching require a wide spacing of lathe of twelve or more inches. An expert on thatching was consulted to determine that possibility. He felt that the roof could have been thatched based on the wide lathe spacing and the pitch of the roof despite the lack of actually material evidence of thatch or thatching fasteners. In fact a crop of rye straw on adjacent fields was considered for the purpose of providing the thatch for the roof. This theory although not disproved was not followed after the removal sheet metal roofing that revealed the wooden side-lapped shingles .

Although in an advanced state of deterioration, the shingles showed characteristic properties of the side-lapped technique. The vertical joints were aligned, the shingles were biaxially tapered (featheredge) and the shingles were side-lapped to adjacent pieces. The existence of a nineteenth intact side-lapped shingle roof is a rare occurrence. As more are uncovered and identified in the field, more preservationists are becoming aware of their common existence, not only in Southeast Pennsylvania but also along the spine of the southern Appalachians and on the Del-Mar-Va peninsula. Those that have been found represent a widely practiced building tradition that survived in parts of America into the twentieth century.

Fortunately, the unique qualities of the Kaufman barn's roof were recorded and preserved. This information should be used to help understand other roofs of similar nature not. Through this deliberate and methodical investigation and effort of the restoration team primary evidence was uncovered to provide information to improve the accuracy of its restoration. The roof was replaced using this information to accurately prolong this building craft tradition.

Much consideration was given to the location and types of fasteners, proof of reuse of components and variations in detail. The nails and nail holes provided the most reliable information on dating. No additional holes were found in the rafters or the nailers besides those left by the two layers of the extant roofs. This means that either the side-lapped shingle or another roof utilizing no nails was used. Two reasonable possibilities of roofing with no fastener that would were common to the period of the building are clay tile and thatch. These two systems used other fastening techniques clay tiles were

Fish scale or scalloped shaped fired clay tile roofs was not only commonly used on buildings in the Oley valley at the time but also actual tiles were found in archeological debris around other buildings on the Kauffman farm complex. These were often not secured to the roof structure except by a downward extending nib at the top edge of each tile that hooked over the edged of the lathe. *This system relied on the weight of the clay tiles to resist the forces of wind* and weather from lifting and blowing off. These roofs were known for their "chattering" in windy situations caused by their movement and impact to each other. It is unlikely that the tiles were used because their lathe spacing is typically no wider than ten inches. As mentioned earlier, thatch was the other possible roof material considered also needing no nails for fastening to roof structure.

All the fasteners used to attach the side-lapped shingles to the roof lathe and also the roof lathe to the rafters were cut nails except for a few random rose head nails that most likely reused from earlier construction. Also, cut nails were used to attach the siding of the exterior walls to the barn framing. This evidence pointed to a construction date of about1830. This date conflicts with a legend that claims the barn having been built in the eighteenth century and one of the earliest buildings on the site. The decision was made to restore the roof to the wood shingle period because it was the earliest definite material and one that aligned with the most evidence.

The loose shingles salvaged from the roof were sorted by width in ½" increments. The range of widths was found to be from 4 ½"- 7 1/2" and lengths from 28 to 30 inches. According to the percentages of these width increments an order for split red oak shingles was placed. The services of Dave Daugherty,

timber framer, were employed to produce and supply the shingles for the project. It was determined that 8 square of shingles (squares of shingles) were necessary to cover the roof. An extra supply of shingles was ordered to cover

Figure 19: Worker installs sidle-lapped shingles in the diagonal method as described in by Bucher .
-Photo taken by Jim Groff, 2003

loss due to breakage during installation as well as a ready supply for future repair and replacement of shingles.

An aspect of the shingle installation observed was that all the beveled edges on the shingles on both sides of the roof were on the same side of the

each shingle- the left side. This bevel is a typical characteristic found along the thicker edge of these shingles called a "hounds tooth" by Linden "Butch" Fravel[27]. Several reasons for this were discussed. The most widely accepted explanation is that the bevel allows for more aerodynamic flow of wind past the protruding edge. Another reason may be that it is the part of the shingle that will deteriorate the fastest because water can penetrate from both the top and the side surfaces but by beveling the edge you are reducing the exposure area of the shingle and slowing deterioration. Another possibility for the existence of the bevel is that since it is formed during the final dressing of the shingle it could be a way to adjust the width of the shingle in order to match the width of shingles within a vertical row. The width of the exposure of each shingle must be equal to allow the vertical seams to align. If during the installation one would run out of a particular width of shingle part way up the roof, wider shingles could be adjusted with this bevel to produce the narrower shingle width.

A bevel cut may provide more control of the drawknife instead of a straight cut. In order to make a cut flat to the edge of the shingle it would have to be repositioned from the flat position it is held to in the shingle horse, which is an extra step. Additionally the edge the knife could fall into a grain in the wood which essentially runs perpendicular to the shingle face and split off a piece of the shingle instead of making a controlled cut. By holding the drawknife at an angle to the shingle edge, the knife would bridge a number of grains of the shingle, reducing the possibility of splitting and make a more precise and

[27] Linden Fravel is an historian specializing in Shenandoah Valley and Civil War histories. He was consulted for Belle Grove's roofing projects and has studied side-lapped roofs for The Stone House Foundation in Stephens City, Va interviewed January, 2003.

consistent cut. This could be accomplished without changing the flat position of the shingle.

