PROJECT PROFILE

WOOD SHINGLE REROOFING

Restoration of Chowan County Courthouse, Edenton, NC

By John L. Willers

The Chowan County Courthouse in Edenton, North Carolina, was constructed in 1776, and it was designated as a Registered National Historic Landmark in 1970. The structure is not only the oldest public building in North Carolina, it is also the least altered of all the remaining British colonial courthouses in America.[1,3]

Restoration is taking place in two phases: the exterior (Phase 1) and the interior (Phase 2). Phase 1 is complete and consisted of restoring the exterior walls and the roof. This article will address the restoration of the wood shingle roof. Specifically, it will address how the swept valleys, fanned hips, and combed ridges were designed and constructed to prevent water entry, and it will address specific detailing and construction techniques at the roof of the apse.

Photograph 1—Before renovation. Roof investigation in progress.

The Restoration Team

The restoration contract was issued to HagerSmith Design, PA, of Raleigh, NC, by the Restoration Branch of the North Carolina Division of Archives and History, Department of Cultural Resources. HagerSmith engaged the services of George Fore, Architectural Conservator, Raleigh, NC; Lysaght & Associates, structural engineers, Raleigh, NC; and Rooftop Systems Engineers, P.C., Raleigh, NC, to assist with various aspects of the restoration.

Rooftop Systems Engineers, P.C., was assisted by Martin L. Obando, Technical Advisor and Director of Application Specifications for the Cedar Shake and Shingle Bureau, Mission, BC. Assistance was also provided by the Restoration Branch of the North Carolina Division of Archives and History and members of the 1993 Courthouse Study Commission of Edenton, NC.

The prime restoration contractor was Progressive Contracting Company, Inc., of Sanford, NC, whose subcontractor for the reroofing was Preservation Services, Inc., of Fredericksburg, VA.

The Structure

The roof has a plan-view area of approximately 3,150 square feet. The construction prior to restoration consisted of a wood timber roof structure, wooden roof deck, and cedar shingles.

Records indicate that, in 1835, there was an unsuccessful attempt to replace the wood shingle roof with a more modern metal roof. Subsequently, several wood shingle roofs were installed, the most recent being in 1979.[1,3]

Portions of the timber structure had been damaged by water entry, specifically the lower portion at the base of the valleys and various locations at the cornice. Defects in the swept valley construction were the primary cause of the damage to the timber structure. Split shingles, resulting in aligned joints from one course of shingles to another, permitted moisture to enter the cornice at various locations, resulting in moisture damage. There was no evidence that underlayment or interlayment had been used, except for narrow sections of sheet metal interlayment at the hips and valleys.

Obviously, no interior renovation could be initiated until after the roof had been replaced. The reroofing would need to assure that there would be a permanent solution to water entry at the valleys, eaves, and all other details, and the architectural integrity would have to be maintained.

Photograph 2—New cypress shingle roof.

