NITRATE VILLAGE NO. 1 HISTORIC DISTRICT

DESIGN REVIEW GUIDELINES

Historic Sheffield Commission

2025

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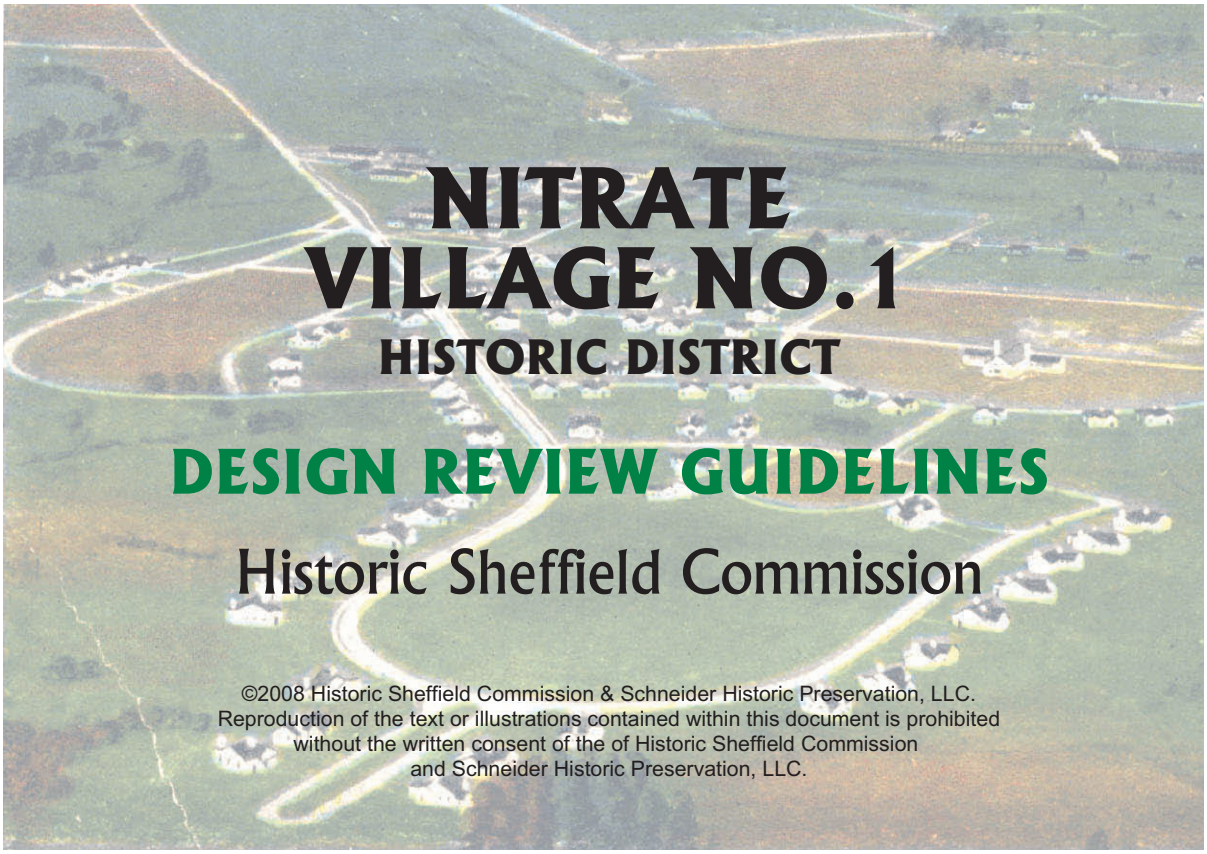

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SCHNEIDER
Historic Preservation, LLC
411 East 6th Street, Anniston AL 36207 • **Phone: (256) 310-6320**
Alt. Phone: 256-240-9912 • Fax: (334) 323-5631
e-mail: dbschneider@bellsouth.net

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Historic Sheffield Commission

Mayor
Steve Stanley

City Council
Gary Highfield (District 1)
Barbara Cook (District 2)
Fred Mason (District 3)
Casheta Rutland (District 4)
Randa Hovater (District 5)

Historic Sheffield Commission
Laura Aldridge
Jimmy Austin
Mollie Holland
Matthew DeOrazio
Constance Finch
Ethan Stokes
Lori Woolfolk
Michael Wright

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Historic Sheffield Commission
David B. Schneider

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NITRATE VILLAGE NO.1
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DESIGN REVIEW GUIDELINES

Historic Sheffield Commission

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NITRATE VILLAGE NO. 1
HISTORIC DISTRICT
DESIGN REVIEW MANUAL

Historic Sheffield Commission

THE DESIGN REVIEW PROCESS

Sheffield's historic resources make an important contribution to the city's character, economy and quality of life. In recognition of this, the City of Sheffield officially designates local historic districts and has established a design review process to help ensure the preservation of the character of these districts. The Nitrate Village No. 1 Historic District (hereinafter referred to as The Village Historic District) is among the districts the city has recognized for its unique and significant heritage. Within each historic district, all projects that result in exterior changes to buildings or their settings and for which a building permit is required must obtain a "certificate of appropriateness" from the Historic Sheffield Commission before a building permit can be issued. The Commission is a city board consisting of at least nine appointed volunteer members. As property owners and members of the community themselves, commission members recognize their responsibility to promote the commission's purposes through a cooperative and reasonable approach to working with applicants and the owners of the city's historic resources.

Every historic building has its own character and relates to its surrounding neighborhood in a different way. Because of this, historic district commissions typically use a set of "design review guidelines" to guide them in making reasonable and consistent decisions regarding how proposed changes will affect the overall historic character of a building and its neighborhood. This Guide describes the Historic Sheffield Commission's design review process and guidelines relating to Nitrate Village No. 1. These guidelines are based upon the Secretary of the Interior's Standards for Historic Rehabilitation, widely accepted standards developed by the National Park Service, as well as preservation principles and practices developed over more than seventy years of historic district designation in the United States. These guidelines are intended to help property owners in The Village Historic District apply the guidelines in a manner that provides ample flexibility to meet most economic circumstances and personal preferences while still ensuring the preservation of the historic character of the district.

WHY DESIGN REVIEW?

Real estate is often the most important investment people make. In addition to economic value, the properties which we choose for our residences or for our businesses have value as expressions of our individuality and the role we play in our community. Additional layers of intrinsic value are added to historic properties such as their ability to tell something about the history of the community and its people, their patriotic value, the value of their design and materials, and their relative rarity.

The protection afforded by local historic designation maintains the essential historic character of our neighborhoods. By establishing a reasonable set of design guidelines based upon national historic preservation standards, historic district designation protects the character of historic neighborhoods by helping to ensure that work completed on the exteriors of individual buildings is consistent with the historic character of the building and its surrounding neighborhood.

Property values in local historic districts with design review commissions tend to rise significantly faster than their surrounding general real estate markets. A study that compared properties in Montgomery, Decatur, Birmingham, Hunstville, Mobile, Talladega, and Selma found that “historic designation has a positive and substantial impact on the value of properties located in a historic neighborhood.”

While the maintenance of any piece of real estate carries with it a financial obligation for its owner, historic properties have their own characteristics that require a specialized understanding of the technology and materials utilized in their construction. With this understanding, the cost of maintaining a historic building is often comparable to that of a non-historic building. Historic buildings were typically well built by skilled craftsmen using excellent and durable materials. For this reason, the cost of maintaining historic buildings is often quite reasonable when care is taken to retain existing materials and features.

The Village Historic District’s character, identity and sense of place are largely defined by its rich historic architectural legacy. Investment in the preservation of the neighhborhood’s architecture and layout will ensure that this legacy is passed on to future generations.

PLANNING A PROJECT

Since the overall intent of these guidelines is to maintain the character of the historic district, it is essential that planning for all rehabilitation and maintenance work consider the impact of the work on the character of the building and its surrounding neighborhood.

Understanding Architectural Character

Each historic building has its own individual character and contributes to its historic district in a unique way. Understanding what defines a particular building's character is therefore a critical step in the design review process. Historic character is defined by a mix of factors, typically including architectural period and style, architectural integrity, how the building has changed over time, use of materials, condition of the materials, how the building is sited, and its overall setting. The Village Historic District has a unique architectural identity that is largely defined by the similar architectural style and details common to its buildings.

Architectural Period and Style. The buildings in the Village Historic District are basically of the Bungalow type, rooted in the Craftsman tradition, popular in the U.S. in the early 20th century. The materials used, including stucco exterior walls and red clay tile roofs, suggest a consistent stylistic theme borrowed from the Mission style.

Architectural Integrity. Architectural integrity refers to the degree to which a particular building reflects its historic character and retains its materials. Integrity is lost through alterations and the replacement of materials.

Architectural History. Buildings tend to change over time and some these changes can become significant to an understanding of the history of the building and the district. Being familiar with the history of a building can help answer questions about appropriate rehabilitation and maintenance strategies. It is also important to respect and maintain historic alterations.

Materials. Materials help to define the visual character of a building through the types of materials used, their placement on the building, and the craftsmanship that went into the construction. Materials provide the fabric and texture of a building and often help to relate the building to surrounding buildings. The condition of a building's materials can also help to define its character through the rich patina of age that historic materials often acquire. Much like an antique piece of furniture, historic buildings gain value through the retention of their authentic historic materials and architectural details.

Site and Setting. The relationship of a building to its site and its surrounding neighborhood is a significant dimension of its character. The setback of the building from its front and side property lines, the topography of the property and how the placement of the building responds to that topography, the surrounding landscaping, and how these features are similar or different from neighboring properties play a substantial role in defining the character of the property and the district.

For additional information about identifying what defines the historic character of a building in the The Village Historic District, please refer to Preservation Brief #17: Architectural Character: Identifying the Visual Aspects of Historic Buildings as an Aid to Preserving Their Character.

Understanding the character of a particular building, what defines that character, and how that character relates to the surrounding district is critical not only to the preservation of the individual historic resource, but also the preservation of the overall historic district. Alterations that destroy or alter the character of the building or its relationship to the district often have a serious impact on the overall integrity of the district, and hence its overall intrinsic value.

Contributing And Noncontributing. Within the district, buildings can be classified as follows:

> Contributing - Contributing buildings are those which contribute to the district's overall historic character and that were constructed during the district's period of significance. Contributing buildings also retain integrity. A building has integrity if it retains sufficient historic fabric and features that continue to reflect the overall character it had during its period of significance.
>
> Noncontributing - Noncontributing buildings are buildings that do not contribute to the district's overall historic character. Typically, these buildings were either constructed after the end of the district's period of significance or are earlier buildings that have lost integrity through alterations. Noncontributing properties can be either compatible with or intrusive to the character of the district in terms of scale, massing, materials and other architectural characteristics.

The goal of projects involving contributing buildings should be to maintain the primary character-defining elements of the building by retaining and repairing distinctive features and respecting historic alterations. The goal for a project involving noncontributing buildings should be to retain those features that are consistent with the historic character of the neighborhood and/or to replace incompatible features with compatible ones to the greatest practical degree.

ADDITIONAL INFORMATION

These guidelines reference other publications that may be useful in providing additional background information (please see Appendix C). The Historic Sheffield Commission maintains a library of these publications at the offices of the Sheffield Building Department. The Secretary of the Interior's Standards for Rehabilitation and Illustrated Guidelines for Rehabilitating Historic Buildings and the National Park Service's Preservation Briefs series are also available for review on the National Park Service's internet website and for purchase from the National Park Service.

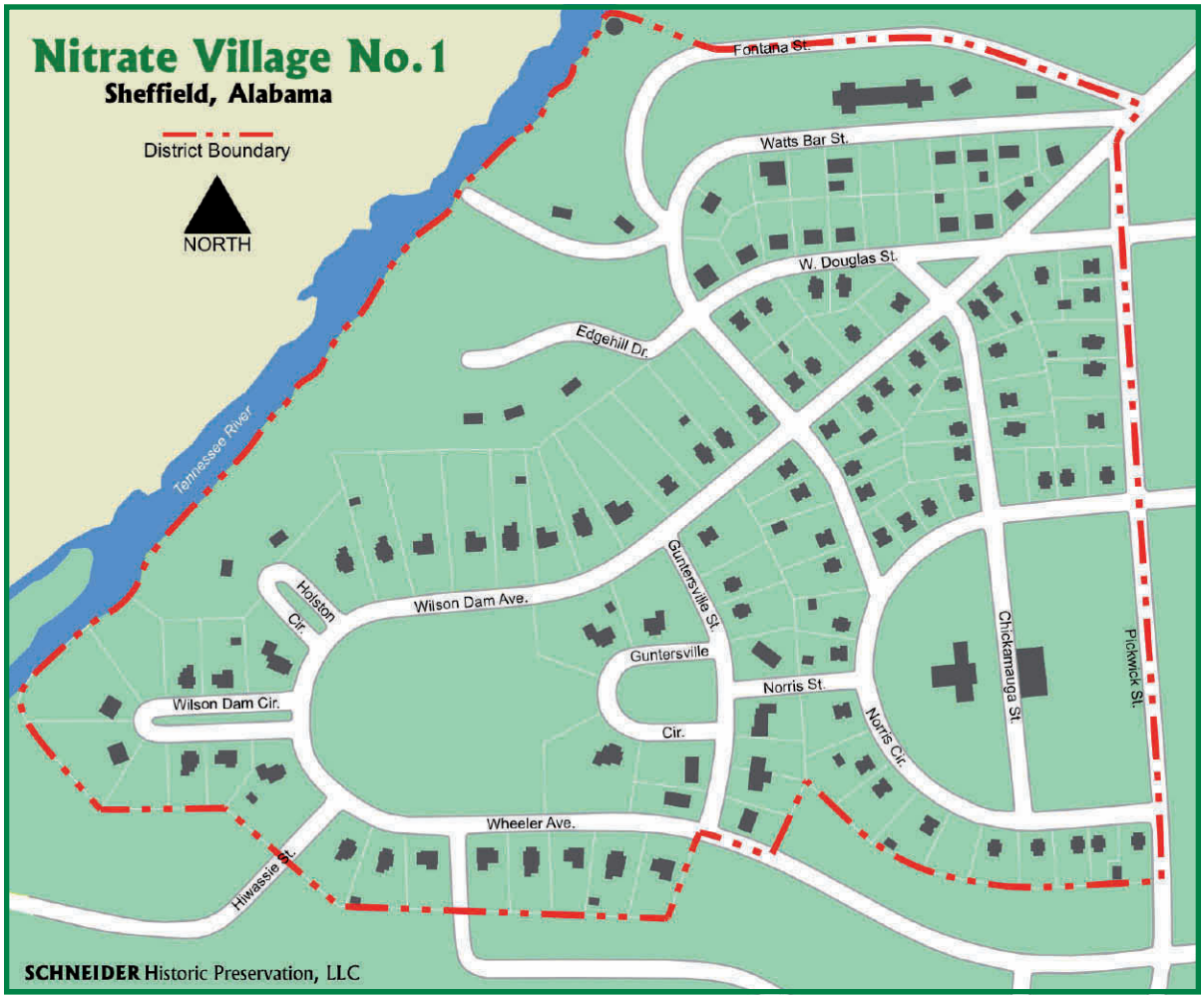
NITRATE VILLAGE #1

Adapted from the National Register Nomination for Nitrate Village, No. 1

A patriotic gesture embodying the progressive and utopian ideals of the era, Nitrate Village No. 1 (The Village) was designed and constructed in 1917-1918 as the United States was entering World War One.