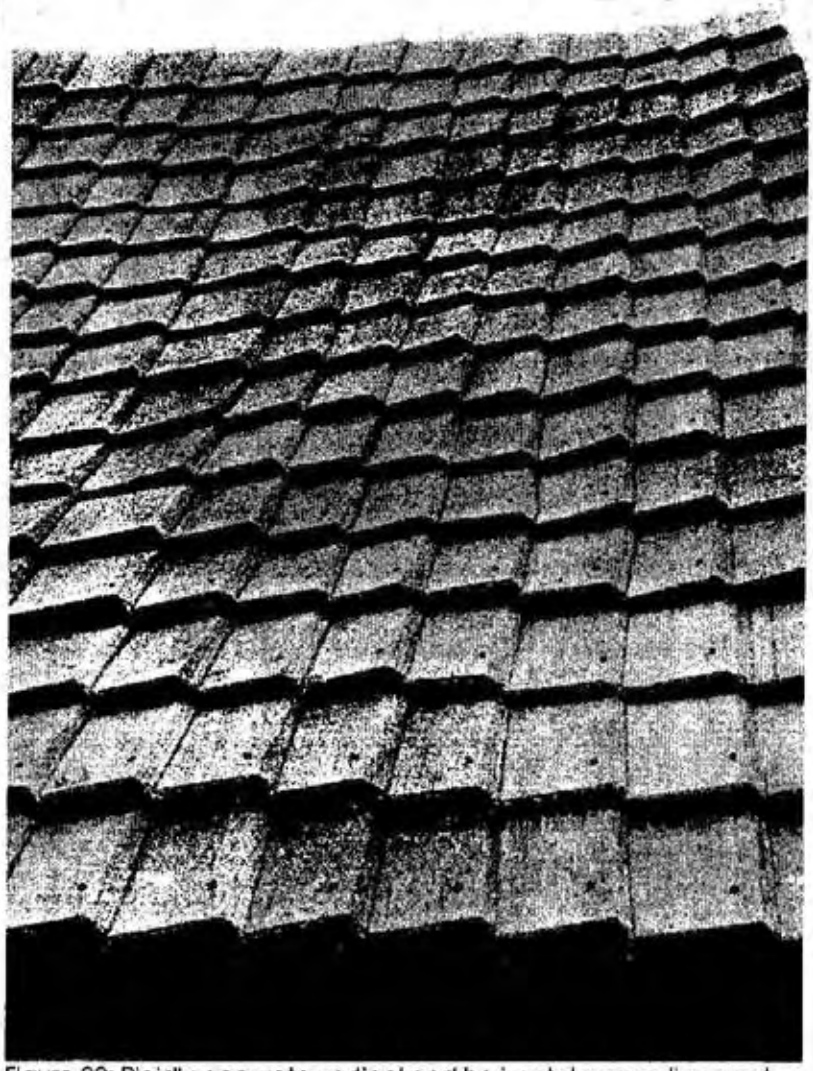

Figure 22: Rigidly accurate vertical and horizontal seam alignment, exposed nails and gaps beneath each shingle are characteristics of side-lapped technique.

-Photo taken by Jim Groff, 2003

A practical reason that all the bevels are on one side of the shingle may not have anything to do with the wind direction or orientation but to the ergonomic efficiency of the river. It would be much more efficient and less

awkward for the river to produce bevels all on one side of the shingle according to his dominant hand - right or left.[28]

The Kauffman roof restoration was the most thoroughly accurate project of the case studies included in this research. It was the only one to have an extant section of original side-lapped shingles to examine for installation details for the restoration. The approach and methodology carried out by the preservation team assured an authentic portrayal of the roof system and it should serve as a model for other restorations of side-lapped roofs.

[28] Jim Groff interviewed September 2003.

John Morgan Cabin - Kulpsville, Pennsylvania

Figure 20 John Morgan Cabin, Kulpsville, Pennsylvania September 2002

A major challenge of re-roofing the 1741 John Morgan cabin was getting the quantity of shingles necessary to cover the roof of this building that met the requisite quality standards of the project. Nine squares (9000) of shingles was too large an order for any one producer to split and shave. The solution was to have two companies make them - one in New York, one in Germany. The irony of this project is that such distant suppliers of shingles had to be employed when the original roof was surely produced locally using nearby materials. But because the continuity of the local traditions of making shingles was broken by the mid twentieth century, only non-regional suppliers/producers are available to meet the demand of these restorations. What was once a common homespun industry has become a highly custom building craft demanding high skill.

Details of this shingle installation followed the earlier roofing campaign that was installed under the direction of Edwin Brumbaugh in1970. White oak (26") shingles were specified for the project. Brumbaugh had designed the similar shingle installation for the Ephrata Cloister in Lancaster County, PA. An innovative augmentation to the historic technique involved layering sheets of bituminous moisture barrier between the shingle courses in order to provide an additional layer of protection from penetrating rain water. The rolled roofing felt was applied to the upper portion of each course which was then covered with the next layer of shingles, completely hiding the it from view.

One potential danger of the insertion of the roof felt is that it discourages the drying of the shingles that could promote the deterioration of the wood and ultimately shortening its lifespan. Observation of the shingles from the previous roof installed in this manner showed no unusual deterioration patterns beyond what has been seen in other side-lapped roof restorations that were traditionally applied. Also the life span of the previous roof installed in the 1970's seems to be reasonably comparable to that the other wooden shingle roofs.

Variations in the exposure area of the shingles occurred at particular areas of the roof. The standard exposure for the roof was 11.5 inches. This was applied to the major slopes of the gable roof. An error of measurement forced a slightly shorter exposure on the lowest courses to properly fit the roof without drastic changes in exposure in the top courses. Smaller exposure areas were also used on the coursing of the pent roof and dormer not only to give extra protection to these weather susceptible areas, but also to visually blend the coursing with that of the main roof that is at a different slope.

The nails that fastened the shingles were modified cut nails. Untreated ferrous nails react with the tannins (tannic acid) in the wood creating blackish/blue substance that stains the shingles in streaking pattern that runs from each exposed nail head along the face of the shingle. This material formed is iron tannate that is considered a rust inhibitor and is the main ingredient in commercial rust inhibitors. Unfortunately it is water-soluble and eventually washes away and as the wood of the roof silvers or ages over time the streaking is less noticeable.

Staining is most prominent on a newly installed roof when the dark stain contrasts the bright wood of the shingles. Although this reaction can occur on other roofing methods but it is less noticeable since the nails are covered by other layers of shingle. It is more pronounced on side-lapped shingles making it

Figure 21: John Morgan Cabin, Kulpsville, Pa. 2002
Shingle detail showing hip joint of pent roof -a problematic installation challenge. Note: iron tannate staining on newly installed shingles.

characteristic of the style. Historic samples of shingles show the staining on the protected layers in where there was enough moisture to make the reaction occur but not enough to wash it away as is the case on the exposed sections.

Tight controls on the shingle specifications were strictly adhered to assure consistency of quality between the two suppliers. Both Rapahold and To the Line Timber Framers had to meet these specification standards. David Daughty of To the Line Timber Framers describes the process of making the shingles for this project. He said that they employed a pneumatic splitting machine to make the initial splits in the logs. The machinery was used to split the smaller bolts or 1/8 to 1/16 radial sections of the round logs. From these bolts hand tools were used to split the shingle blanks.

In place of the "Y" shaped shingle buck made from a crotch in a tree two parallel metal rods affixed at each end provided the leverage for the shingles to be split from bolts. Long-handled frows custom made from tool iron and wooden mallets were the key tools that split the grain of the wood. He points out that several frow blades made of soft iron bent while splitting the oak shingles and that tougher iron was necessary to withstand deformation of the splitting process. A number shingles were rejected because they were twisted.

Daughty prefers splitting white oak over red oak because he feels that it splits more cleanly. He mentioned that the wood grain of red oak, he has found, gets "stringy". Other accounts contradict his opinion to which type of oak splits more easily and more cleanly. But there is variability between the characteristics of each piece of wood that affects its ease of splitting. On the historic shingles

samples he has seen they do not have an overly tight grain quality, as is the case with the Shenandoah Valley samples.

The restoration of the side-lapped roof of the John Morgan Cabin allowed for variation from the traditionally applied techniques. These included the additional layers of roofing felt inserted between the coursing of the shingles following decisions made for a previous roofing campaign. This additional measure is to ensure the seal of the roof to protect the contents of the house. Although likely an unnecessary step it does not visually impact the site and may only minimally affect the longevity of the roof. However the decision to offset the vertical edge of the shingles does alter the appearance of the roof from the traditional way and may cause more splitting of the shingles and leakage over time. It also threatens to mislead future restorations by presenting the deviated configuration as an authentic portrayal.