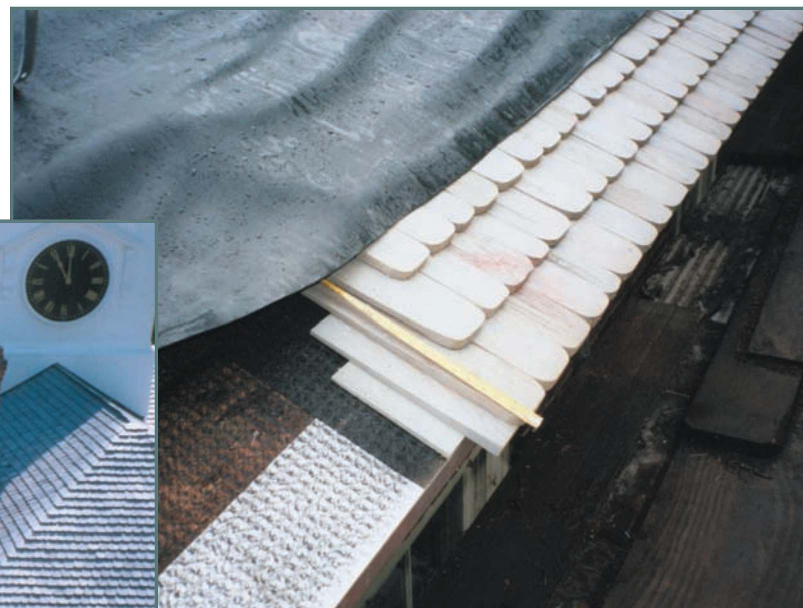
Shingle Specifications

Shingles were found in the clock tower and in the crawl space under the main floor. These were identified as 18"-long, cypress shingles which had been split and dressed, and each corner of the butt had been rounded. Therefore, it was established that the new roof would be a wood shingle roof utilizing "old growth" cypress from which to manufacture the shingles. The specifications for the shingles were:

> "Cypress, 18" and 24" long with butts 1/2" to 5/8" thick and tips 1/4" thick. Shall be No. 1 grade, clear, dense heartwood (a minimum of 40 growth rings per inch), flat-grained, no defects. Widths to be random from 3-1/2" to 5" except as detailed at hips and ridges. Shall be riven on the exposed face and may be riven or sawn on the opposite face with butt ends cut to the shape as shown on the roof plans. Shingles manufactured from mined logs are preferred."

The shingles were hand split by Progressive Contracting from cypress logs which had been dredged from the swamps of Florida and Louisiana.

Also, to retard the growth of moss and fungus, it was specified that the shingles be treated with a stain[2]:



Photograph 3—Typical eave construction viewed from scaffolding during construction. Shows wood deck, edge metal, ice and water shield at eave only, Cedar Breather, two starter courses of wood shingles, and the new cypress shingles.

> "Stain: Shall be a paraffinic, oil-based, non-film-forming, non-ambering, wood preservative with UV inhibitors, fungicide (Busan), and pigments, and be specifically manufactured as a wood preservative for application to roofs. Shall be a semi-transparent stain with a maximum evaporation loss of not more than 4%. Drying time shall be 48 hours or less. Color to be selected by owner."

Requirements to incorporate some means of increasing resistance from fire from internal or external sources were waived due to the need to maintain the historic nature of the building.

This specification was developed following consultation with Professor Todd F. Shupe of the School of Forestry Wildlife and Fisheries at Louisiana State University, Baton Rouge, LA.

DETAILS

Swept Valleys

The detailing of the swept valleys was a challenge. No specific details could be found in any of the industry manuals; therefore, a shingle layout was designed "from scratch." After a brief period of sketching, it was apparent that it was not possible to layout the shingles and maintain joints that would be offset by 1-1/2" while also avoiding the joints of one course crossing over the joints of the course below. Additionally, it was not possible to maintain a minimum width of 3" (1-1/2" to each side of the joint below) at all locations. Further, due to the reduced slope in the valley, the shingles in the valley would have to be longer than those used in the field of the roof.