Everything about The Village and surrounding Nitrate Plant No. 1 Reservation was revolutionary. It is of significant historical importance that the processes and events that have occurred in The Village have become commonplace today. Everything from the layout of the neighborhood, the mode of construction, the design of the homes, the inclusion of outdoor facilities in the form of the children's playground and tennis court, the treatment of utilities, the incorporation of common park areas, use of landscape architecture, and later the installation of The Progressive School was new, cutting-edge and at times controversial.

The impetus behind the construction of the original reservation and Village was Nitrate Plant No. 1, an experimental plant to develop the Haber process for fixation of atmospheric nitrogen. This had never been done before. The plant was intended to reduce the country's dependence on foreign sources of the ammonium nitrates needed for explosive production. President Woodrow Wilson selected Sheffield as the site for the nitrate plant provided for in the National Defense Act.



Preparations were then made to house the large number of civilian and military personnel to be brought in to oversee and guard construction and operations of the plant. Twenty-six bunk houses accommodating 768 men, a large mess hall, and 110 cottages were built – all of temporary type construction. A Village of 85 permanent homes, a school/community building and a barracks for bachelor-officers – all of stucco construction with clay tile roofs – were built to accommodate military officers and their families. These permanent structures and surrounding remainder of the original reservation, including the water pumping station, make up The Village historic district.

With a majority of the temporary structures of the reservation in place and the officers' homes almost complete, construction of Nitrate Plant No. 1 started on October 4, 1917. Construction of Wilson Dam began in 1918. The Dam was to provide power for Plant No. 1 in addition to Plant No. 2, which would be located in Muscle Shoals.

At the end of World War One as orginally planned, the plant was re-purposed for civilian use. Nitrate Plant #1 continued operation for a number of years in the production of nitrate fertilizer. In April and May 1919 prior to end of wartime development, finishing touches were made in The Village that included the grading of the streets, installation of storm drains and sewers, and construction of tennis courts across from the bachelor-officers' quarters.

Electricity was provided via underground cables from a nearby steam plant. This is one of the first recorded uses of buried utilities, a common practice today. Approximately 150 fluted, metal street lights were added. The lights were topped with an acorn-shaped, glass globe and illuminated the streets on both sides, accentuating the Liberty Bell design and lighting the path all the way to the Nitrate Plant No. 1 (it should be noted that the streets at this time did not have names, these were added with the advent of TVA).

The planners of The Village chose the distinctive Liberty Bell layout and a consistent design theme for The Village's various buildings. The layout is an example of the one of the earliest uses of the cul-de-sac, an element which has been predominant in the development of new home neighborhoods in the 20th century. The Liberty Bell layout was a patriotic gesture during a time of national war.

The overall community plan includes a street grid with streets ranging from forty to seventy feet in width and two large and several smaller public greens: one in the upper portion of the bell between Wilson Dam Avenue and Wheeler Avenue, and the other at the base bordered by Pickwick Street and Norris Circle and divided by Chickamauga Street. Houses are

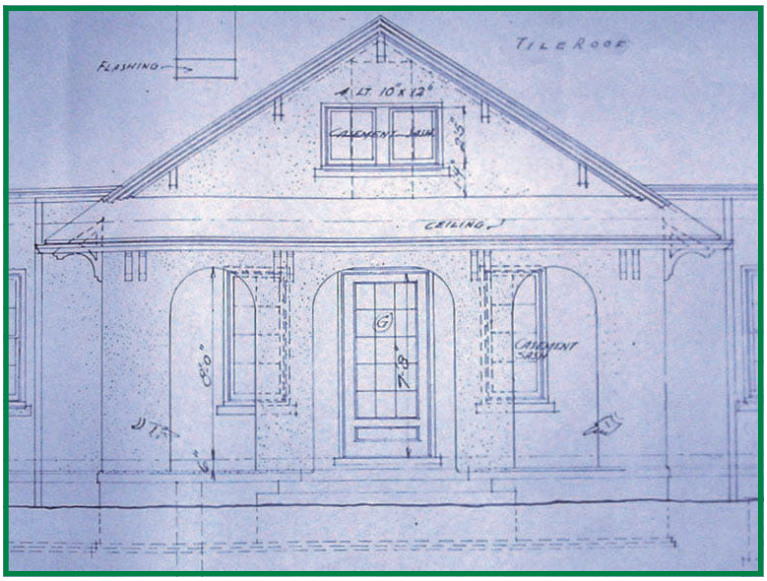
typically set back from the streets approximately twenty to thirty feet. Three-dimensional studies completed by the architects using 1/16-inch scale plaster models resulted in an overall design of harmonious visual character that achieves variety despite the standardization of the house plans.

All contributing houses and buildings within the district share several common elements. The houses are of the Bungalow type, rooted in the Craftsman tradition, popular in the United States in the early 20th century. The stucco exterior facade, red clay tile roofs, and arched entries suggest a consistent stylistic theme borrowed from the Mission style, and reflecting a Spanish/Mediterranean influence. The wood used throughout the buildings, including finishes, support beams and window structure is of the highest-quality heart-pine.

The architects achieved cosmetic variety, or an illusion of diversity by using slight variations in the treatment of facades and with slight shifts of roof planes and types, while the central interiors remained more constant. All contributing buildings within the district have brick foundations and stucco exterior, with the stucco applied to either metal lath mounted on wooden frames or to structural clay tile blocks. The use of red clay tile roofs was a major design element that was intended to visually tie the community together. Fortunately, with few exceptions, these roofs remain substantially intact.

The Village stands as one of the first large-scale implementations of a new idea about the building process – it utilized a system of standardization of building materials. The process was embraced and later popularized by Frank Lloyd Wright. The system that involved cutting the lumber and other materials in a mill or factory, then bringing them to the site for assembly, saved material and time. The system, while commonplace today, was revolutionary at the time of the construction of The Village. It is one of the first and earliest examples of its utilization.

Great savings in the cost of millwork was achieved by the use of standardized sizes and the ordering of material in large quantities. Two or three standard sizes for window sashes were used throughout the entire Village. All front doors used in the buildings were the same size. Hardware for the entire community, including public buildings, was uniform throughout. Light fixtures, ranges, plumbing and other materials were also uniform, though in some instances



by no means basic. For example, the plumbing fixtures in the school/community building were so ahead of the time that they are still considered state-of-the-art almost a century later. All of the bathrooms were outfitted with automatic-flushing Crane commodes, many of which remain and are in working order. All pieces of construction materials were fabricated elsewhere in the country and transported in by train. The pieces were labeled and numbered indicating to which structure they belonged.

The construction of the buildings was carried out on the same order that wartime merchant ships were fabricated. The architects prepared sets of nine by twelve inch sheets showing every detail needed in the construction of the houses. The drawings included standards for millwork, hardware, plumbing fixtures, heating, and the installation of fixtures and were supplied to contractors, subcontractors, millworkers, and other workers on the project. This same plan for detailing materials was adopted by the Bureau of Housing and Transportation for the Department of Labor and by the Housing Bureau of the Emergency Fleet Corporation.

From the time World War One ended in November of 1918 to 1933, a portion of The Village was occupied by personnel from the U.S. Ordinance Department and Alabama Power Company in connection with the U.S. Corps of Engineers while the Wilson Dam was under construction.

There was great national debate over what to do with the inactive nitrate facilities. There were several offers from private individuals, such as industrialist Henry Ford who in July 1921 offered the government $5,000,000 for the whole facility and planned to develop the area into a huge industrial complex. The bitter debate raged in Congress for over ten years and one political party included a supportive plank in its presidential platform during the elections of 1924, 1928, and 1932. Senator George Norris of Nebraska championed the cause for public use of the facility from 1919 to 1932. In May 1933 Norris was victorious in his efforts when President Franklin Roosevelt signed into law an act creating the Tennessee Valley Authority and authorizing the re-development of the facilities at Muscle Shoals as a fertilizer production and development center.

The Village came under TVA control in 1933 and provided housing for TVA personnel, including chemical engineers, lawyers, executives and skilled labor and their families. By the fall of 1933, TVA opened a school for the children of its employees in both the former bachelor-officers' quarters and the school/community building. The bachelor-officers' quarters were easily adapted for school use and housed one of the first schools of its kind, known as a progressive school. Before the progressive school movement, much of what we think of as everyday schooling did not exist. The progressive school movement was child-centered, and focused on the child as an individual in determining how best that child can learn, and by considering where that child's strengths lay. The movement embraced experiential learning – today's field trips and hands-on science experiments were unheard of before the progressive school movement. There was also an emphasis on curriculum revision. For example, the new social studies, which contained the old history and civics, added economics, sociology and anthropology. Progressives favored teaching a traditional subject in a completely different way, such as emphasizing creative writing, drama, and journalism in English courses.

These types of activities were innovative at the time, and often controversial. The TVA or Wilson Dam School was one of the first progressive schools in the world, and people came from all over to learn from its example. The school was open from 1933 to 1949. It was closed and the students incorporated into the city school system when The Village was deeded to the City of Sheffield in April 1949.

In October 1949, the homes in The Village were auctioned, with the right of first refusal going to the families currently living in them. Many of the residents, who continued to be TVA employees, purchased those homes.

Many long decades have past and some of the progressive elements of The Village have been lost, but most remain as a testament to the quality of the materials and design and the insightfulness of its planners. The things that have been lost, can thankfully be restored one day, including the underground utilities, which while inactive are still located where they were placed and once used. As today's neighborhood designers are "discovering" the use and benefits of common green spaces, park areas, landscape architecture, The Village's acres of dedicated green space endure as a reminder of the brilliance of the original design.

The special quality of the architecture and design of The Village is still breathtaking and awe-inspiring. Its contribution and role in the history of our country, state and area looms large; and, it stands to teach many lessons. One of no small significance is that beauty and aesthetics are worth the investment – they teach, they move, they are art, they are adaptable, they are appreciated and they last.

DEFINITIONS

The following terms are used throughout these guidelines. The words “appropriate” and “inappropriate” are used because they relate to the city’s ordinance which requires a “certificate of appropriateness” from the Historic Sheffield Commission before a building permit can be issued for exterior work in the locally designated historic district.

Adaptive Use. Adapting a building to a different use than that for which it was built or has historically been used.

Alteration. Any act or process that changes one or more of the exterior architectural features of a building, including but not limited to the erection, construction, reconstruction or removal of any building.

Appropriate. A proposed activity that is consistent with the guidelines.

Certificate of Appropriateness. A document evidencing approval by the Historic Sheffield Commission of an application to make a material change in the exterior appearance of a designated historic property or of a property located within a designated historic district.

Demolition.The removal of a building, or a portion of a building, either by direct action or by neglect.

Historic material (or object). Material (or object) from which the building was originally built or modifiied during the historic district’s period of significance.

Inappropriate. A proposed activity that is not consistent with the guidelines and may result in the Historic Commission withholding a Certificate of Appropriateness.

Neglect. The failure to maintain a building’s weathertight condition and/or the failure to prevent or correct deterioration of a building’s structure, materials or finishes.

Period of significance. The time period in which the building was first built and/or during which it has derived its historic significance, as stated in the historic district’s National Register nomination.

Preservation. To sustain the existing form, integrity, and material of a building or structure.

Primary Elevation/Vantage. An elevation or vantage of a building that faces either a front or side street or that is otherwise prominently visible from public vantages within the district.

Recommended. A proposed activity that is recommended but is not required.

Reconstruct. To re-create an historic building, or a portion thereof, or an architectural element that has been damaged, destroyed or allowed to deteriorate; to erect a new structure resembling the old using historical, archaeological, and architectural documents.

Rehabilitation. Returning a property to a state of utility through repair or alteration which makes possible an efficient contemporary use while preserving those portions or features of a property which are significant to its historical, architectural, and cultural values.

Repair. To maintain a building or portion of a building, in place, using the same materials.

Restoration. Accurately recovering the form and details of a building and its setting as it appeared at a particular period of time by means of the removal of later work or by the replacement of missing earlier work to match documented conditions.