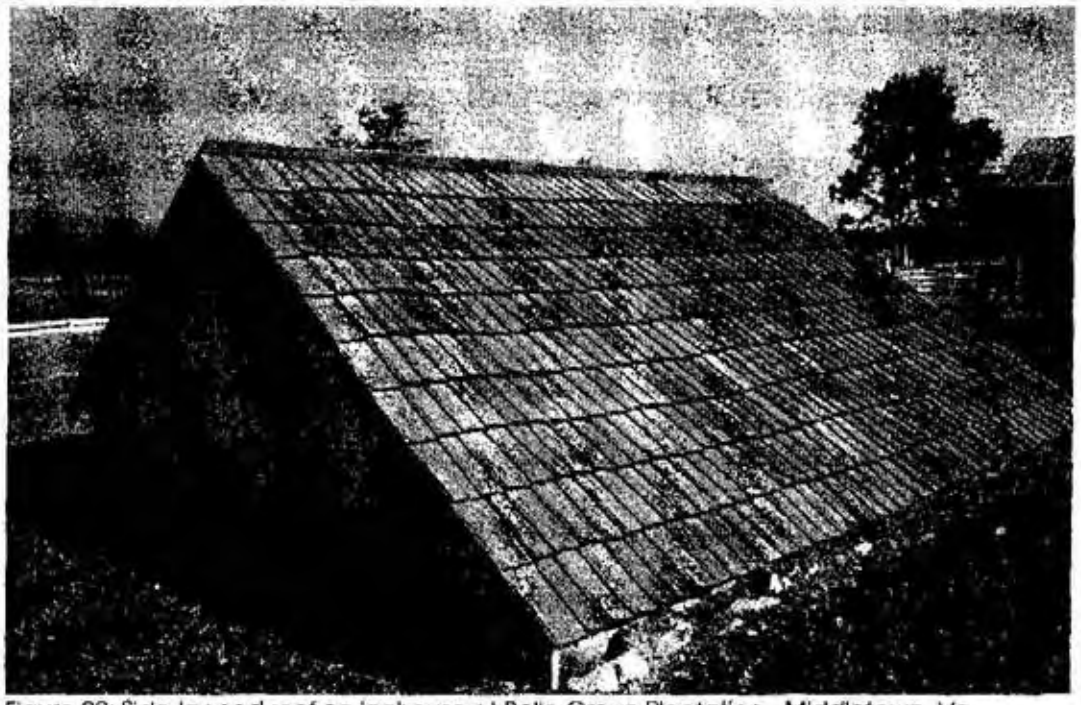

Figure 22: Side-lapped roof on Icehouse at Belle Grove Plantation - Middletown, Va. 2000

The need for replacement of the roofs of two out building on the grounds of Belle Grove Plantation was realized in 1999 due to their advanced deteriorated state. The smokehouse and the icehouse, both early nineteenth century limestone buildings, contributed to the original farm complex owned and developed by Major Isaac Hite from 1783 until his death in 1835. These building supported the functions of the large Manor House situated some 30 yards to the east and continued the substantial limestone construction. Both contribute very visible features of the landscape that set along the path that today take visitors to the museum. Worn edges, weathered surfaces, missing members and layer of moss were all indicators that this roof had fully out lived its useful life. The roof consisted of sawn western red cedar shingle roof installed in

the 1970's by Malcolm Brumback, life resident of the property. The exposure of these shingles was 5" and they were laid in the standard staggered joint method. This method butts the vertical edges of adjacent shingles and aligns their bottoms into regular rows or courses. Nails secure them above the exposed area (typically two nails per shingle) that is then covered by the next course.

The roofs of both these buildings are simple gabled forms with two sloping sides meeting at a single ridgeline. Approximately the same size roof covers each structure. In roofing terms each holds around 3½ squares of shingles that translates to 350 square feet of surface area. The smokehouse comprises of a nearly square floor plan (14'X14") with its wall's of random ashlar stonework of locally available limestone. Only the wood plank door on the north wall and two vertical slots, one on each gable penetrated the stonework of the smoke house. There are no windows or other architectural details in the well-laid stonework reflecting the utilitarian function of the building. The icehouse is basically a large round pit thirteen feet in diameter that is covered by a similar gable roof springing from the ground level. The roof shaded the deep pit to aid in the cooling effect of the ice and kept things from falling into the pit. It looks as though the building had sunk into the ground to its eaves. The same local gray limestone as the smokehouse lines the subterranean walls of the pit. The pitch of both roofs is roughly seven feet vertical to every twelve horizontal.

Funding for the roofing project was secured from a grant the Commonwealth of Virginia. The estimate submitted to the state was for in-kind replacement of the existing red cedar roof at $15,000. It was after the money for the project had been secured that additional research determined that side-

lapped shingles were used at Belle Grove and specifically on these buildings. The labor-intensive technique of hand splitting the shingles instead of sawing standards shingles required additional funding in order to install. Alternative ways were discussed to produce the shingles mechanically but it was realized that only traditional techniques could produce its complex form. The extra cost was resolved through an agreement between the roofing company and Belle Grove's management. All parties realized the significance and educational benefits of restoring the roofs and demonstrating the unusual building craft of side lapped shingle installation.

Belle Grove's Historic Structures Report identifies wood fragments from shingles from earlier roofing campaigns that had fallen through the cracks of in the garret of the manor house to be that of white oak (Quercus alba).[29] Curiously, one would expect that cedar would have been the wood the shingles were made of because cedar trees grow so rampantly around the plantation. But interestingly almost all the wood used in the house was oak from the structural framing to the split lathe in the walls, except for the flooring that is pine and some carved decorative molding that is mahogany. Further investigation revealed a technique that historically used white oak to make shingles - the side-lapped method. Local Historian, Butch Fravel, verified that this side lap technique was commonly used in the Shenandoah Valley in the nineteenth century. He had found local historic samples of this shingle type from buildings in Stephens City that he had collected. He also had stereograph images of local buildings that showed the roof detailing quite clearly. Mr. Fravel had been

[29]Henry Brown... *Belle G rove: An Historic Structures Report*. March, 1996. p.244.

researching this roof of this trying to restore the roof of the Old Stone House Museum also in Stephen city with which he is actively involved. His shingle samples matched the dimensions of the ones found at Belle Grove (26" long by 5"wide) and were also made of oak (red and white). So it was very possible that this shingling technique had been applied to the roof of Belle Grove both originally and in later campaigns.