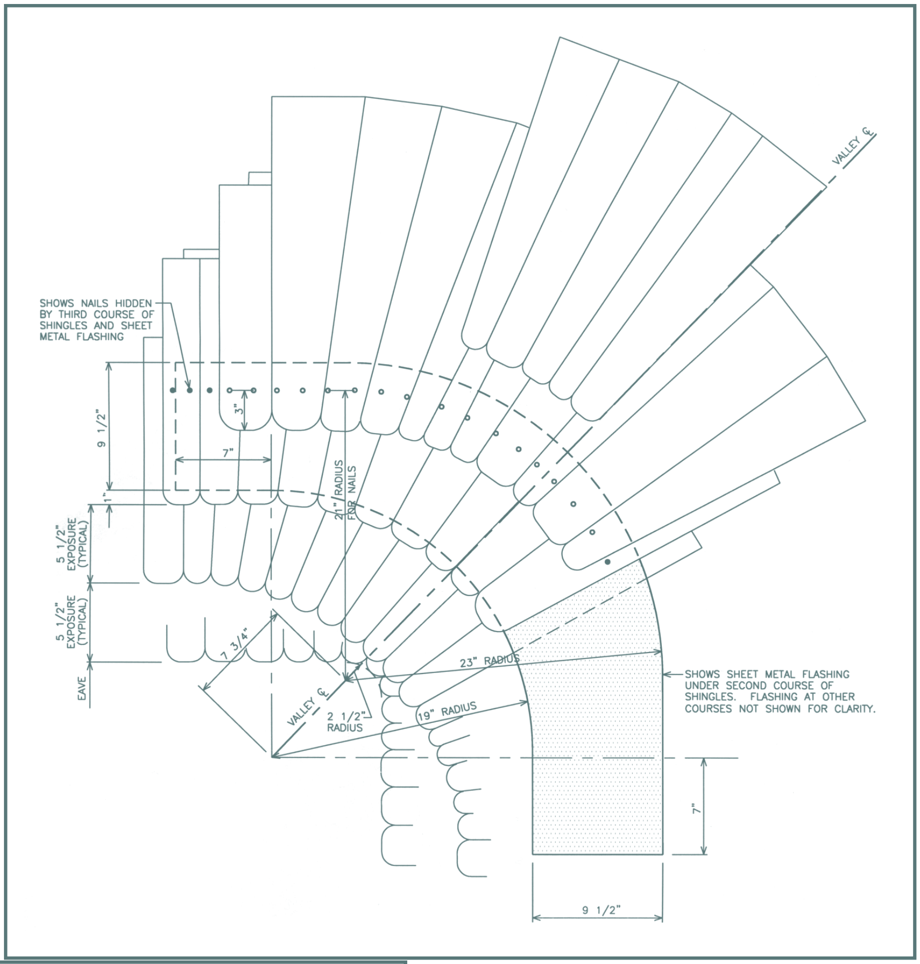


Figure 2—Swept valley shingle layout showing placement of sheet metal interlayment. Only one piece of interlayment is shown for clarity.