Reversible. New construction work that can be removed in the future without damaging or requiring demolition of historic materials.

Secondary Elevation/Vantage. An elevation or vantage of a building that faces a rear or side yard or that is otherwise not prominently visible from public vantages of or within the district.

Stabilization. To reestablish a weather resistant enclosure and the structural stability of an unsafe or deteriorated property while maintaining its essential form as it exists at present.

SECRETARY OF THE INTERIOR'S STANDARDS

The Secretary of the Interior's Standards form the basis for the Village's Design Guidelines. The Standards were developed by the National Park Service and are generally accepted nationwide as standards for the rehabilitation of historic buildings. The basic purpose of the Standards is to maintain the primary character-defining elements of a building by: recommending that distinctive features be retained and repaired rather than replaced, historic alterations be respected, and, where new additions or other alterations are required, they be made in such a way as to be reversible in the future. The Standards generally do not require the restoration of missing elements; rather, they are designed to allow for changes that are needed to adapt a building to a new function.

Standard #1:	A property shall be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the building and its site and environment.
Standard #2:	The historic character of a property shall be retained and preserved. The removal of historic materials or alteration of features and spaces that characterize a property shall be avoided.
Standard #3:	Each property shall be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or architectural elements from other buildings, shall not be undertaken.
Standard #4	Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.
Standard #5	Distinctive features, finishes, and construction techniques or examples of craftsmanship that characterize a historic property shall be preserved.
Standard #6	Deteriorated historic features shall be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature shall match the old in design, color, texture, and other visual qualities and, where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.
Standard #7	Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible.
Standard #8	Significant archeological resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.
Standard #9	New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.
Standard #10	New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

For a more detailed description of the Standards and how to apply them, please see The Secretary of the Interior's Standards for Rehabilitation and Illustrated Guidelines for Rehabilitating Historic Buildings (Washington D.C.: U.S. Department of the Interior, 1992). Additional information can be found on the internet at the National Park Service website.

1. ROOFING

All contributing houses within The Village Historic District retain their original historic clay tile roofs with only two exceptions. These roofs are an essential character-defining element of the district and its individual buildings. Historic roofing should be retained and repaired whenever possible. Where historic roofing has been replaced over time with alternate materials, the restoration of the clay tile finish is recommended. Likewise, the use of similar clay tile is recommended for all new construction and additions.

a. *Form*. Historic roof forms should be retained at principal elevations. Where additions are considered at secondary elevations, the roof form should be similar to those of the building and should be constructed in such a manner as to not obscure the overall form of the historic roof.

b. *Historic Materials*. Historic roof materials including roofing and exposed flashing and valleys should be retained and repaired as needed. If it can be demonstrated that roof surfaces are deteriorated beyond the point of reasonable repair, replacement is appropriate. Utilizing replacement materials should match the existing historic roofing in design, materials, color, and workmanship.

c. *Repair of Clay Tile Roofing*. Clay tile roofing is an exceptionally durable material that will outlast alternate materials if properly maintained. In most cases, only individual tiles will deteriorate or become broken and these should be replaced in kind to match existing adjacent conditions in design, materials, color, and workmanship. Sometimes, roofs leak not because of a failure of the tiles themselves but because the underlayment, sheathing, fastening systems, or the flashing around chimneys or at roof valleys have deteriorated. In such cases it may be necessary to carefully remove the tiles from a portion (or all) of the roof so that repairs can be made to the underlying decking and flashing. The original tiles can then be reattached. Please refer to the Ludowici Tile Instructions (Appendix C) and Preservation Brief #30 (Appendix D).

d. *Replacement Roofing*. In the rare instance that the historic clay tile roof cannot reasonably be repaired or where alternate materials have previously been installed, appropriate new roofing will: a) approximate the historic roofing in size, profile, color and texture; b) be installed without removing, damaging, or obscuring character-defining architectural features or trim; c) retain the original pitch, form, shape, profile and dimension of the roof ; and d) retain other character-defining features of the roof (cornices, brackets, chimneys, etc.). Changes to the roof pitch or slope are not

Note how the material and form of this historic clay tile roof is an integral element of the design and character of this house. Both the roof's form and its material are significant features.

Note how the ridge caps, valley design and materials, and the chimney design contribute to the historic character of this roof.

Note the contributing gable dormer with its round arched louvered vent and the thin and simple cornice.

Trees should be pruned to prevent damage to historic roof tiles.

appropriate on roof faces that are visible from primary vantages. Flat roofs that are not visible from the street may be replaced with any new material.

e. *Gutters*. Historic gutters, leaders, and downspouts should be retained and maintained. New gutters and downspouts should be consistent with the architectural character of the building and should be fabricated using painted metal or exposed copper. The use of architectural gutters and rectangular downspouts is not recommended unless documentation exists of their historic use on the subject building.

f. *Chimneys*. Historic chimneys should be retained. Repairs should be accomplished to match adjacent historic conditions in design, materials and workmanship. All masonry repairs should match the historic color, texture and composition of the historic masonry and its pointing materials. The use of metal chimneys or chimneys clad with wood or materials of similar appearance is not appropriate. The addition of new chimneys to historic buildings are appropriate only at secondary elevations. Such chimneys should be constructed or faced with appropriate materials that are compatible with the historic character of the building. Decorative chimney caps are appropriate if they are compatible with the overall historic character of the house. Simple flat or nearly flat caps or top sealing dampers are appropriate if they are minimally visible and if any visible portions are finished to approximate the color of the adjacent chimney. The use of flat stone caps that do not project beyond the chimney faces are also appropriate.

g. *Other Roof Features*. Historic roof ornamentation should be retained and repaired as needed. Unless documentation exists that shows that they were present on visible portions of the historic roof, new roof vents and attic fans should be located on surfaces that are not visible from principal vantages and be as as unobtrusive as possible. Toilet and other vent stacks should be painted to match the color of the adjacent roof.

h. *Skylights*. Skylights on historic clay tile roofs are not appropriate. They may be appropriate in new construction if they are not readily visible from principal vantages. In such cases, the use of low-profile flat skylights is recommended.

i. *Antennas*. Modern communication antennas (including satellite dishes) are visually inconsistent with the historic character of the district and should be located and sized to be minimally visible from the street vantages.

For additional information, please see the following Preservation Briefs: 04: Roofing for Historic Buildings; 19: The Repair and Replacement of Historic Wooden Shingle Roofs; 29: The Repair, Replacement, and Maintenance of Historic Slate Roofs; and 30: The Preservation and Repair of Historic Clay Tile Roofs.

2. EXTERIOR MATERIALS

Exterior materials, typically stucco and wood in the historic buildings of The Village Historic District, are significant character-defining elements of the historic character of a building. Existing historic exterior materials should be repaired rather than replaced.

Masonry

a. *Retain and Repair*. Historic masonry should be retained and repaired as needed.

b. *Repair*. Masonry repair should match the historic work in material, color, texture, workmanship and character. Utilizing inappropriate mortar, those with a high Portland Cement content and most ready-mix mortars, can have both negative visual and physical consequences and are generally inappropriate for historic masonry. Such mortars are typically harder than the surrounding masonry materials and can result in considerable damage over time. Please refer to Preservation Brief #2: Repointing Mortar Joints in Historic Masonry Buildings prior to undertaking any repairs to historic masonry or stonework.

c. *Cleaning*. It is recommended that Preservation Brief #1: Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings be reviewed prior to undertaking any masonry cleaning. Historic masonry should only be cleaned when necessary to halt deterioration or to remove heavy soiling. Always begin with the gentlest cleaning method possible and begin by cleaning a test patch in an inconspicuous area. The test patch should be observed over a period of time to assess both the immediate and longer term effects of the cleaning. Often a simple garden hose and soft bristle (nonmetallic) brush is sufficient. Low-pressure water cleaning should be conducted within the range of 20 to 100 psi at a range of 3 to 12 inches. Steam cleaning and the use of non-ionic detergents can also be effective. Chemical cleaning may also be acceptable for the removal of stains or paint. However, caution should be taken to insure that chemical cleaning methods are appropriate for the particular masonry surface. Cleaners such as muriatic acid, caustic soda, or lye should never be used on historic brick surfaces.

Abrasive cleaning can damage the exterior surface appearance of historic masonry.

Abrasive (such as sandblasting) or high pressure cleaning methods should never be used on historic masonry surfaces.

Non-Masonry Exterior Building Materials

Wood was historically used for soffits and trim, window, and doors on buildings throughout The Village Historic District.

d. *Retain and Repair Original Materials*. It is appropriate and recommended that historic exterior nonmasonry materials be retained and repaired as needed wherever practical. All repairs should match the original work in design, material, texture and workmanship.

e. *Replacement Materials*. It is recommended that deteriorated historic materials be replaced in kind to match the existing historic design, materials, and workmanship. Applied synthetic sidings, such as vinyl or aluminum, can change the visual character of a building and can conceal underlying problems (such as moisture penetration, decay, and insect infestation). Likewise the replacement of traditional materials with composition board (wood fiber, cementious, etc.) or plywood type materials changes the visual character of a building. Therefore the application of synthetic sidings to historic buildings within the district is not appropriate.

3. WINDOWS

Windows are significant character-defining elements of historic buildings. The type, size and dividing lights of windows and their location and configuration (rhythm) on the building help establish the historic character of a building. Original window openings should be retained, as well as original window sashes.

Note the variety of windows on this house: double 4/4-light at left, triple 4/4-light at center, and single 6/6 at right. The size, pane configuration, and details of windows are a major character-defining feature of historic buildings.

Note specialty Palladian window arrangement with arched center 1/1-light sash flanked by louvers.

a. *Retain Existing*. Existing historic windows should be maintained and repaired with matching materials when needed. It is often more economical to retain deteriorated windows than to replace them, especially since new technologies such as the use of epoxy consolidants aid in repair.

b. *Replacement Windows*. The condition of existing windows should be evaluated on a window-by-window basis and replacement is only appropriate where the deterioration of historic window elements can be demonstrated to have exceeded the point of reasonable repair. New windows or window elements should match the historic windows in design and materials. Modern metal or vinyl-clad windows, different types of vertical or horizontal glazing arrangements and windows with snap-in muntins or muntins sandwiched within glazing are not appropriate on principal elevations but may be appropriate on secondary elevations of additions to historic buildings, additions to noncontributing buildings, and new construction. When using such windows it is recommended that they approximate the visual character of windows in adjacent historic buildings in terms of their glazing pattern and the width, profile and finish of their framing members. The addition of modern picture windows or other openings not in scale with the building should not be installed on principal elevations.

c. *Specialty Windows*. Historic specialty windows should be retained and repaired as needed to match documented historic conditions. Where such features do not presently

exist, their installation at principal elevations is not appropriate unless they are being installed to match documented historic conditions.

d. *Glass*. Where replacement window panes are required, the reuse of historic rolled ("wavy") glass from historic windows or appropriate reproduction antique glass is recommended. Insulating replacement glass shall match the color and/or transparency of the historic glass. Glass block, stained glass, leaded glass, colored glass, and other types of decorative glass or synthetic replacement are typically not appropriate on principal elevations but may be appropriate at secondary elevations.

e. *Screen/Storm WIndows*. Historic screen windows should be retained and repaired as needed. The use of interior storm windows is recommended, especially at principal elevations. Exterior storm windows are appropriate as long as they meet the following characteristics: 1) framing members are minimal in width and profile; 2) any horizontal bracing or other divisions line up visually with the meeting rails of the underlying window sash; and 3) the framing is finished to blend in or match the surrounding trim color. Storm windows should also allow for ventilation along their bottom edge to allow condensation to evaporate. Exterior screens should follow the same general guidelines for storm windows. Screen/storm windows should be installed without removing, damaging, or obscuring character-defining architectural features or trim and installed in such a manner as to be removable in the future without destroying architectural features.

Note how the dividing rails of these storm windows meet the dividing rails of the historic window. The minimal framing is finished to match the adjacent window trim. The result is a storm window that has minimal visual impact on the historic window.

f. *Awnings*. Awnings were not a historical element used in the design of The Village's houses and are not recommended. New awnings may be compatible if they are minimal in design, compatible with the style of the building, and constructed of canvas. All awnings should be installed so as not to damage the structure or significant historic features. Aluminum, vinyl, or other sythetic awnings are typically not appropriate.

g. *Exterior Shutters*. Exterior shutters were not a historical element used inthe design of the Village's houses are not appropriate.

Note: Department of Interior Preservation Brief #3 discusses energy conservation in historic windows and is available at the Sheffield Building Department or online at www.cr.nps.gov/hps/tps/briefs/presbhom.htm.

4. EXTERIOR DOORS

Often one of the most important decorative features of a house, doorways reflect the age and style of a building. Original doors and openings should be retained along with any mouldings or transoms. Replacements should respect the age and style of the building.

a. *Openings*. Historic openings should be retained. It is inappropriate to add, reduce, enlarge or infill openings on principal elevations. Whenever possible, repair rather than

replace door casings, moldings, and other trim or, if the original is missing, replicate their original configuration. Alterations at secondary elevations are not recommended but appropriate if not readily visible from principal street vantages.

b. *Doors*. Historic doors should be retained and repaired as needed. If replacement of an historic door on a primary elevation is necessary, it is recommended that a new door be installed to match the design of the original door. Appropriate replacement doors will have the same muntin configuration as the existing historic doors. Snap-in or applied muntins or muntins sandwiched between two layers of glass are inappropriate.

c. *Hardware*. The hardware on original Village doors is solid brass, which polishes easily, and with proper care, does not deteriorate over time. Repair rather than replace existing historic hardware. Where comditions warrant the installation of new hardware, the new hardware should be of simple design and compatible with the style and period of the building.

d. *Glazing*. Retain and repair existing glazing where practical. Appropriate replacement glass in doors may be insulating and should be clear. "Low-E" or other similar light-absorbing or reflective coatings on glass are appropriate provided there is no apparent change of glass color or reflective value from the appearance of the historic glass where visible from the street.