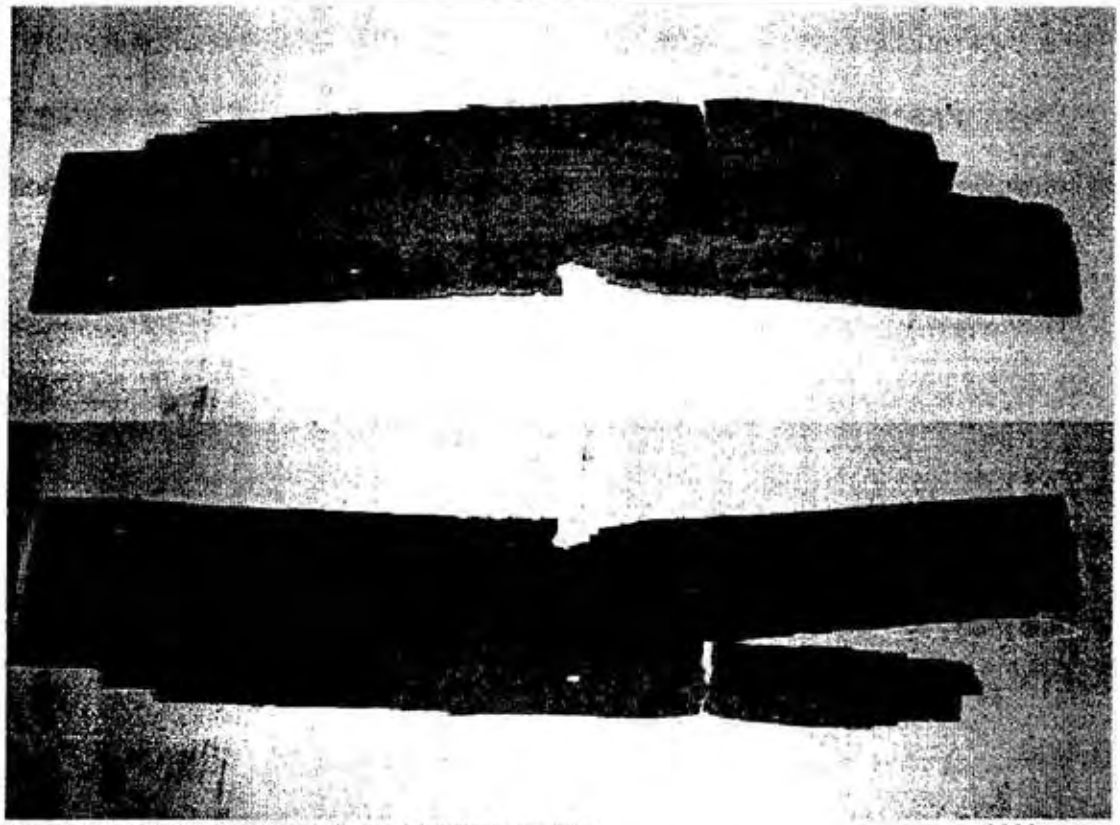

Figure 23: Belle Grove Plantation - Middletown, Va. 2002
Historic feather-edge shingle sample of white oak retrieved from garret of manor house.

The question of whether the shingles had also been used on the ice house and smokehouse remained speculative until life resident of the property Malcolm Brumback recalled it quite distinctly, after seeing a sample of the reproduction of a side lap shingle. He had helped his grandfather install a roof of this type onto

1'X10" board about three feet long with a strip of wood @1"x2" attached along its one side. The board was marked in half-inch increments from the edge of the strip that was attached. Easily and rapidly the widths of shingles could be determined by placing a shingle against the strip. The sorted shingles were placed in piles from 4 ½" -7". The majority of the shingles fell within 5-6" range though. This sorting step is beneficial to the installation process because the roofer must keep track of the widths of shingles in vertical row to assure the vertical joint alignment. So each shingle in a particular row is the same width. Contrarily, in the standard wood shingle technique a rather random selection of shingle widths are used to avoid aligning the vertical seams.

Figure 28: Log cabin on Cedar creek Grade Road near Winchester, Va. 2000
Extant side-lapped shingle roof uncovered during demolition of the building. Shingles were salvaged for this research.

-Photo taken by Eric Deihl

Three-inch boat nails, a type of cut nail, were first ordered to attach the shingles but they proved to be too short. The installer recommended that a nail long enough nail to penetrate through the one- inch thick nailer boards beneath should be used to maximize the holding power of the nails. The thicker than expected shingles and the layering of both the side lapping and the overlapping of rows prescribed that 4" nails were needed to install the shingles securely.

Boat nails are a type of cut nail whose shank are twisted 90° and flared just below the head. They are designed for marine usage design increases the wedging forces of the nail especially in wet conditions. Its design takes advantage of the swelling properties of wet wood to the nail and results in a more secured hold. The large nail head has a faceted surface that is made to resemble rose head nails. Their size was larger than what was found for shingle applications in the region but does exaggerate the roofing technique's unique exposed location. Boat nails can be clinched or bent over to further prevent them from dislodging but it was not needed for this application.

Another measure suggested and carried out by the roofer was to sharpen the cut tips of the boat nail to appoint to aid in penetrating through the multiple sub layers of shingles and the nailer and to minimize grain blow out of these members. This step may have been unnecessary but since hidden on underside it was not discouraged.

Galvanized boat nails were chosen in hopes to encourage the longevity of the roof. Although the galvanizing will reduce or eliminate the characteristic Iron tannate staining it may provide corrosive protection to the nails from not only the environment, but also the borate treatment. An added advantage to

using galvanized nails is that the zinc coating may also discourage biological growth on the wood shingles.

The installation process involved a good bit of debate and discussion on the approach and method since neither the roofers, nor the project manager, nor had the shingle suppliers as well as several other consultants ever actually installed a roof of this type. A plan was hashed out that followed some general instructions in Boucher's article along with evidence from shingles and also general roofing knowledge. The main issue with the roofers again was the alignment of the vertical joint that directly contradicts the modern standard practice.

An alternative method was proposed by the roofer, which butted the long edge of the shingle against its neighbor. This caused several conditions to happen: first the nail that penetrated the first predrilled layer actually missed the layer beneath because of the skewed alignment. It also caused the shingle to lay flat against the shingle below eliminating the air pocket typical of this technique. Not only would this approach cause trimming issues at the ends of the courses, but also it would altar the geometric grid pattern characteristic of this style. Also, it decreased airflow that might cause accelerated deterioration. The ultimate decision was based on the fact that all the historic shingle samples available had the three pairs of nail holes aligned parallel to the shingle's edge. This could have only occurred by side-lapping adjacent shingles and aligning joints vertically.

The shingles were laid starting with a double thick first course. The sub layer was made with the upper part of roughly half-length shingles. This standard

roofing procedure not only provides added protection to the lowest portion of the roof but also raises the bottom full course in the same plane as the rest of the roof instead of being slightly lower and askew. The remaining cut butt-ends of this first sub-course can be used at the ridge where only partial shingles are needed since there is no lapping from above.