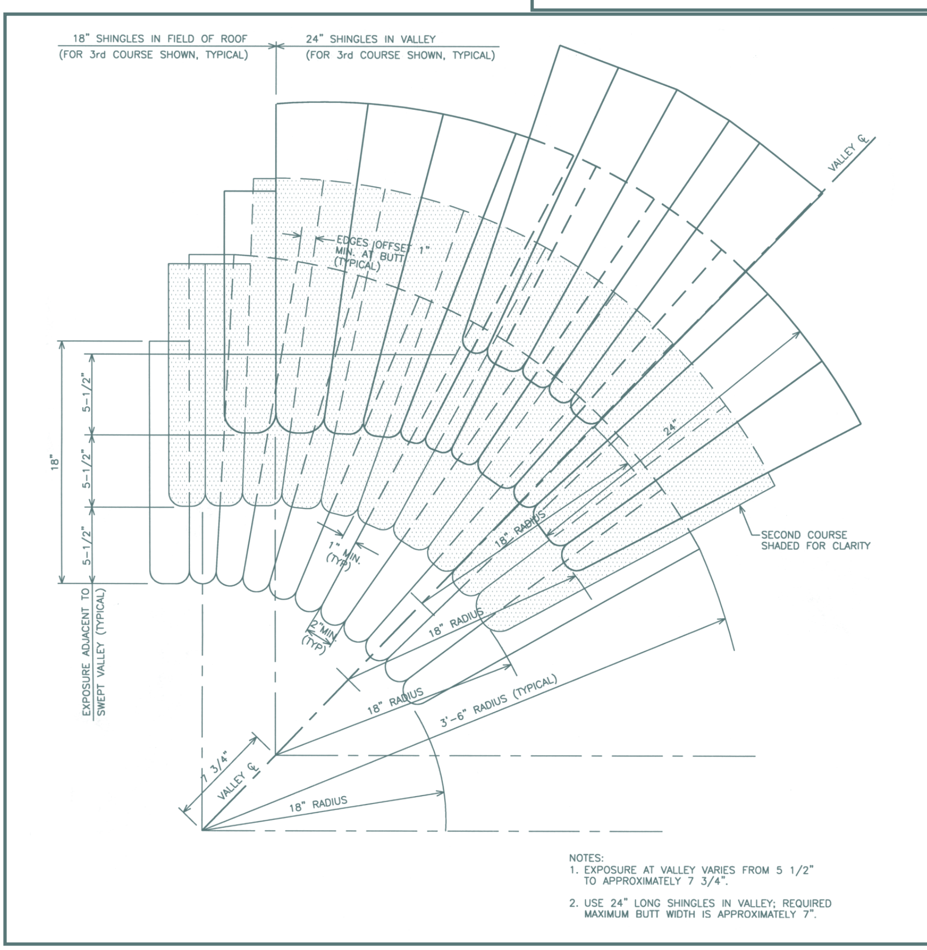


Figure 1—Partial swept valley shingle layout. Note the two different lengths of shingles and note that the exposure varies from 5-1/2" to a maximum of approximately 7-3/4". The second course of shingles has been shaded for clarity.

The use of shingles with a minimum butt width of 2" (1" radius on each corner) and with a length of 24" rather than 18" would be required within the swept area of the valley. This would satisfy the geometric requirements, but it would not be watertight (see *Figure 1*). The only way to achieve a watertight valley would be to install sheet metal interlayment as shown in *Figure 2*.

Photographs 4, 5 and *6* show the actual construction.

Photograph 4—Swept valley construction. Note the 24" valley shingles, which are tapered and have very narrow tips. Geometry of this construction does not permit the joints to be offset from one course to course below; therefore, the lead "step" flashing was installed. Also, note the adjacent 18" shingles. The longer shingles in the valley are necessary due to the increased exposure required within the sweep of the valley.

Photograph 5—Buddy Tate constructing a valley. Note the 18" shingles approaching the valley, the 24" shingles within the swept portion of the valley, and the lead flashing.

Fanned Hips

The detailing of the fanned hips was as difficult as detailing the swept valleys. Again, I could find no specific details in any of the industry manuals. Although there is a photograph in *Preservation Briefs 19*[4] of workmen constructing a fanned hip, there are no details of how they completed their construction. Therefore, I again began to design a shingle layout "from scratch."

Based on what was learned from the design of the swept valley, layout began by using shingles with a minimum butt width of 3" and with a length of 24". Again, this would satisfy the geometric requirements but would not be watertight (see *Figure 3*). The only way to achieve a watertight hip would be to install sheet metal interlayment as shown in *Figure 4*. *Photographs 7, 8* and *9* show the actual construction.

Combed Ridge

Details of a combed ridge are shown in various industry publications; however, due to the joints formed by abutting

Photograph 6—View of completed swept valley.