5. PORCHES

Porches are major character-defining elements of the Village's 1918 bungalow style houses. Especially when they are on the front elevation or prominent side elevations, porches are often prominent decorative and functional features and are therefore important to understanding the architectural development of the building and the district.

a. *General*. Historic porches should be retained and repaired as needed. The removal of historic porches and their architectural elements that are visible from principal vantages is not appropriate. If original porches have deteriorated or become badly damaged they may be repaired in the same configuration using appropriate new materials, retaining as much of the existing porch materials as possible. Porch floors shall be maintained using concrete of the same color, texture, and scored design as the original.

b. *Previously Enclosed Porches*. It is recommended that historic porches that have been enclosed in the past be restored to their original appearance unless the enclosure, by nature of its age, architectural elements, or other special circumstance, has achieved historic significance.

c. *New Porch Enclosures/Screening*. The enclosure of porches is not recommended because such enclosures typically alter the historic character of the house. Porch enclosures are appropriate if they are generally transparent in nature and installed so as to have minimal visual impact. Historic components should be preserved and the enclosure recessed behind them. Opaque enclosures of (brick, stucco, wood, etc.) are not appropriate.

d. *Removable Screens*. Removable, wood framed seasonal storm windows or screens are appropriate. The use of alternate framing material may be appropriate if it is minimally visible and finished to match the adjacent woodwork. More permanent triple-track storm windows and screens or jalousie windows are not recommended.

e. *Stairs and Railings*. Most porches within the district historically were built without railings. Where historic porch stairs and/or railings do remain, they should be retained and repaired as needed. Where porch stairs or railings are later additions or are missing altogether new elements should be utilized based on documentation of historic conditions.

f. *New Porches/Decks*. Porches should not be added to principal elevations on buildings which were constructed without porches at these locations. The addition of new porches or decks is appropriate on rear elevations which are not readily visible from major streets.

6. EXTERIOR PAINTING

Exterior painting is reviewed by the Commission and should follow the guidelines below.

a. *General*. Historic materials that have historically been painted should remain painted. Likewise, historic materials that have not been previously painted should remain unpainted.

b. *Surface Preparation*. All surfaces to be repainted should be carefully hand prepared for new finishes. The use of abrasive cleaning methods such as sandblasting or the use of power rotary sanders is not appropriate and causes severe permanent damage to historic materials. In addition, the use of water should be carefully considered and should be conducted within the range of 20 to 100 psi at a range of 3 to 12 inches. For wood surfaces, hand scraping and sanding, chemical strippers that do not damage the wood surface, or heat guns when care is used not to burn the wood surface are appropriate. For masonry surfaces, nonabrasive surface brushing, low pressure water washing, or chemical strippers or cleaners that do not damage the masonry surface are appropriate. For metal surfaces, hand scraping or low pressure water washing is appropriate.

c. *Color*. The Village houses and buildings were not originally white and were not originally painted. The original color, which is easily identified by using a mild pressure washing in an inconspicuous location, was attained by mixing pigments with the stucco. The predominately white exteriors appeared after T.V.A. acquired The Village utilized a lime-wash solution. Restoration of the original exterior finishes is appropriate where possible. Exterior paint schemes that are consistent with the original stucco colors or light, neutral tones, are also appropriate.

d. *Stucco/Masonry*. When repainting stucco or masonry, use “breathable” paints (such as latex or acrylic latex) which allow moisture and vapors to escape. Transparent or opaque stains are not recommended for surfaces that have been previously painted. Prior to repainting, remove only loose paint from surfaces that have been historically painted. Complete removal of all paint from a surface is typically not necessary prior to repainting. Priming will typically be necessary in order to insure that new paint will bind properly to the existing paint.

7. NEW CONSTRUCTION/ADDITIONS

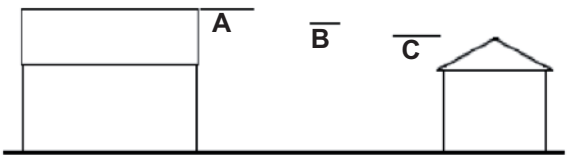
One of the major character-defining elements of The Village Historic District is the overall uniformity of character between its individual historic buildings. While individual buildings fall within twelve distinct general historic designs, they are visually unified by the use of clay tile roofs, stucco exterior finishes, and other common stylistic elements and features (similar windows and doors, the use of porches, etc.).

a. *General*. All new construction and additions must conform with setbacks, density and other requirements as set forth in the zoning ordinance of the City of Sheffield. Appropriate new construction and additions in The Village will be compatible with the size, scale, setbacks, massing, material, and character of the buildings which surround it. The zone of influence for new construction and additions typically includes the block on which the building is proposed to be built, the two adjacent blocks on the same side of the street, and the three opposing blocks on the other side of the same street – although a larger zone may be considered if warranted by the siting and location of the property.

b. *Compatible Scale*. The height, proportions, rhythm, setbacks, design, materials, window and entrance placement, roof form and materials, and porch configuration of new construction and additions in the district should be compatible with the historic buildings within the property's zone of influence.

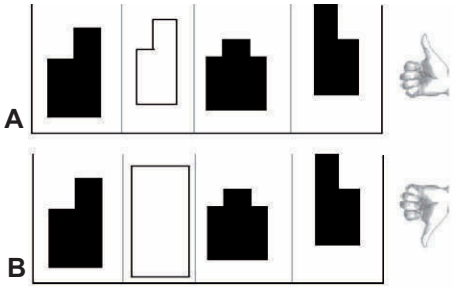
c. *Uniformity of Character*. It is generally not appropriate to replicate one of the twelve historic general designs for new construction except in the case of the reconstruction of a particular building or addition that has been demolished or otherwise destroyed. It is appropriate to design new buildings and additions that are compatible in character to the historic designs and that utilize the design elements that are common to the district.

New Construction: Height



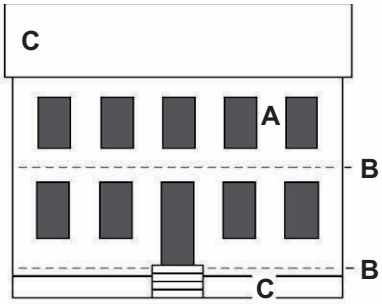
Height of new infill building (B) should b an average of the surrounding houses (A) and (C) and those within the property's zone of influence.

New Construction: Size



A: New building footprint (A) is consistent with remaining houses on the block and is appropriate.
B: New building footprint (B) is inconsistent with remaining houses on the block and is inappropriate.

New Construction: Scale



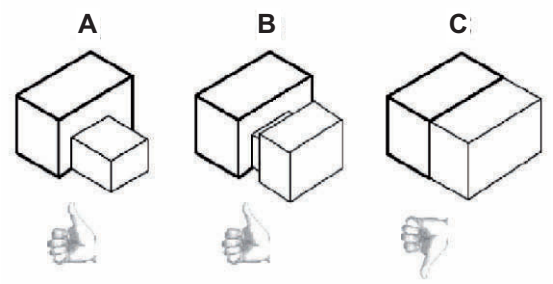
A: The overall ratio and relation of window and door openings within the facade should be consistent with surrounding buildings.
B: The floor to floor heights and elevation of the first floor should be consistent with surrounding buildings.
C: The proportion of the foundation and roof to the facade should be consistent with surrounding buildings.

d. *Additions Should Not Damage Exisiting Building*. It is not appropriate for additions to compromise or damage the historic building or to alter significant character-defining features that are readily visible from primary vantages.

e. *Location of Additions*. Whenever possible, an addition to a historic building should be constructed on a secondary elevation of the building that is not readily visible from the street. There must be a visual distinction between old and new.

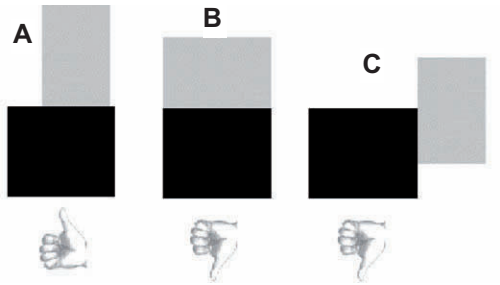
f. *Dormer Additions*. Roof dormers are not a traditional feature of the architectural character of The Village Historic District and therefore the addition of dormers to exising buildings or their use in additions is inappropriate. Dormers may be appropriate on new construction where they are not visible from any primary vantage but should not exceed one-half (1/2) of the adjacent roof area, should be compatible in form to the surrounding roof, and should be constructed in the same materials.

Additions: Scale



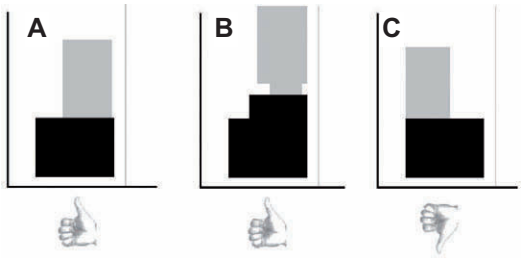
A: Additions that are clearly subordinate in size are appropriate.
B: Larger additions where mass is broken into smaller components are appropriate.
C: Additions that change the apparent mass of the historic building are not appropriate.

Additions: Size



All three additions are the same size. Note how different placements can affect the character of the existing house.

Additions: Corner Lots



A&B The addition is set back from the intersecting street thereby allowing it to recede visually from the existing building. These alternatives are appropriate.
C Placing the addition closer to the intersecting street causes an adverse visual impact and is not recommended unless site conditions make such a placement necessary and the addition is clearly smaller in scale than the existing building.

8. GARAGES AND OUTBUILDINGS

a. *Historic*. Many garages, outbuildings and other ancillary buildings were built during The Village's period of historical significance and contribute to the character of the district. These buildings should be preserved and maintained. Modifications to existing garages to accommodate modern vehicles are appropriate provided they do not alter the overall historic character of the building.

b. *New Construction*. New outbuildings should be simple in design to complement and blend with the principal building on the site. Outbuildings constructed within street vantages should generally meet the guidelines for new construction or additions.

c. *Garage Doors*. Where practical, historic garage doors visible from the street should be repaired rather than replaced. Where new or replacement garage doors are installed in historic garages, they should duplicate the existing size, shape, proportion, profile, hardware, details, design and operation, of the historic door and fit within the existing opening. For new garages, simple wood garage doors are appropriate.

9. SIGNAGE

Traditionally, the presence of signage within historically residential areas of the district was very limited. The introduction of signage within these areas therefore must be given careful consideration if it is to be compatible with the overall historic character of the district. Please note that the City of Sheffield has a separate sign ordinance which must be observed in addition to the requirements of this section. The sign ordinance provides additional information and details about the types, sizes, and location of signs that are permitted within the city. This section is intended to provide additional guidance relating to the impact of signage within the historic district.

a. *General*. Historic signs shall be retained. Signage that is based on documented historic conditions is appropriate. Other appropriate new signs will be compatible with the style of the building and the District. An approved sign should be affixed in such a manner so as not to damage, destroy, cover, or obscure any significant historic fabric or details either during installation or any subsequent removal.

b. *Park Area*. Only street signs and markers placed by the City of Sheffield are appropriate in any common park area within the Village.

c. *Size*. The scale and proportions of the sign should be related to the scale and proportions of the building on which it is mounted. Signs should not obscure or visually compete with the building's architectural elements.

d. *Materials*. Sign materials should be compatible with the building's materials. The use of interior-grade wood, unfaced plywood, plastic substrates, unfinished wood and other non-traditional materials is inappropriate.

e. *Temporary Signs*. Where not otherwise regulated by the City of Sheffield's sign ordinance, temporary signs placed by Realtors and contractors should not remain in place more than ten (10) days after the closing of a sale or completion of contract job. Election signs and any other temporary signage are subject to the City of Sheffield's sign ordinance.

f. *House Numbers*. Appropriate house numbers will be those that are consistent with the scale and design of the building and typically should not exceed six inches in height.

g. *Plaques/Historical Markers*. New plaques denoting homeowner, date built, or other honorary historic plaques or markers are appropriate but should be consistent with the scale and design of the building and/or the surrounding neighborhood.

10. EXTERIOR LIGHTING

a. *General*. Historic exterior lighting should be retained and repaired as needed wherever practical. Appropriate new light fixtures for lighting entrances or yards should be compatible with the historic style of the building or The Village. Care should be taken to avoid damaging, covering or obscuring any character-defining architectural features. Lights that can be concealed in the porch ceiling or beneath eaves are appropriate.

b. *High Intensity Lights*. High intensity discharge type light fixtures (such as mercury vapor, high or low pressure sodium, or metal halide) are not appropriate in locations where glare would be visible from the street.

c. *Walkway Lighting*. For walkways, small footlights are recommended and larger large freestanding lights are not recommended.