Several allowances were made for the roofer in installing the shingles. He secured the shingles course by course instead of in a diagonal pattern as suggested by Bucher.[30] The diagonal method allows the shingles to be placed directly a top one another without having to tuck the edges for the side lap. The roofer on the Belle Grove project found it easier to keep the rows straight if he worked on one at a time and less trouble sliding the shingle edge to produce the side lap. This course-by-course laying method is the one used for butt joint shingle applications to which most roofers prescribe.

The roofer pre-drilled the nails holes with a cordless drill right on the roof. This way allowed a hole to penetrate through all the layers of the shingles and the nailer as opposed to the traditional technique of punching a hole in only the top shingle. Punching must also be done prior to installation using a specialized tool and guide to properly place the hole. Pre-drilling lessens the chance of splitting the sub layers of shingles while driving the nails. It proved to be an effective method since very few splits were noticed on the surface shingle or sub layers.

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[30] Ibid Bucher p.55 "Such shingles are laid bias on a roof, you put your first shingle on the lower right hand corner and then lap them sidewise as well as in rows one upon the other. Quoting Levi Yoder of his recollection of

One aspect of pre-drilling that should be noted is to properly size the hole to receive the nail but too much to allow the loosening of the nail. In the traditional punching technique a slightly smaller hole was pierced to accept the nail. Unlike drilling that removes wood fibers from the hole, punching leaves most of the wood fibers that in essence swell around the shaft of the nail and secure it in wet conditions. So, if the hole is drilled too large then there is a greater chance of the nail working loose over time. A rule of thumb is to allow about half the diameter of the nail shank width for the pilot hole.

The field of the roof was completed in the manner above. An unusual aspect to the orientation of the side laps was realized when considering the wind direction. It had been noted in Bucher's article that the side laps were situated so that the thicker edge faced away form the prevailing winds. This meant that in order for shingles on both sides of a gable roof to face away from the prevailing winds then they had to be lapped opposite each other. So a left handed overlap on one side accepted wind the same as a right-handed overlap on the other side. This affected the dressing of the individual shingles whether they are to be installed on the right or the left hand side especially if the bevel edge detail is utilized. So in the specifications for the shingles ordered, half the shingles must be beveled and dressed on the opposite side.

The roofs of the smokehouse and the Icehouse were finished at the ridge with a *combed* ridge also called a *turkey tail* ridge. To make this type of ridge the top course of shingles on one side are trimmed at a line at the planar junction of the two sides. On the other side the top course is allowed to extent beyond the other one 2-4" thus covering the open joint of the ridge. Wind

direction also dictates which side extends over the other. The side facing the prevailing winds projects over the opposite to block rain from that direction to direct access to the ridge joint. This method was applied to the Belle Grove roofs based on photographic evidence of local roofing practice. Flashing was also installed under the shingles at the ridge as an extra measure to prevent water from penetrating the ridge. The flashing may not be a historic practice but since it was hidden it was allowed.

Bell Grove's smoke house and icehouse roofs fairly accurately depict the tradition side-lapped shingle configuration. Except for the pronounced galvanized nail heads, supplemental measures like the borate treatment and ridge flashing are not visible to the casual observer. The benefits from these deviations far outweigh their negative impact to the accurate portrayal of this roof type. One gets a sense of the unique characteristic of this roofing technique by looking at these very visible structures and can imagine similar applications on other buildings on the property.

Hans Herr House- Lancaster, Pennsylvania

Figure 26: Hans Herr House, Lancaster County, Pennsylvania c.1975
-Courtesy of John Milner Architects

The Hans Herr House is the oldest surviving dwelling place in Lancaster County, Pennsylvania and also the oldest standing Mennonite meetinghouse in the Western Hemisphere. Christian Herr, son of Hans Herr built the house in 1719. Both father and son along with 7 others purchased 10,000 acres of what was at the time the westernmost edge of the Pennsylvania colony in 1710 and settled there the following year. The house site sits along an ancient Native path called the "Great Conestoga Road." Both Christian and his father, Hans, were Mennonite Bishops that explains it use as a meetinghouse. Several generations of Herr's occupied the dwelling through the mid nineteenth century. Today the property is interpreted as a house Museum in conjunction with several other dwellings, barns and other outbuildings on the complex. The house was restored

in the early 1970's to return to its eighteenth appearance including the reinstallation of a side lap shingle roof.

Figure 26: Workers install the side-lapped shingles in the course-by-course method aligning seams vertically as they proceed up the roof.
-Courtesy of John Milner Architects

Investigation of house by the restoration team uncovered evidence for the use of the side lapped shingle. Samples of shingles of white oak were found being used for shims or wedges to level the original floorboards in various parts of the house. These shingles made of white oak measured 36" long and tapered both lengthwise and widthwise. Since the sample shingles were never actually installed on the roof they lacked the exposure wear and nail holes that can be used to determine their exposure length. To find out the exposure length of the shingles examination of nailing patterns of the rafters was necessary. The distance between nail holes on the rafters reflects the shingle lathe spacing that

has a direct relationship to the exposure length of the shingle, as is the case with most shingle applications. . The location of the nail holes revealed a 12" for spacing of the lath that held the original roof. The new lath and side-lapped shingles were installed according to this spacing.

Local craftsman were employed to rive and dress the shingles. A bevel was drawn along the thick edge of the shingle only just beyond the 12" exposure. The shingles were installed courses by course in the horizontal method onto the roof with aligned vertical joints and consistent shingle widths going up the roof.

The restored side-lapped shingle roof of the Hans Herr House provides and authentic interpretation of this unique method of roofing. It proves that this traditionally installed roof can function effectively to protect a building with a finished interior.