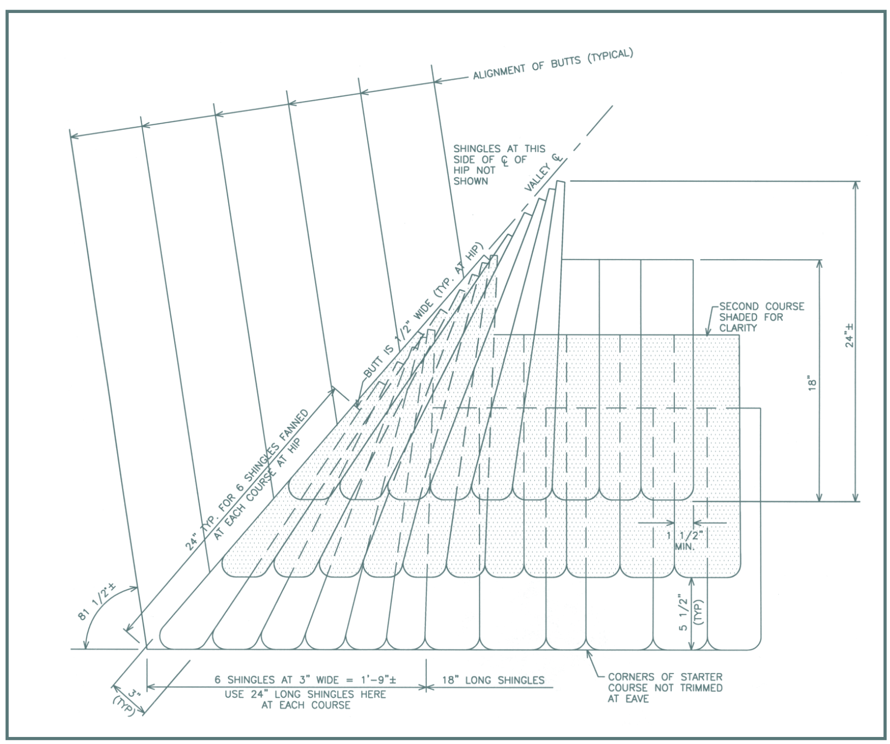


Figure 3—Partial fanned hip shingle layout. Note the two different lengths of shingles. The second course of shingles has been shaded for clarity.

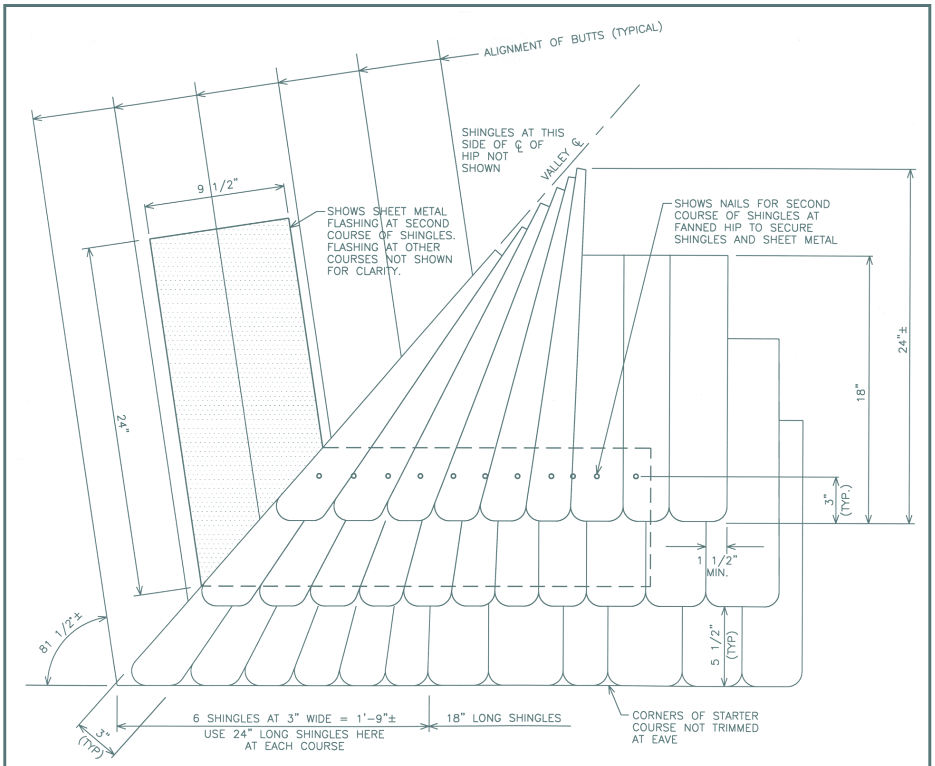


Figure 4—Fanned hip shingle layout showing placement of sheet metal interlayment. Only one piece of interlayment is shown for clarity.