11. SITE FEATURES

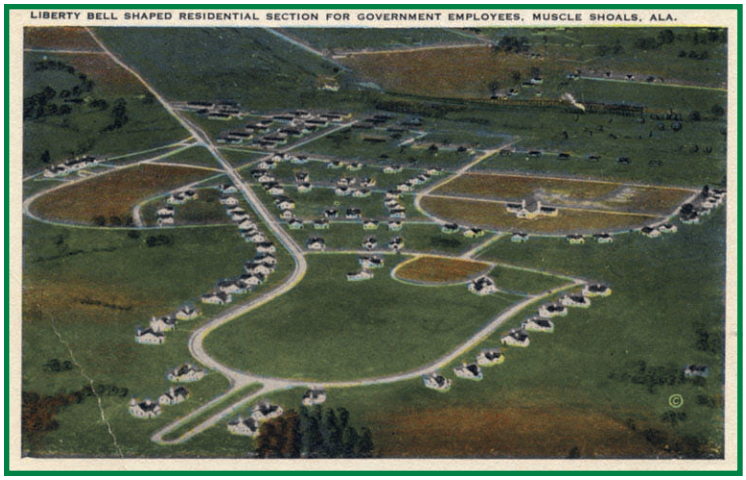
The setting of a historic building is typically one of its major character-defining features. Setting involves the siting of the building on its property, how that siting relates to other surrounding buildings within the neighborhood, and the nature of paving and landscaping. The Village Historic District was a planned community where careful consideration was given to the siting and arrangement of buildings and open spaces around the district's distinctive Liberty Bell street layout. This overall landscape design and its component elements is a major character-defining aspect of the historical significance of the district. Appurtenant elements, such as historic street lighting, contribute to this overall character and should be maintained.

The construction of permanent structures on the historic common, green, park areas or open spaces of The Village is inappropriate, as are changes in the alignment of roadways and the general placement of buildings. Trees or planting are only appropriate along the perimeter of park area, and historical layouts of the landscape architecture should be consulted in regard to type and historic placement.

Landscaping

The relationship between a building and the landscape that surrounds it is an important character-defining feature of both the building and the overall historic district. Landscape features and appurtenant buildings and structures can impact the character of the site and its surrounding neighborhood and are therefore considered in the design review process. The intent of these guidelines is to provide basic guidance for features of the site to help insure that they are in keeping with the overall historic character of the district.

While few documented historic landscapes remain within the district, certain elements of traditional landscape design do remain. The width of front and side yards and the presence of certain types of plant materials are examples of these elements.



The Village's overall Liberty Bell plan including the layout of its streets and the siting of its buildings and open spaces is one of its major character-defining elements.

a. *General*. Landscaping should complement a building rather than overwhelm it. Buildings should not be completely hidden from sight by trees and bushes. Plantings should typically be some distance from the base of a building to prevent holding excessive moisture against it. Likewise, climbing plants and vines can cause damage to the surfaces of historic buildings.

b. *Parking*. Parking areas should be located at secondary elevations wherever possible. Parking lots and driveways should be screened by fencing or shrubbery to separate them from the streets and adjacent properties. The traditional historic relationship between the street, the sidewalk and the façade or entrance of the building should be retained. Installing pavement or drives that are not consistent with this relationship is typically inappropriate.

c. *Driveways*. It is typically inappropriate to widen existing driveways. Paving with chert or crushed limestone is recommended although the Commission may approve alternate materials.

d. *Walkways*. Poured concrete walkways were an element of the historic plan of the Village and the continued repair and reuse of concrete for walkways is appropriate. The use of brick paving for walkways is also appropriate as is the use of fine gravel or stone pavers. Modern applied finishes to concrete are generally not recommended. [Note: The replacement of walkways within city rights of way requires the approval of the city's public works department.]

e. *Grading*. Historic grading should be maintained where its is visible from public vantages.

f. *Trees*. The removal of existing trees with a base circumference of 20 inches or more is not recommended unless the tree is diseased, has been extensively damaged, or is dead. Where such trees are removed it is recommended that new trees of a similar species be planted. It is recommended that trees be kept pruned back away from roof and eaves. Specifically, the cedar trees located along some of the city easements are original to the neighborhood and should be preserved.

g. *Plants*. It is recommended that plant materials be native to this region of Alabama and the use of species of plants that have been traditionally used, such as heirloom varieties,

in the community is encouraged. Typically plantings between primary elevations and the property line should be scaled so that they do not block the view of the building.

Fencing

Fencing was not a historic feature of the Village. Fencing along principal street vantages should be appropriate to the architectural character of the district's buildings and typically be low in height, open in character with thin framing and railings so as to not block views of the building from the street, and be constructed of wood or ornamental metal. Non-traditional fencing within the district, including wood privacy fences, chain link, wire, etc., should typically be limited to rear yards and secondary street vantages.

a. *Existing Fencing.* Existing fencing may be retained and repaired as needed. If the existing fencing is to be replaced, it should meet all requirements of this section.

b. *New Fencing*. Where new fences are desired along principal street vantages, they should be compatible with the principal building on the site and the surrounding neighborhood in both design and materials. Wood and metal fencing typically shall be painted or solid stained, unless constructed of cedar or redwood.

c. *Height*. Fences at principal street vantages should be low in height (typically no higher than 36-42"; please refer also to the City of Sheffield's Fencing ordinance for additional requirements). Fences on readily visible secondary vantages should be no higher than six feet. Please note that fencing must also comply with any other applicable city building or zoning codes.

d. *Other Fences*. The use of chain-link, wire, wood plank, vinyl, solid brick or open weave fences is typically not appropriate at principal street vantages. Where such fences are used in rear or side yards at secondary vantages the posts and rails shall face the interior of the property and such fencing shall be painted or solid stained. Please note that the City of Sheffield has a fencing ordinance and that a separate permit may be required.

Site Elements

a. *Ornaments*. Garden ornamentation such as statuary, birdbaths, and other freestanding elements are appropriat if they are compatible with the overall historic character of the property and the district.

b. *Yard or Garden Structures*. It is recommended that yard or garden structures such as gazebos be located away from principal street vantages unless they are replacing features documented to have historically existed on the property. Other structures such as trellises, retaining walls, flagpoles, etc. should be consistent with the design and scale of the building and be located so as to not obscure views of the building from principal vantages.

c. *Excavation*. Excavation for basement light and ventilation is appropriate in areas not visible from the street, and where the integrity of the original structure is not compromised.

d. *Street Lights*. Historically accurate street lamps located with respect to the original and historic placement of street lamps in the Village are appropriate.

e. *Other*. Streetscape elements (including benches, planters, light fixtures, street signs, etc.) of a historic scale and size within the historic context of the site and district, (i.e., part of an original design that is at least 50 years old, or would be considered historically accurate for the time-period of the site or district) are appropriate.

f. *HVAC Units*. All heating and cooling mechanical units, including window air conditioning units, ground and roof condensers, and exterior conduits and ductwork should typically be placed away from principal elevations. Where mechanical units must be located in areas that are visible from the street, they should be screened with landscaping, framed lattice panels, brick opened weave walls or other appropriate screening.

g. *Satellite Dishes/Solar Units/Other Antennas*. Satellite dishes, solar energy collectors or other antennas and/or their towers are appropriate so long as they are not readily visible from the principal vantages. Typically, such structures should be located so as to be screened by the building or in an inconspicuous location removed from the street. Screening can be used to mitigate visual impact but should be and appropriate to the character of the building and/or its landscape setting.

Disability Access

Where provisions for disability access are necessary, they should be compaitible with the historic design of the building, taking care to make the feature as unobtrusive as possible. Reversible and readily removable accessibility provisions, such as ramps or chair lifts, are recommended to prevent permanent alteration to the historic fabric of the building.

12. DEMOLITION

a. *Demolition Not Appropriate for Contributing Buildings*. The demolition of contributing buildings is not appropriate. The Commission may only grant a certificate of appropriateness for the demolition of a contributing building where it finds that: the public safety is endangered, the building is no longer contributing to the district, and/or where demolition is necessary to otherwise enhance the historic district.

b. *Demolition May be Appropriate for Noncontributing Buildings*. Demolition is appropriate if a building is noncontributing or has lost its architectural significance or integrity and if its demolition would have a positive effect on the overall appearance and character of a district.

c. *Outbuildings Considered to be Contributing*. Outbuildings (such as garages, sheds, etc.) and permanent landscaping features (such as retaining walls, fences, gazebos, etc.) are considered to be contributing unless the Commission makes a determination that they are noncontributing or the Commission determines that their removal would otherwise not be detrimental to the historic character of the district.

d. *Replacement*. In reviewing the appropriateness of any demolition request, the Commission may consider the proposed reuse of the property to determine if the demolition will have a positive effect on the overall appearance and character of a district. Accordingly, the Commission may withhold a certificate of appropriateness for a demolition request until such time as a certificate of appropriateness has been approved for any proposed new construction on the site.

e. *Presumption of Contributing Status*. There shall be a presumption that a building is contributing to the historic district. The Commission may determine that a particular building does not contribute to the historic district if the Commission determines that it has lost its historical or architectural integrity or is otherwise inconsistent with the historic character of the district. For guidance, the Commission will use appropriate publications by the National Park Service regarding the National Register of Historic Places.

13. RELOCATION

a. *Relocation*. Because the significance of a historic building is related to its physical location and setting, the relocation of buildings within the district is generally not appropriate. Relocation may be appropriate if the Commission determines that it is the most reasonable alternative to the building's demolition or if the building has previously been moved within the past fifty years. Relocated buildings must generally comply with all other requirements of these guidelines. In its new location, the building should be compatible with the design, materials, height, massing, proportions, orientation, and siting of the buildings surrounding it. The building's new setting should be, to the greatest degree practical, similar to that of its historic setting.

   For additional information, please see the following: National Register Bulletin 15: How to Apply Criteria Considerations, see Criteria Consideration B: Moved Properties.

14. MOTHBALLING/STABILIZATION

If a building becomes vacant or is abandoned, it is recommended that it be secured in order to prevent demolition by neglect.

a. *Security*. Secure the building against vandalism, break-ins, and natural disasters. Apply temporary coverings to window and door openings in such a manner so as to not damage historic features or materials.

b. *Stabilize*. Structurally stabilize the building as needed and provide and maintain a weather-tight roof. Temporary roofing may be installed if needed. Discontinue all utilities and remove flammable materials and debris from the building.

c. *Ventilation*. Provide adequate ventilation to the interior of the building through the use of vents in the window and door coverings.

d. *Pest Control*. The building should be treated to prevent termite infestation and wood-decaying fungus.

e. *Monitor*. Periodically monitor the building to insure the effectiveness of the mothballing program.

   For additional information, please see Preservation Brief: #31: Mothballing Historic Buildings.

Appendix A

Historic Sheffield Commission

Checklist for COA Review

Please use the following Checklist to ensure a that you have provided the Commission with a complete complete application. The information submitted should clearly and completely illustrate the work that is being proposed, how it affects the subject building, and how it will be visually compatible with the neighborhood. In order to insure that your project gets and expediant and fair review, the Commission cannot review incomplete applications.

- *Please circle the Category or Categories (A-F) Below Which Best Represent Your Request*

- *Provide and check that you have submitted the appropriate materials listed under that or those category or categories.*

_____ **A. FOR NEW CONSTRUCTION, ADDITIONS, OR FOR EXTENSIVE RENOVATION OR REPAIR TO EXISTING STRUCTURES**

_____ 1. Two sets of scaled and dimensioned drawings which shall include:

_____ a. *Siteplan:* A site plan illustrating the property's boundaries, all existing buildings, significant landscaping, paving and sidewalks, and all proposed changes. For new construction and additions, the siteplan should also indicate required setbacks.

_____ b. *Floorplans:* For existing buildings and additions: a floor plan showing all areas of the building to be altered or affected by the proposed work and the size layout of any proposed additions; for new construction: a detailed floorplan.

_____ c. *Elevations:* Elevation drawings: For existing buildings, elevation drawings of all affected exterior elevations; for new construction: drawings of each exterior elevation.

_____ d. *Details:* Detailed drawings or photographs of any decorative architectural details (i.e. columns, balustrades, modillions, etc.).

_____ 2. Notes describing materials to be used on the exterior (i.e. walls, roof, trim, cornice, windows, etc.). Note that the Commission may also request sample materials.

_____ 3. All paint information requested in Category D.

_____ 4. Photographs of the subject property and surrounding buildings are required. The photos should clearly show the building, all areas to be affected by the work, and how the building visually relates to the surrounding neighborhood.

_____ a. Photos of the subject property.

_____ b. Photos of the surrounding neighborhood and buildings.

_____ **B. FOR ROOFING PROJECTS**

_____ 1. Photographs showing the existing roof and details of its condition,and all areas to be repaired or re-roofed.

_____ 2. Itemized cost estimate of repair work, prepared by the proposed roofing contractor.

_____ 3. Samples of existing and proposed roofing materials (underlayment, mastic, decking, fasteners, flashing, roofing material).

_____ 4. For clay tile roofs only: Name and address of proposed roofing contractor, with references of other roofing work involving tile roofs.

_____ **C. FOR MINOR RENOVATION OR REPAIR TO EXISTING BUILDINGS**

Minor projects include ordinary maintenance which stabilizes deteriorated or damaged architectural features and does not the change design, material, color or outward appearance of the building.

_____ 1. Photographs showing the overall exterior of the building and details of all areas to be affected by the propoed work.the building to be renovated with details of the areas of work.

_____ **D. EXTERIOR PAINTING**

_____ 1. Color sample for the main body color

_____ 2. Color sample for the trim or decorative features

_____ 3. Color sample for the accent areas, such as lattice shutters, porch deck, etc.

_____ **E. FENCES, DRIVES AND GATES**

_____ 1. A drawing or photograph of the type of fence, wall or gate with the height and scale noted.

_____ 2. A site plan illustrating the property's boundaries, all existing buildings, significant landscaping, paving and sidewalks, and the location of the proposed fencing.

_____ 3. A description of the materials to be used.

_____ 4. Paint samples, if the fence, wall, or gate is to be painted.

_____ **F. DEMOLITION**

For demolition of existing structures, either historic or non-historic, submit a City of Sheffield Demolition Application.

_____ **G. SIGNAGE**

For Signage Requests, submit a City of Sheffield Sign Application.

IMPORTANT NOTICE: INCOMPLETE APPLICATIONS WILL NOT BE PLACED ON THE AGENDA.