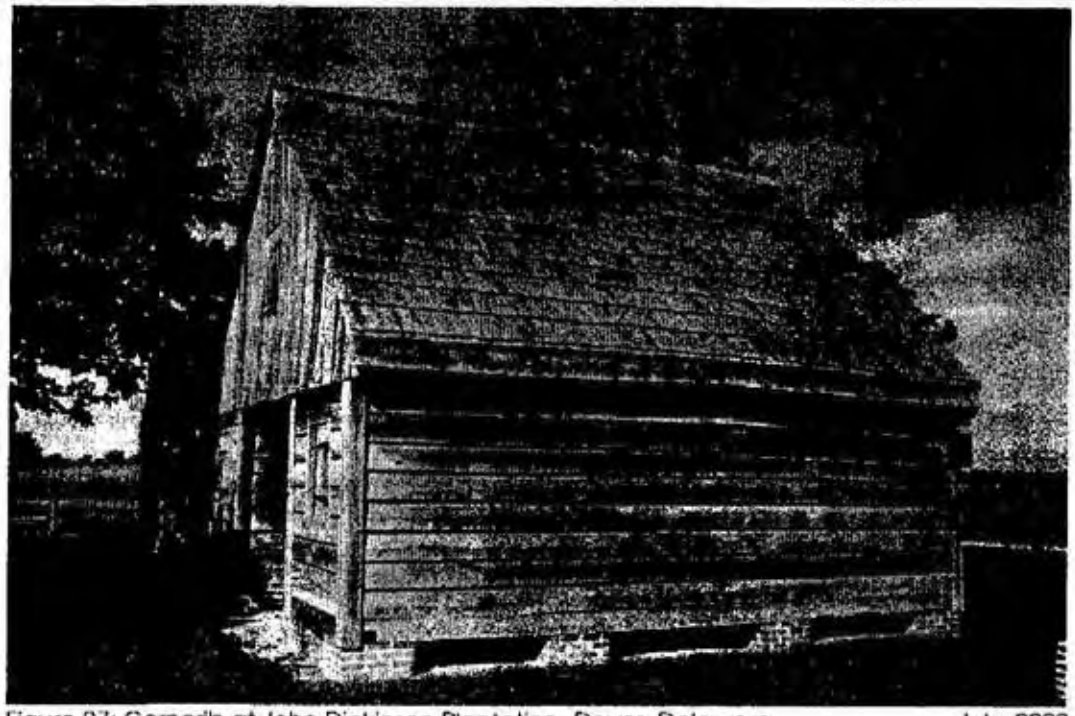


Figure 27: Corncrib at John Dickinson Plantation- Dover, Delaware July, 2002
Note smaller exposure of bottom course at drip edge detail replicated from nearby Cherry Grove Plantation in Earleville, Md.

The Dickinson Plantation was developed under the auspices of John Dickinson, (1732-1808) colonial lawyer and most often remembered as the penman of the Revolution. Records show that the outbuildings having side-lapped roofs existed at the time of the 1797 Tax assessments but were subsequently demolished. Currently these structures are interpretive reconstructions following both the written descriptions from Dickinson letters and regional building practices. A section of the extant roof from the Cherry Grove Plantation Earleville, Maryland was used to provide detail information for installation of side-lapped shingles to these roofs (see drawing below). Numerous entries in local property tax records list hand-riven oak shingles to be a

predominant roofing technique in that area supporting their use on the reconstruction.

The reconstruction in the 1980's of four outbuildings incorporated the use the side-lapped shingle technique of roofing. The stable, the corncrib, the feed barn and the smokehouse all have interpretations of this roof type. Construction information for the project was based on archeological evidence, archival documentation and conjecture with an awareness of local craft traditions. Archival research consisted of notations from orphan court records, maintenance receipts and records, and some photographic images form the 1950's of the extant original structures.

A notable variation of these roofs includes the substitution of cedar for the specified white oak shingles on three of the outbuildings. This re-selection was made due to the difficulty in working with the hard oak and splitting that occurred during installation. Another aspect of this roof is that the seams of the shingles do not line up vertically, meaning that the shingles were not sorted prior to attaching them and that fitting the shingles to align vertically was not a concern. This deviates from the drawings of the roof of Cherry Grove Plantation that was used as a model and that show that the vertical joints aligned.

Cedar was chosen to make the shingles after the attempt to produce white oak shingles was deemed too difficult. The smokehouse does have white oak shingles but it was learned that shaving (with a drawknife) the shingle blanks was prohibitive because of the hardness of the wood. The available wood did not meet the standards necessary for making a good shingles. Twists in the grain of the wood produced warped shingles.

Spoon-tipped cut nails attach the shingles to the oak nailers or roof lath. Project coordinator Leon Massina explained that the sharper point of the spoon-tip was necessary to cut through the grain of the oak as opposed to punching it out, which a normal square end cut nail does. The increased friction due the wedging of the spoon tip nails aid in preventing the nails to pop out over time. Mr. Massina also pointed out that the nails were oriented against the grain of the nailers as to reduce the possibility of splitting the grain of the nailers open. He also felt that the more random placement of the nail holes created by not aligning the seams prevented the shingles from splitting along a single overstressed grain line in a particular shingle.

The first or bottom course of these roofs reveals another unique aspect of the shingle installations at the Dickinson Plantation. Only a two-inch exposure is given to the bottom course of shingles. This detail taken form the Cherry Grove drawings seems to function as a sort of drip edge or as sacrificial extension of the first full course. This short starter course is also side-lapped like the rest of the roof but only partial shingles were used as is typical of other techniques.

Although documented in written form that side-lapped shingles were found on these buildings, details for the roof reconstruction were based on known regional samples. Despite the specifications for a traditionally laid side-lapped roof deviations occurred due to issues with handling the shingles resulting in a change of the wood from oak to cedar. The lax attempt at vertical seam alignment may lead to premature deterioration of the roof and might cause leakage to occur.

Conclusion:

Roofs not only play a vital role in the authentic and accurate interpretation of historic buildings, but also can offer broader insights into our past. One distinctive roof style, side-lapped shingle technique, was employed by generations of Americans from the early eighteenth-century until well into the twentieth-century in some remote areas. Although likely never common in large East-coast cities, the widespread and prolonged use of this roofing method in rural areas of the mid-Atlantic and the southern Appalachian regions shows that it was highly valued both economically and socially. This value was seen in the support from communities of a cottage industry that supplied local markets with shingles. In places like Stephens City, Virginia photographic evidence shows that as late as the 1880s side-lapped roofs were still visible on the majority of roofs in the town. It was even still a preferred roof in Westmoreland County, Pennsylvania until the 1930's. Whereas most other areas, especially cities, showed a preference for massed produced shingles by then, these remote areas still had the raw materials and the tradition of labor to support the production of such side-lapped shingle roofs.

Building traditions like side-lapped shingle roofing, once passed down from father to son, nearly ceased with society's acceptance of industrialization and manufactured building materials distributed nationally in most areas by the twentieth-century. Since the chain of knowledge has been broken for handcrafted techniques like side-lapped shingling, the only way these traditions will be continued is through deliberate study and effort to preserve them. Fortunately, some early photographs and a few crumbling roofs remain to tell us