Photograph 7—Fanned hip construction. Note the 24" hip shingles, which are tapered and have very narrow tails. Geometry of this construction does not permit the joints to be offset from one course to course below; therefore, the lead "step" flashing was installed. Also, note the adjacent 18" shingles. The longer shingles at the hip are required due to the increasing distance as the shingles approach the hip in the wood deck.

shingles and due to the required exposed nails, these typical details were not considered satisfactory for this restoration project. Therefore, the typical detail was modified to incorporate two layers of interlayment.

The first layer of interlayment would be installed once the tails of the shingles reached the ridge line. The interlayment would be stainless steel sheet metal clad with ice and water shield material. This would be fabricated to the maximum width possible without being exposed to view.

Next, the second-to-last course of shingles would be installed on each side of the ridge. Following this, the second layer of interlayment would be installed. This would be similar to the previously installed layer of interlayment, except that the ice and water shield material would be installed on the bottom face of the stainless steel sheet metal. This would avoid exposing the ice & water shield material to UV rays at the joints between shingles.

Finally, the last course of shingles would be installed to form the combed ridge. A single layer of interlayment would shed any water entering the joint between abutting shingles at the ridge; however, two layers were detailed to provide two opportunities to seal the shanks of the exposed nails.

Figure 5 shows this detail. *Photograph 10* shows the actual construction.

Photograph 8—Fanned hip construction. Shingle to right side of hip has been mitered and lapped; however, the butt remains to be trimmed.

Photograph 9—Completed fanned hip construction.

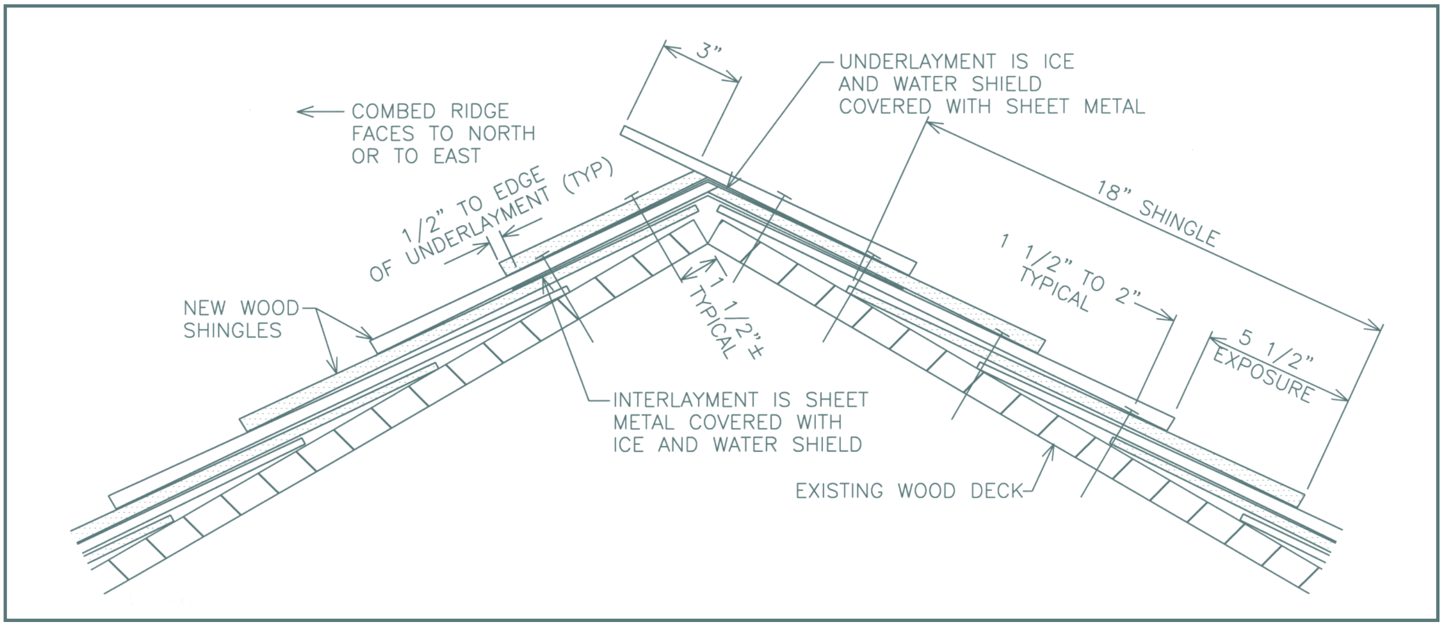
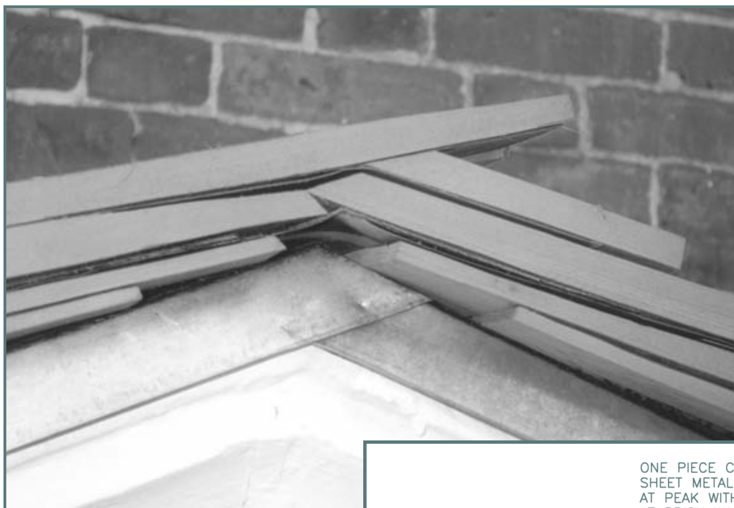