Historic Sheffield Commission

Application for Proposed Work

City Ordinance requires that all applications for proposed work in historic districts include the following information:

Date of application: _____ Date received: _____

Address of property: _____

Name of owner: _____

Owner's address: _____

Name of applicant: _____

Applicant is: Owner? _____ Owner representative?_____ (If applicant is an owner representative, this Application must be accompanied by a notarized document from the owner designating the Applicant as the owner's representative).

Applicant's address: _____

Applicant's telephone number: _____

Refer to the Checklist on the back of this application for requirements for specific work items to be performed. Refer to the Review Board Guidelines for assistance with appropriate treatment for structures and property in The Village Historic District. Staff is available to assist with application preparation. For large projects, such as new construction or substantial additions or renovations, consultation with staff is strongly encouraged. NOTE: Incomplete applications will not be placed on the Commission's review agenda.

Describe the proposed work:

Does the proposed work involve demolition?

Does the proposed work involve signage? __ No ___ Yes If Yes, attach completed sign application.

Refer to the Checklist for information to be submitted based on project with the Application. Incomplete applications will not be placed on the agenda.

A sign will be placed in the front yard of the property prior to the Review Board meeting to notify surrounding property owners of a pending application. Attendance at the meeting is strongly advised in order for the applicant to respond to any questions.

The Historic Sheffield Commission meets in regular session on the 1st Thursday of each month at 6:00 pm, to consider applications for Certificates of Appropriateness. An application form for a Certificate of Appropriateness can be obtained from the Sheffield Building Department, located in the municipal building, and must be filed with the Building Department at least 14 calendar days prior to the next regular session meeting of the Commission.

An application for a Certificate of Appropriateness is not considered complete until all illustrative material necessary to adequately describe the proposed project has been submitted to the members of the Commission. The Historic Sheffield Commission may refuse to consider an application for a Certificate of Appropriateness if it judges that insufficient information has been provided by the applicant.

Appendix B

Historic Sheffield Commission

Reference List

Internet Resources

http://www.nps.gov/history/hps/tps/standards_guidelines.htm: The Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings published by the Department of the Interior National Park Service, revised 1995. (Note: Although there is a 2004 edition, the Secretary of the Interior has reverted to the 1995 edition. The Secretary of the Interior's Guidelines are presently under revision.)

www.cr.nps.gov/hps/tps/briefs/presbhom.htm: The National Park Service's "Preservation Briefs" covers a wide range of topics such as masonry, mortar, conserving energy in historic buildings, repairing plaster and cleaning and caring for historic buildings.

www.Preservationbooks.org: A source for many helpful books and publications including, Old House Dictionary, Lighting for Historic Buildings, Repairing Old and Historic Windows, Floor Coverings for Historic Buildings, Fabrics for Historic Buildings, Paint in America, etc.

www.traditional-building.com: Includes an online directory of product suppliers, a product database, online articles and product reports from current and previous issues of the magazine.

http://www.oldhousejournal.com: For more than 25 years, Old House Journal has provided practical, step-by-step articles for people interested in the renovation, restoration and preservation of old homes.

Published Resources

The Visual Handbook of Building and Remodeling – Professional Edition, Charlie Wing, Published by Rodale Press, Inc., 1998 A complete guide to building materials and specifications. Covers every major aspect of construction.

A Field Guide to American Houses, Virginia and Lee McAlester.

American Bungalow (magazine)

Bungalow Details: Exterior, Jane Powell and Linda Svendsen (pp. 44-47).

Bungalow Colors Exteriors, Robert Schweitzer

Illustrated Dictionary of Architectural Preservation, Ernest Burden

Window Repair

For additional guidance regarding window preservation and repair see: U.S. Department of Interior Preservation Briefs #9 or #13 and Practical Preservation Report "Save Your Wood Windows" by John Leeke. Copies of these documents are available at the Sheffield Building Department.

Clay Tile Roofs

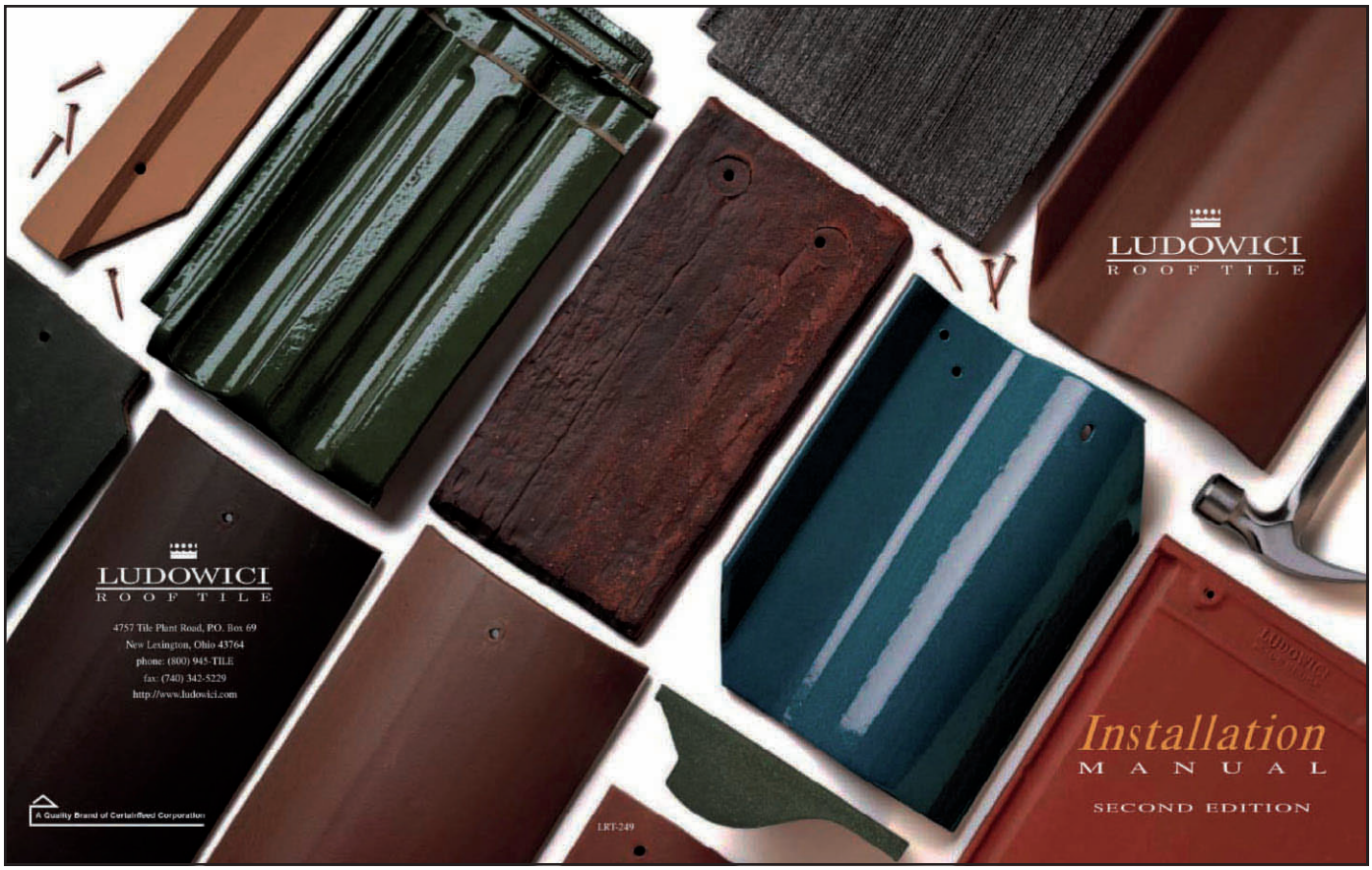
For roofs in The Village, Ludowici tiles are recommended for damaged tiles that need to be replaced. Contact information for contractors and material suppliers is on file with the Historic Sheffield Commission, and is available at the Sheffield Building Department. Included as an appendix to the Design Guidelines for Nitrate Village No. 1 (The Village) Local Preservation District, is a copy of application, care and how-tos for the French-style and Spanish-style Ludowici tiles, both of which are found on Village structures.]

Appendix C
Historic Sheffield Commission

Ludowici Tile Instructions

Excerpts

General Instruction Maunal



CLAY TILE ROOFING

has been in existence for centuries. In the last few decades, clay tile roof installation techniques have been refined to protect your home while retaining the aesthetic, "of-the-earth" characteristics that make up the roof's appeal.

"of-the-earth"

The purpose of this manual is to provide technical information and installation instructions for Ludowici clay tiles. It is intended to serve as a guide for proper techniques for typical installations. Ludowici clay tile is a versatile roofing material and can be applied on complex, original design roofs. Installers are encouraged to contact Ludowici representatives for any question not covered in this manual. Some techniques may vary from region to region and other sound installation techniques may also be acceptable.

CONTENTS

Ludowici Roofing Tile

1 Composition, Materials, and Special Characteristics

Ludowici tile is manufactured from select Southeastern Ohio shale and fire clays. After mixing, the clay is extruded and pressed into shape. Glazing is applied and then the tile is kiln fired. The tile is incombustible with an extremely low moisture absorption rate, averaging 1%. All Ludowici clay roof tiles have a high breaking strength and meet or exceed the Grade 1 requirements of ASTM C 1167-96. Tiles are available in unglazed or a multitude of clay red, fire-flashed, designer or custom-glazed colors.

2 Types of Clay Tile

Flat Shingle Tile (non-interlocking flat or shingle) is designed to be laid in a double thickness, similar to wood shakes and slate. Ludowici produces several styles of flat tile, including *Calais™, Georgian™, Norman™, Provincial™, Antique™, Brittany™, Colonial™, Crude™, and Flat Slab shingles.*

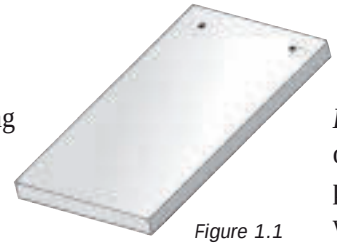


Figure 1.1
Flat Slab Tile

Interlocking Tile is laid in a single thickness with only a 3″ course-to-course overlap. The sides are interlocked with channels or ribs. The heads (top of tile) and butts (bottom of tile) may also interlock. Ludowici produces several styles of interlocking tile, including *Americana™, Americana XL, Classic™, Classic XL, Celadon™, Lanai™, Lanai XL, Williamsburg, Williamsburg XL, and Imperial.*

Figure 1.2
Interlocking Flat Tile

Interlocking Profile Tile. Like flat interlocking tile, this tile is laid in a single thickness with course-to-course overlap and side interlocks. The reinforcing ribs add strength and reduce the weight of this tile. Ludowici produces *French Tile* in this type.

Figure 1.3
Interlocking Profile Tile

Pan and Cover Tile (also called barrel or mission) is installed in pairs of pieces, either straight or tapered, with one laid concave and the other convex. Pan and cover tiles come in a variety of styles, with overlapping features for a tight fit. Ludowici produces several styles of pan and cover tiles, including *Greek, Italian, Roman, Palm Beach, Straight Barrel Mission, and Tapered Mission Tile.*

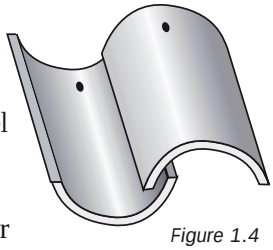


Figure 1.4
Pan and Cover Tile

One-Piece Spanish Tile (S-Tile) is laid in a single thickness with a course-to-course overlap. Ludowici produces several styles of S-tile. Most popular are the 13 1/4″ and 18 3/8″ *Spanish Tile.*

Figure 1.5
S-Tile

Tower Tile™. Ludowici produces the unique, tapered tile, installed like pan and cover tile, designed for tower (radial) applications.

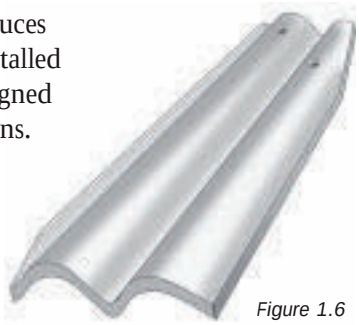


Figure 1.6
Tower Tile

3 Standard Fittings

Note: Not all fittings are shown.

The following fittings are examples of those usually required for the perimeter of the roof.