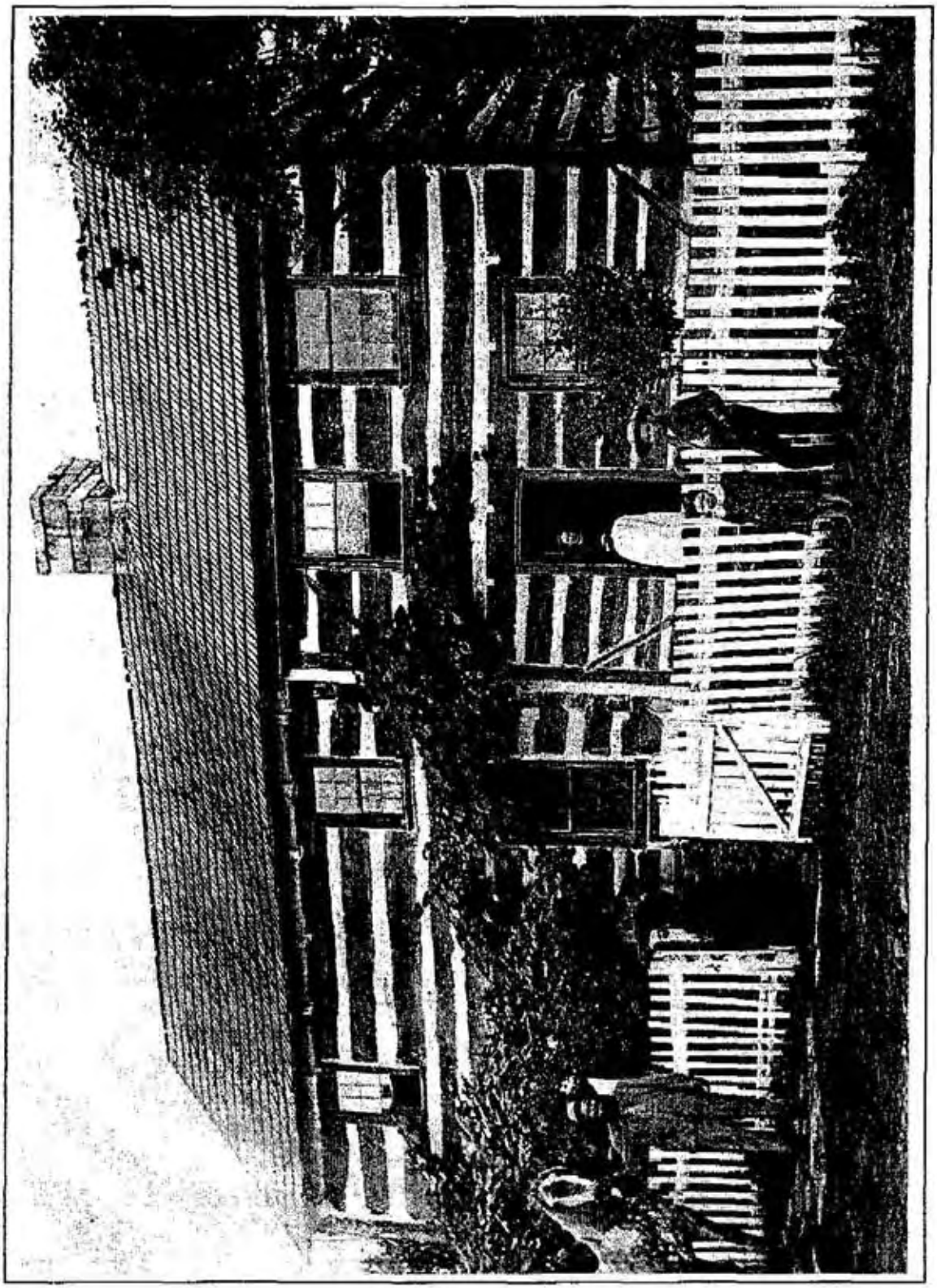
how to replicate these roofs. These photographs and other information gathered here are intended to fill in the gaps of information that a break in craft traditions kept from being passed along. The efforts of common people in developing and maintaining the side-lapped roofing technique should be recognized as contributing to America's cultural identity. Their fruits although not epic were essential in developing the country. Accurate reinstallation of such roofs on some buildings that had once had them, most likely at museums and historic sites, would allow visitors to see this unique craft in an historical context.

This thesis promotes the theory that the American side-lapped shingle roof represents a technology brought from Europe that was blended with the use of available American woods and the scarcity of nails in pre-industrial rural contexts. In contrast, Bucher believed that it came directly from Europe in an intact form. His theory does not account for the different economic and environmental conditions between eighteenth-century Europe and wilderness America nor does recognize inventiveness in the colonial American frontiersman. Neither Bucher nor this research had uncovered any specific examples of side-lapped shingles in Europe, leaving the possibility that it may not have existed there. But the research confirms that Bucher's concept that this technique was widely utilized in the Mid-Atlantic regions. It shows more distinctly the variations in the shingle application that existed amongst regions, like the preference for white oak or red oak and the length of the edge-bevel. Side-lapped shingle usage was not just an esoteric method tied to a single ethnic group or locality, as many have mistakenly believed, but at least a regionally common roofing method with local variations.

The educational value of understanding and representing this craft tradition through accurate interpretation on historic buildings benefits not only the academic community and those with interests in American architectural history, but also the casual observer who may be encouraged to wonder why this roof is so different and expand his thinking about history and American building traditions. It provides a glimpse into the lives of earlier generations and forces us to consider and understand the challenges of living prior to the Industrial Revolution. When we recognize the contributions of common people who invented and maintained the side-lapped roofing technique, we learn another aspect of American history and culture.

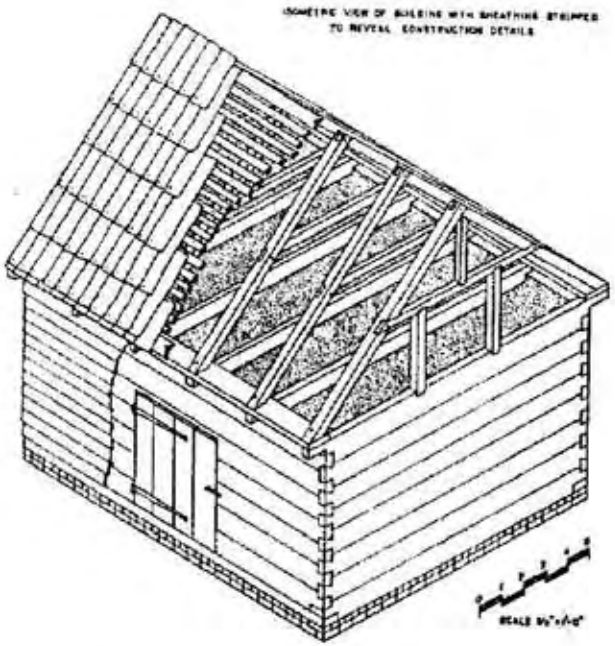
Appendix A: Distribution Map of Side-lapped Shingle Roofs

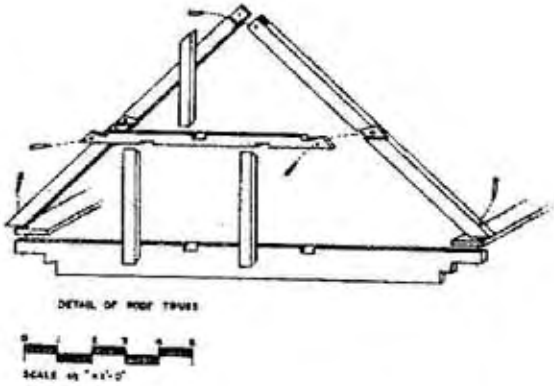
Appendix B: Historic Photograph of Log Cabin near Franklin County, Pa. c.1885
From private collection