Figure 5—Combed ridge. Note the dual layers of interlayment.

The cap would cover the exposed nails of the last course of shingles and would serve as the last piece of step flashing along the wall.

The actual construction is shown in *Photographs 12* and *13*. Note that the actual construction involved the installation of two pieces of concealed interlayment rather that a single layer of concealed interlayment as detailed.



Photograph 10—Combed ridge. Due to the joints between adjacent shingles and the exposed nails, ice and watershield-clad stainless steel interlayment was installed at two locations within the ridge construction. Also, note the added layer of ice and water shield that was placed under the first layer of clad stainless steel.

Peak of Apse Roof

Designing this detail would involve addressing constraints similar to those encountered for the swept valleys and the fanned hips. *Figure 6* shows how the last three courses of shingles would be installed utilizing narrow, tapered shingles. As the construction approaches the peak, it becomes increasingly difficult to maintain the required offset at the joints between shingles, and the nails for the last course of shingles would be exposed.

Therefore, sheet metal interlayment was detailed here as well. *Figure 6* shows one layer of sheet metal interlayment and a sheet metal cap that would be fabricated with a vertical flange.

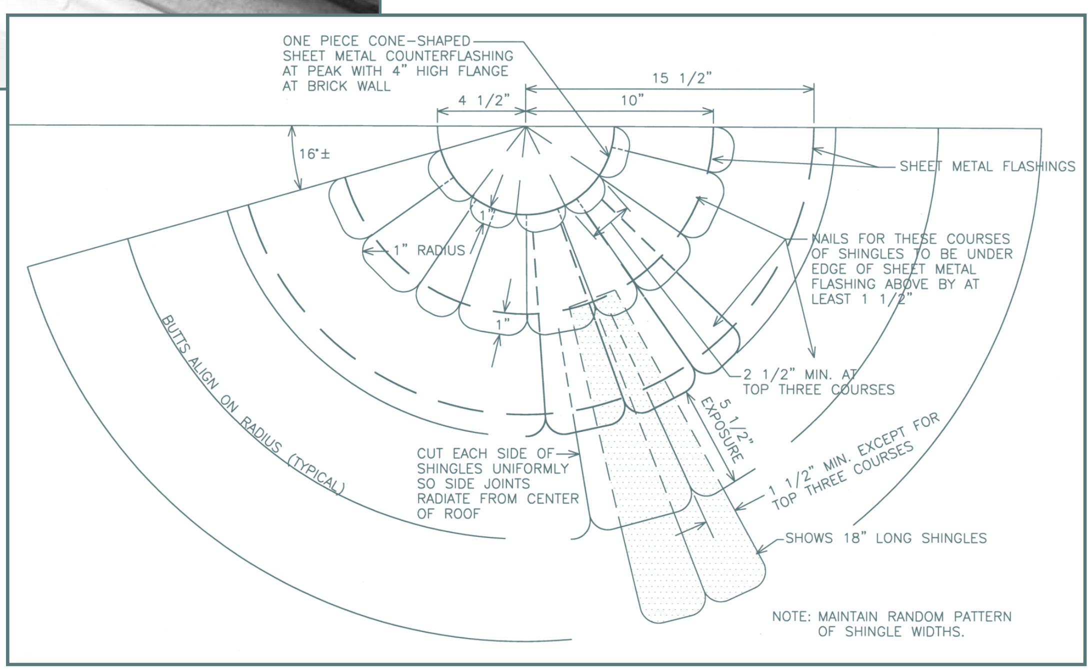


Figure 6—Plane view of shingle construction at peak of apse roof showing shingle layout and location of sheet metal interlayment.

SUMMARY

A "belt and suspenders" approach was taken relative to the long-term performance of the roof of this historic structure. This approach was sustained by the efforts of Progressive Contracting Company, Inc., the general contractor, and its roofing subcontractor, Preservation Services, Inc. The beauty and function of this roof are due in large part to the craftsmen who installed the shingles, the sheet metal flashings, and the counterflashings.

The total construction cost of this 3,700 s.f. roof, as bid in 1997, was approximately $290,000.

Copies of the AutoCAD details are available from the author at no charge. Please contact the author via the firm's website, (www.rooftopsystemsengrs.com) and give your name, the name of your firm, telephone and fax numbers, and your e-mail address.

Photograph 11—Roof of apse before reroofing. Note that the geometry of this cone-shaped roof is not a portion of a true cone. The circular eave does not intersect the wall at a 90º angle; therefore, the apex would be located within the main building. This altered the geometry of the exposed roof such that the distance from the peak to the eave, as measured along the wall, is greater than the distance from the peak to the eave as measured in a plane perpendicular to the wall. This required that the exposure of the wood shingles be constantly changing along each course of shingles.

Photograph 12—Fanned shingle installation at apse.

Photograph 13—Fanned shingle installation at apse roof. Note the lead cap at the peak of the apse shingles. Not visible is the lead interlayment under the course of wood shingles below the lead cap.

References:

1. "A Plan for the Restoration of the 1767 Chowan County Courthouse," Gerald Allen & Jeffrey Harbinson Architects, P.C., New York, New York.
2. "Treatments for Wood Shingle Roofs," Contractor's File, Forest Products Laboratory, Texas Forest Service, APT Bulletin Vol. XXI No. 1 1989.
3. "A Report on the 1767 Chowan County Courthouse for the Chowan County Board of Commissioners," Courthouse Study Commission, November 4, 1993.
4. Park, Sharon C., AIA, "Preservation Briefs 19: The Repair and Replacement of Historic Wooden Shingle Roofs," U.S. Department of the Interior, National Park Service, Preservation Assistance Division, Technical Preservation Services.

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