- An Eave Closure or Under Eave Fitting at the eave
- End Bands, Gable Rakes and Top Fixtures
- Flat Shingle — Short Top, Long Top and Header Course
- Ridge, Closed-Ridge End, Ridge/Hip Terminal at the ridge
- Ridge/Hip Terminal, Hip Roll, Hip Starter

Figure 1.7 Eave Closure (Straight Barrel Mission Tile)

Figure 1.8 Under Eave Fitting (Interlocking)

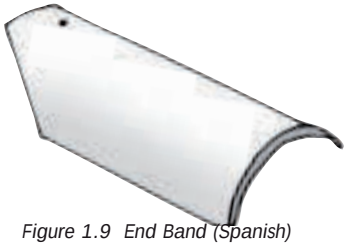


Figure 1.9 End Band (Spanish)

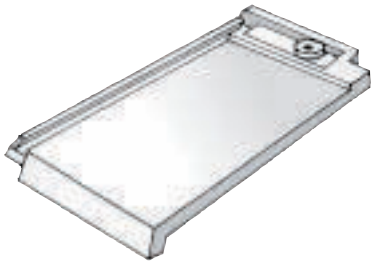


Figure 1.10 End Band (Interlocking)

Figure 1.11 Right Gable Rake (Interlocking)

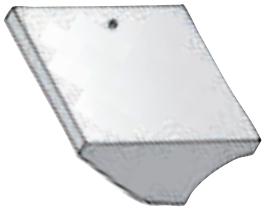


Figure 1.12 Top Fixture (Spanish)

Figure 1.13 V-Hip and Ridge

Figure 1.14 206 Ridge

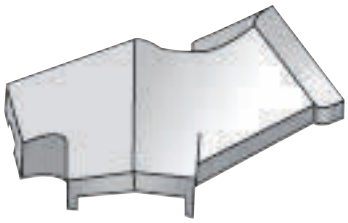


Figure 1.15
118 & 211 Hip & Ridge Terminal

Figure 1.16 102 Hip Roll

Figure 1.17 CC Hip Starter (Used with Circular Cover)

In addition to the standard fittings, Ludowici produces a variety of ornamental and functional fittings. Some of these are:

- Eave Fittings – closed eave, beveled eave
- Gable Fittings – flared gable tile and deep flange gable rake
- Ridge Fittings – ventilating ridge, ridge cut-off, deck mould raised flange, ridge angle, ridge tee, ridge cross, ornamental gable terminal, ornamental ridge/hip terminal
- Hip Fittings – chamfered cut hip, ornamental hip starter, bonnet hip plates
- Valley Fittings – closed valley and cut valley
- Cone apex or hip convergence – finial

Figure 1.18
Flower & Leaf (Ornamental) Hip Starter (End View)

Before Getting Started

1 Roof Slope

Ludowici Roof Tile recommended minimum slope requirements are 3:12, 4:12, or 5:12, depending on style (see Chart 2.1). No clay tile roofs are to be installed below a roof slope of 3:12.

There is no maximum slope requirement for tile roofs (except Tower Tile with a maximum of 18:12). However, on extremely steep (above 19:12) or vertical applications, wind current may cause the tiles to rattle. To avoid this, set the butt of each tile with a bead of sealant where it will not be seen. Wind clips placed under each tile should be used with the sealants. See Silicone Sealant Recommendations on Page 8.

IMPORTANT:
On low pitches, from 3:12 to the standard recommended product minimums, it is required to apply a self-adhering modified bitumen membrane or waterproofing underlayment, such as CertainTeed WinterGuard™, on the entire deck. Adequate ventilation will be required.

Note: For technical questions not answered in this publication, please contact our Technical Service Department at (800) 945-TILE (8453).

Chart 2.1:
Recommended Minimum Slope Requirements*

Tile Name	Slope
*Flat Shingle Tiles***	
Antique	5:12
Brittany	5:12
Calais	5:12
Colonial	5:12
Crude	5:12
Flat Slab Shingle	5:12
Georgian	5:12
Norman	5:12
Provincial	5:12
Interlocking Tiles	
Americana, Americana XL	3:12
Celadon	3:12
Classic, Classic XL	3:12
Imperial	3:12
Lanai, Lanai XL	3:12
Williamsburg, Williamsburg XL	3:12
Interlocking Profile Tiles	
French	3:12
*S-Tiles***	
Spanish – 13 1/4″ and 18 3/8″	4:12
*Pan and Cover Tiles***	
Greek	4:12
Italian	5:12
Palm Beach	5:12
Roman	4:12
Straight Barrel Mission – 14 1/4″, 16″ and 18 3/8″	5:12
Tapered Mission	5:12
*Tower Tiles****	3:12

*For standard underlayment installation.
**These tile types can be reduced to 3:12 by using waterproofing underlayment (see "Important" box).
***Requires waterproofing membrane for all roof slopes.

2 Weight

Proper roof framing is required to carry the weight of a tile roof. The weight of one square (100 sq. ft.) of tile will range from 600 pounds to over 1,900 pounds (see Chart 2.2). The weight of the roof tile is determined by the type and size of the tile, and the exposure of each course of tile. Reducing the exposure of the tile will increase the roof load.

The weight of the underlayment, fastening system, roof accessories, and trim tile also needs to be considered when determining the total weight. Check dead load allowances of the applicable local building code.

It is recommended that the structural design of the roof be evaluated by a registered engineer to determine that it can support the load and most building codes require the engineering review. Getting a written letter of approval is suggested and may be required by local building codes.

If the installation is in a region of seismic activity or heavy wind load, local building codes must be consulted for additional requirements.

IMPORTANT:
Weights of actual tile may vary by +/- 10% of the average weight. Structural loads should be determined using the average weight multiplied by a factor of 1.10.

Chart 2.2:
Average Weight of Tiles per Square (Maximum Exposure)

Tile Name	Average Weight per Square (lbs.)	Pieces per Square
Flat Shingle Tiles		
Antique	1,650	412
Brittany	1,900	412
Calais	1,600	317
Colonial	1,800	310
Crude	1,935	480
Flat Slab – 3/8″	1,300	480
5/8″	1,780	480
Georgian	1,600	276
Norman	1,600	317
Provincial	1,575	317
Interlocking Tiles		
Americana, Americana XL	800, 750	158, 109
Celadon	660	109
Classic, Classic XL	800, 750	158, 109
Imperial	860	129
Lanai, Lanai XL	800, 750	158, 109
Williamsburg, Williamsburg XL	800, 750	158, 109
Interlocking Profile Tiles		
French	1,025	133
S-Tiles		
Spanish – 13 1/4″	900	171
18 3/8″	800	114
Pan and Cover Tiles		
Greek	1,550	240
Italian	945-1,340*	156-260
Palm Beach	1,100	163
Roman	1,550	240
Straight Barrel Mission	1,165-1,250*	163-225
Tapered Mission	1,230-1,300*	212-246
Tower Tiles		
Provided upon request - is specific to tower system		

*Various possible weights, dependent upon tile size and/or combination of pans and covers used. Please consult the factory or local sales representative for average weight. See Page 16 for specifics.

3 Roof Deck

A design standard for roofing decks is to have a maximum deflection of L/240 between supports. A deck will be exposed to live and dead loads. A live load is one that will only be exerting pressure on the roof deck for a short time. Example: Snow or wind loads. A dead load is one that will exert a constant pressure to the roof deck ie., underlayments, tile and battens.

For Board Plank Deck: Well-seasoned plank board (1″ full thickness, maximum 6″ nominal width) that is not prone to warping, cupping or twisting.

For Plywood Deck: APA rated plywood is required for a minimum of 3/4″ thick wood decking and must be rated for structural use as roof sheathing. The expansion crack between panels shall be at least 1/16″ but no greater than 1/8″. H-clips are to be used when rafters are spaced greater than 16″ on center, to hold the side joints of the plywood together between supports. Unsupported end joints must be blocked.

Fastener Pullout Resistance: Minimum average fastener pullout resistance for clay roofing tile is 180 psi, with no single value less than 170 psi. Greater pullout values may be required depending upon the predicted aerodynamic moment expected for the tile shape, building shape, and the proximity to the coastline. An engineer should be consulted to assure local building code compliance.

Concrete Decks:
Nailable Concrete Decks – Nailable concrete decks over time may loose their plastic nature, which allows direct nailing. For old decking material, a pullout test should be performed to determine the usefulness of the deck, and the appropriate fastener. An engineer should be consulted to assure local building code compliance.

Non-Nailable Concrete Decks – For concrete decks that will not accept direct nailing, nailer boards are required. Attachment strips that allow the tile to be fastened to them should be pressure treated wood. These may be a board and batten system or pressure treated wood strips that can be embedded into the concrete deck during construction (discussed further on page 12). Other means of attaching tile to a concrete deck include wire-tie systems and expanding nail-in anchors.

Note: Ludowici does not recommend applying tile over spaced board sheathing or open battens.

4 Underlayment

Most problems with water-shedding roof installations occur from water that migrates through the joints of the tiles through capillary action, wind-driven rain, and runoff or ice damming. Because of this possibility, the underlayment is critical to the success of the roof.

Ludowici recommends the following for minimum underlayment:

- All decks shall be covered with two layers of No. 30 asphalt-impregnated roofing felt or one layer of No. 43 coated base sheet.
- All hips, valleys and ridges shall be covered with a waterproof underlayment, example: self-adhesive modified bitumen membrane or two layers of No. 43 coated base sheet.

Note: Roofing felt should meet or exceed ASTM standards D226/D2626.

CAUTION:
Solvent-based flashing cement or caulking (sealant) must not come into contact with a bitumen membrane in order to prevent damage to the membrane.

IMPORTANT:
On low pitches, from 3:12 to the standard recommended product minimums, or in regions where ice dams may occur, it is required to apply a self-adhering modified bitumen membrane or waterproofing underlayment, such as CertainTeed WinterGuard™, on the entire deck. Adequate ventilation will be required.

In regions where ice dams may occur, the waterproof underlayment should be extended a minimum of 24″ upslope from the inside of the interior wall line of the building directly to the roof deck. (Further clarification found on Page 13, Ice Dam Protection.)

5 Fastening Methods

Attachment requirements and fastener length by tile type are referenced in Chart 2.3.

Nails or Screws. Nails are the most commonly used fastener for attaching clay tiles. Nails for tiles and cleats must be copper, 11-gauge minimum, 3/8″ head minimum and proper length to give good penetration. Screws must be stainless steel or brass, #8 or #9 with a minimum 3/8″ diameter head.

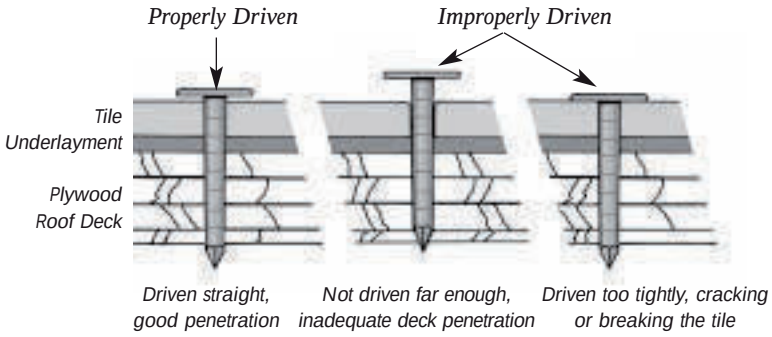


Figure 2.1 Proper Nailing Techniques for Plywood Deck

IMPORTANT:
Do not install the recommended fastener tightly against the tile due to the risk of breakage from installation and deck movement. The tile should "hang" from the fastener.

Note: Each field tile is provided with (2) two fastening nail holes. When installing field tiles, care should be taken to fasten each tile with nails or screws in every provided fastening hole.

- For a plywood deck, use ring shank copper nails of the specified length to assure good penetration through under side of deck (see Figure 2.1).
- For board plank deck, use smooth shank copper nails of the specified length. Fasteners should penetrate deck board 3/4″. Do not penetrate underside of deck.
- For gypsum plank or nailable concrete deck, use stainless steel or silicon bronze screw shank nails of length to penetrate half to three-quarters the thickness of the deck. Never penetrate underside of deck.
- When insulation is applied over the deck, observe the following:
  – Minimum slope (per style) to 6:12 – the tile can be nailed through underlayment and insulation into the deck with a sufficient length fastener.
  – On 6:12 or greater, a tile-tie system should be used.
- For metal decks, use sheet metal screws and the proper mastic.
- For fibrous cement decks, use a tile-tie system.

Note: When using stainless steel screws, tile replacement will require the use of a hack saw to remove the screws. A slate ripper may be used with copper or brass fasteners.

Wire. On non-nailable surfaces or some insulated decks or where fastening through the metal flashing needs to be avoided or if underlayment cannot be penetrated, such as special low slope applications, wire and strapping systems are sometimes used. Wire must be solid copper, 16 gauge, with or without insulation. Wire-tieing is also usually specified in areas prone to earthquakes. Consult the manufacturer of these types of systems for specific design and installation.

Clips. Wind clips are often specified and/or required in high wind and seismic areas. They aid in holding the tiles in place and reduce stress at the preliminary fastening point (see Figure 2.2). Refer to local building codes in such areas.

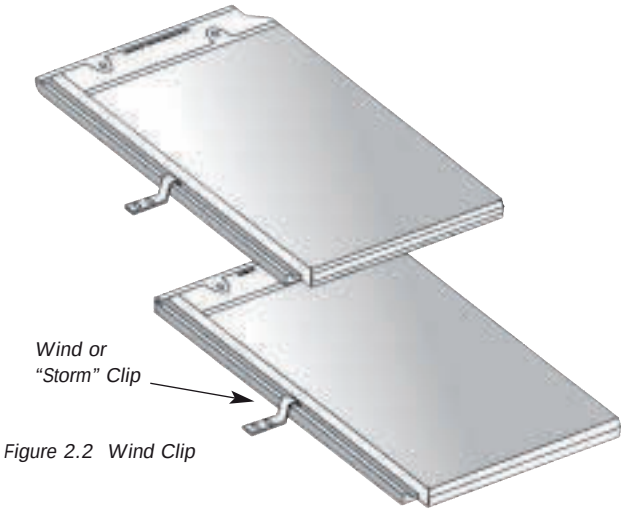


Figure 2.2 Wind Clip

Note: In high wind regions, install each tile with #8 or #9 brass flathead phillips or square drive screws and/or use wind clips. Wind clips and sealants may be required by the local building codes.

Bedding Tile. Where freeze/thaw cycles are not an issue, tile may be laid in a full or partial bed of mortar. This method is best used in combination with other means of attachment.

Foam Adhesive. This method of application is approved for use in South Florida and is being tested for use in other areas. Refer to local building codes. See Tropical Conditions on Page 84 for more details.