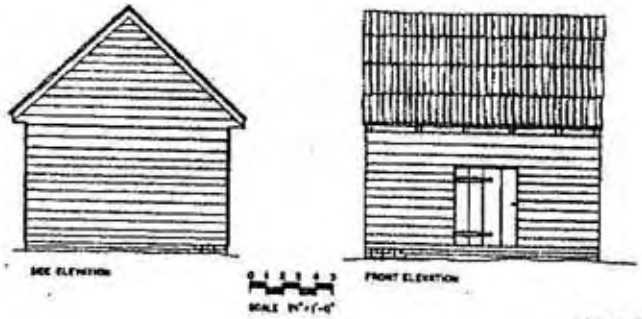


JOHN DICKINSON'S SMOKEHOUSE

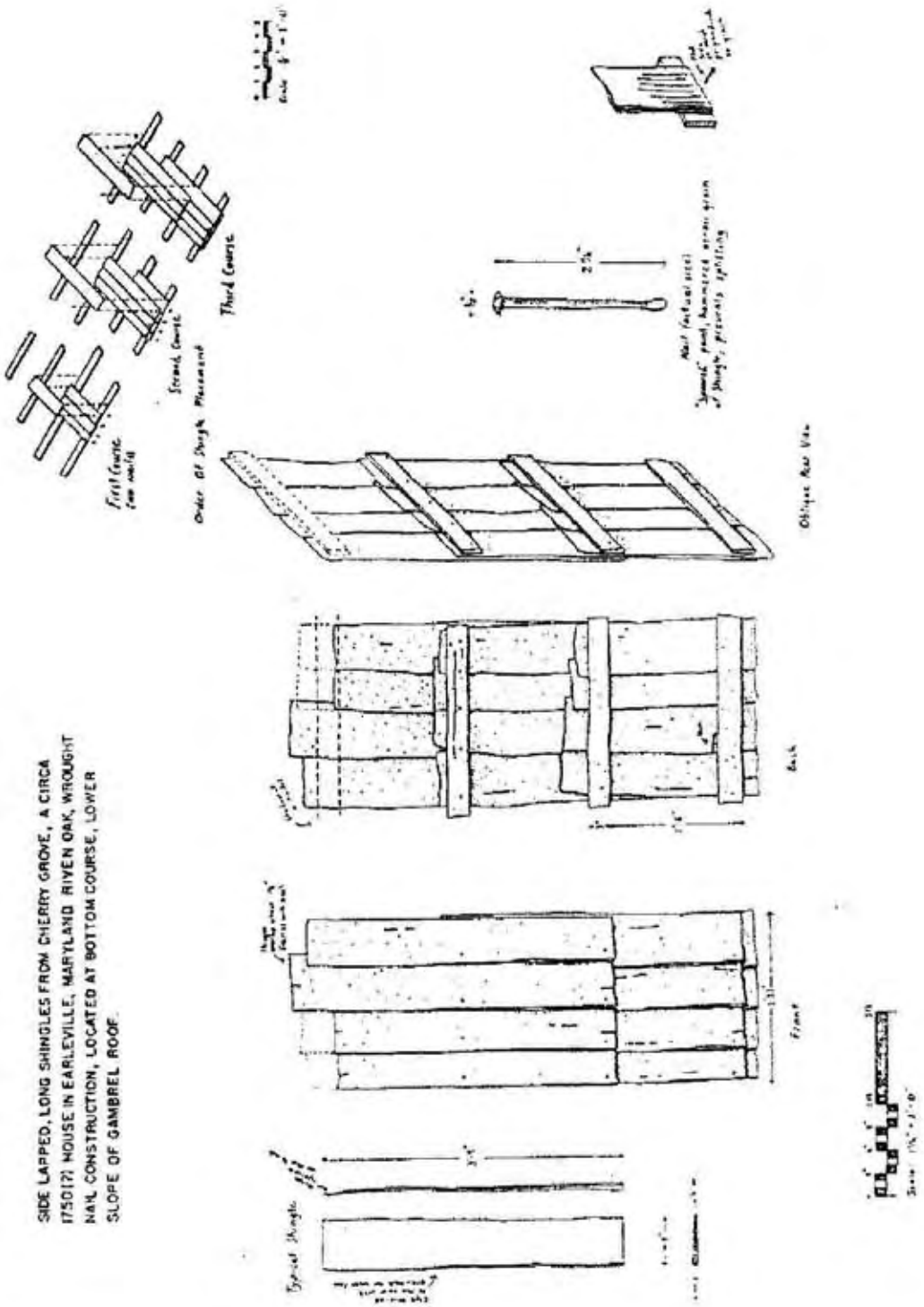
SEVERAL HISTORICAL DOCUMENTS INFORM THIS RECONSTRUCTED VIEW OF A LATE EIGHTEENTH CENTURY KENT COUNTY SMOKEHOUSE. MOST IMPORTANT TO THE JOHN DICKINSON MANSION OUTBUILDINGS RESTORATION IS THE DECEMBER 1, 1797 AGREEMENT BETWEEN JOHN DICKINSON AND CARPENTER JOHN KILLEN TO BUILD A "NEW SMOKEHOUSE 12 x 14 FEET IN THE CLEAR OF HEWED LOGS COVERED WITH OAK SHINGLES... LOGS TO BE DOVETAILED." A JUNE 17, 1806 BILL OF REPAIRS ON POSSIBLY THE SAME BUILDING BY CARPENTER WILLIAM DICKINSON (UNRELATED TO JOHN) CALLS FOR THE "RIVING AND SHAVING (OF) 200 CLAPBOARDS" FOR EXTERIOR SHEATHING. A SURVIVING SMOKEHOUSE, CIRCA 1820, OF VERY SIMILAR DIMENSION AND DESCRIPTION AT YORK SEAT FARM, NEAR LITTLE CREEK, DELAWARE, PROVIDES MANY CONSTRUCTION DETAILS, INCLUDING PLACEMENT OF SILLS AND PLANKS, POSITION AND SIZE OF THE DOOR OPENING, AND THE PINNED RAFTER/FALSE PLATE/TIE BEAM SYSTEM OF THE ROOF TRUSS. MANY DICKINSON OUTBUILDING CONSTRUCTION DOCUMENTS SPECIFY 3'x8" SHINGLES OF OAK OR CEDAR. A SECTION OF SIMILAR SHINGLING SURVIVES FROM CHERRY GROVE, A MID-EIGHTEENTH-CENTURY GAMBREL ROOF HOUSE IN EARLEVILLE, MARYLAND, GIVING PHYSICAL EVIDENCE FOR ONE TECHNIQUE OF LAYING A ROOF OF SUCH MATERIAL. VERTICAL BOARD DOORS WITH DIAGONAL BATTENS ARE CUSTOMARY ON LOCAL OUTBUILDINGS OF THE PERIOD.







Appendix D: Drawings and notes of Cherry Grove Plantation- Earleville, Md. model for John Dickinson Plantation outbuilding restorations. Delaware State Museums - Dover, Deleware



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Appendix E: Correspondence – Alex Weidenhoeft, USDA Biologist

Appendix F: Correspondence – Alex Weidenhoeft

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