Chart 2.3: Attachment Requirements

Tile Type	Fastener Length			Quik-Tach™ Brackets	Hurricane Clips
	For Field Tile	For Hip	For Ridge		
Flat Shingle Tiles					
Flat Slab Shingle 3/8″	Boards: 1 1/2″ Plywood: 1 3/4″	2″	Header Course: 1 1/2″ V-Type: 2 1/2	Type C*	N/A
Flat Slab Shingle 5/8″	Boards: 1 3/4″ Plywood: 2″	2″	Header Course: 1 1/2″ V-Type: 2 1/2	Type C*	N/A
Antique, Brittany, Calais, Crude, Colonial, Georgian, Norman, Provincial	Boards: 1 1/2″ Plywood: 1 3/4″	2″	Header Course: 1 1/2″ V-Type: 2 1/2	Type C*	N/A
Interlocking Tiles					
Americana, Americana XL Classic, Classic XL, Lanai, Lanai XL, Williamsburg, Williamsburg XL	Boards: 1 3/4″ Plywood: 2″	2″	2 1/2″	Type C	On Eave: 3/4″ Above Eave: 1 1/4″
Celadon	Boards: 1 3/4″ Plywood: 2″	2″	2 1/2″	Type C	1 1/4″
Imperial	Boards: 1 3/4″ Plywood: 2″	2″	2 1/2″	Type C	1 1/4″
Interlocking Profile Tiles					
French	Boards: 2″ Plywood: 2 1/2″	2″	2 1/2″	Not Required	1 3/4″
S-Tiles					
Spanish	Boards: 1 1/2″ Plywood: 1 3/4″	2″	2 1/2″	Type B Type D (18 3/8″)	On Eave: 3/4″ Above Eave: 2 5/16″
Pan & Cover Tiles **For Cover with Stringer**	**For Pan**				
Palm Beach & Straight Barrel Mission	Plywood: 1 3/4″			Type D (remaining)	
14 1/4″, 16″, 18 3/8″, 2″	Boards: 1 1/2″	2″	2 1/2″	Type B (14 1/4″)	Wind Locks
16″ Tapered Mission 2″	Boards: 1 1/2″ Plywood: 1 3/4″	2″	2 1/2″	Type D	Wind Locks

*Type C brackets must be cut or bent for these tile patterns.

IMPORTANT:
*Before application of Ludowici clay tiles in alpine** conditions, plans must be submitted to the Ludowici Technical Department for approval. Ludowici will not assume any liability or responsibility for damage caused by the application of clay tile in alpine conditions.*

**Alpine conditions are defined as climactic areas that experience frequent heavy winter snowfall intermittent with strong solar radiation common to high altitude geography. (See Alpine Conditions on Page 83 for more details.)

6 Assemble All Tools and Supplies

The following tools are needed for basic installation of clay roofs:

- safety equipment as required by OSHA and other local and state agencies
- rule or tape
- mason's trowel and bucket
- chalk line and chalk
- 4″ diamond-tipped turbo blade on angle grinder
- claw hammer
- protective eyewear/dust mask
- chipping hammer
- caulking gun
- felt knife
- sheet metal shears
- roof jacks
- slate ripper
- segmented diamond blade (8″to10″ diameter)
- wet tub saw
- tile nippers
- marking pencil
- sharp steel punch
- battery-operated, clutch-driven drill (with extra batteries)
- carbide spear point glass drill bits
- small steel roller

IMPORTANT:
All roof work can be hazardous. Safety requirements are spelled out by OSHA and individual state Occupational Safety and Health Administration regulations. It is the responsibility of the installer to take all necessary precautions. Contact the Occupational Safety and Health Administration for complete information regarding safe roofing practices.

In addition to tools, the following materials are needed:

- Flashing: use a minimum weight of 16 oz. copper, at least 24″ wide, with 1/4″ edge turned over and fastened with cleats for valleys. Under special circumstances, such as unusual exposure to high wind or heavy snow, this flashing weight should be increased. Lighter weight copper flashings are undesirable because they can puncture too easily and they will not provide the wear-life required for a long-life roof system.

- Underlayment: two layers of No. 30 asphalt-impregnated roofing felt or one layer of No. 43 coated base sheet, doubled on rough surfaces, hips, valleys, and ridges, or one layer of self-adhesive modified bitumen membrane such as WinterGuard™. See WinterGuard Application Instructions, Page 9.

- Plastic cement: plastic cement for gable rakes, hip rolls, ridges, stringers, and other conditions should be non-running, heavy-body flashing cement composed of mineral ingredients to meet the requirements of ASTM D-4586.

- Cant strips, wood nailers, and field tile nailer strips: all should be foundation grade wood.

- Mortar and mortar color to match tiles: Ludowici defines mortar as one part Portland cement and four parts sand (to ASTM specification C-270).

- Silicone sealant or adhesive: the recommended sealant for exposed caulking is Dow Corning® 790 Silicone Building Sealant™ or GE® SilProof™ (ASTM C-920, low modules). These sealants may be used as hidden adhesives. NP1 or other adhesives may be suitable as well, however, care should be taken to select for maximum durability and also for compatibility with adjacent materials. Some sealants are available in different colors to match tiles.

- Required fasteners.

IMPORTANT:
All roofing components should be selected to be compatible with the long service life of a Ludowici roof.

WinterGuard™ Application Instructions

Application (Peel and Stick)

WinterGuard can be applied in any length convenient to the applicator. First, align unrolled material with lower edge of roof and hold in place. Lift starting end of material (approximately 1 foot), peel back and fold under at least 6″of both sheets of protective release film. Carefully return the exposed adhesive surface to the deck and press firmly in place. If, at lower temperatures, material does not adhere immediately, tack in place mechanically. Reroll material from the other end until the peeled and folded back film is exposed. Beginning with the folded back film, peel both sheets of the remaining film from the roll, pulling parallel to the eave. Be sure all material lays flat and is well adhered.

Alternatively, apply by the "peel and flop" method utilizing the two-piece split sheet release film feature to adhere longitudinal halves, one at a time. It is best to cut the product into manageable lengths of about 12 feet when applying WinterGuard by this method.

The upper edge of WinterGuard must extend to a point no less than 24″ beyond the interior wall line and, in areas of severe icing, at least up to the highest water level expected to occur from ice dams. In order to ensure waterproofing, overlap all sides and ends 6″, press overlaps firmly with a roller, and off-set end laps 2 feet from course to course.

Valleys, Ridges and Hips

In the valleys, the width of the material must be 36″ minimum, and on the ridges and hips, 12″ minimum. Cut WinterGuard to convenient pre-measured lengths (4-6 feet recommended). Peel off the release film and drape the sheet into place allowing the membrane to locate and adhere in the valley center line or ridge peak first, working outward toward the edges. In valleys, start the application at the low point and work upwards. To ensure waterproofing, overlap all sheets 6″ at lap joints. Do not use WinterGuard as a permanent weathering surface (such as in open valleys).

CAUTION:
Solvent-based flashing cement or caulking (sealant) must not come into contact with a bitumen membrane in order to prevent damage to the membrane.

7 Storage, Handling, and Inspection

Field tile is generally shipped in pallets, and fittings in boxes. Upon receipt of shipment, the pallets and boxes should be examined for possible damage in transit and, if any, should be noted on the shipping papers and a claim must be filed promptly against the delivering carrier. Ludowici Roof Tile will provide information and assist you in the proper filing of a damage claim. Remember, however, that prompt inspection of incoming merchandise is always important as damage claims will not be honored by the carriers if they are not filed promptly.

The pallets and boxes of tile should be placed in a level, safe place away from traffic and construction activity. Pallets of tile must not be stacked on top of each other.

If any problems are identified, notify Ludowici Roof Tile immediately. Do **NOT** install any of the tiles. Once the tiles are installed, they are considered suitable for use and will not be replaced except per the terms of Ludowici's warranty.

8 Range of Tones

Colors within a given shipment of Ludowici clay roof tile will vary slightly due to subtle changes in clay composition and kiln firing temperatures. Such color variances are not a defect but a natural desirable feature that gives roofs depth and character.

The person responsible for the blending of the shades of color should randomly select tiles from at least three different pallets. This blending will ensure a proper blend to provide a harmonious color roof without blotches or streaks.

After the installation of about 75-100 tiles, the roof should be inspected from the ground at a distance greater than 40 feet to determine that there are no streaks or blotches. To ensure a good range of tones, this inspection must be done at regular intervals.

9 Color Blending with Different Color Tile

Blending different tile colors can provide a unique and aesthetically pleasing roof.

Make a drawing to detail the layout and to help determine the proper number of tiles of each color.

In order to maintain the correct color blend, pull tiles from the different pallets of each color. Premix these piles in the desired percentage and load the roof one square at a time. This will provide even distribution.

After the installation of about 75-100 tiles, the roof should be inspected from the ground at a distance greater than 40 feet to determine that there are no streaks or blotches. To ensure a good color blend, this inspection must be done at regular intervals.

Note: It may be helpful to lay the tile blend out on the ground so the installer has a visual example. Make one person responsible for the ongoing and end result of the blending. Complete information on color is available in Ludowici's *Guide to Color*.

10 Snowguards

Snowguards are generally required in areas where snow and ice may accumulate on the roof. Snowguards are sometimes used on sloped roofs to prevent a mass of snow or ice from sliding off the roofs and injuring persons, damaging gutters or plants, and blocking walks and driveways. Snowguards hold the snow in place above the eaves until it can melt and the water runs off.

It is recommended that snowguards should be installed on at least 3 or 4 courses, offset from course to course, spaced in staggered interval rows. Begin with the third or fourth row. However, spacing and quantity of snowguards is a matter of judgement based on local weather conditions (see Figure 2.3).

Alpine conditions will require a professional engineer to design the required snow retainage system. Tile should not be exposed to ice and snow loads exceeding 100 pounds per square foot.

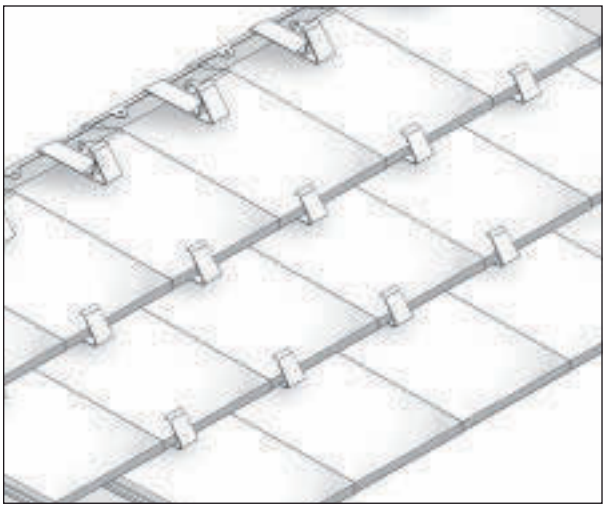


Figure 2.3 Recommended Snowguard Spacing

A snowguard must be made of nonferrous material to prevent possible rust stains. Many styles are available (see Figure 2.4).

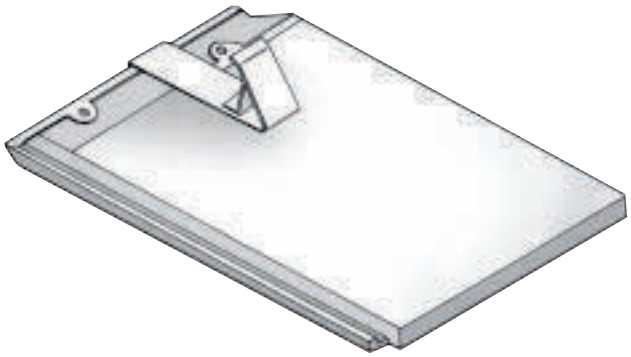


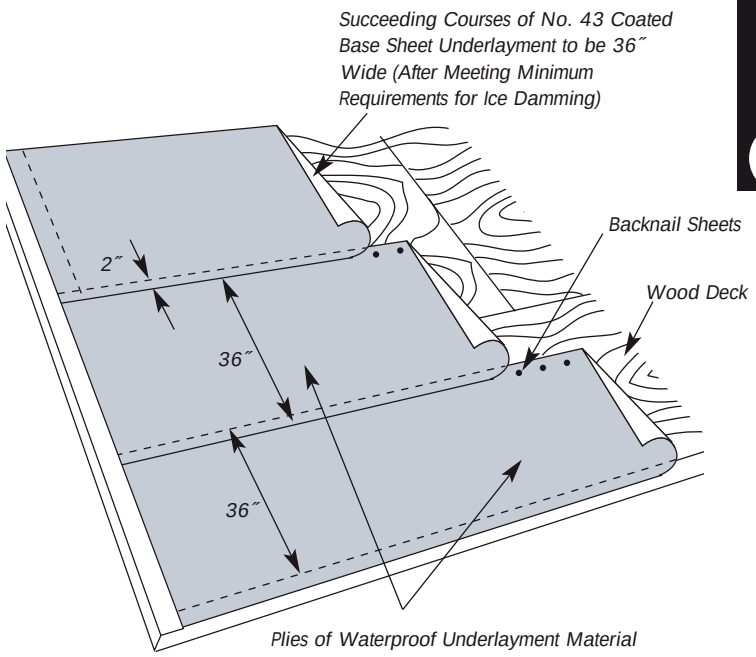
Figure 2.4 Snowguard with Interlocking Tile

Preparing the Roof

1 Inspecting the Deck

- Ensure that the roof deck is clean, smooth, and dry before roof tiles are applied.
- Verify that there is no significant delamination, warpage, bowing, or separation from the rafters or trusses. Check for deck rot.
- If deck is APA 3/4″ rated plywood, check that panels are spaced approximately 1/16″ to a maximum of 1/8″ apart for expansion and H-clips are used between supports when the rafter spacing exceeds 16″ O.C. Unsupported end joints must be blocked.
- Make repairs to the deck as necessary.

Note: Prior to applying any roofing material, all contractor work above the roofline must be completed.



Note: All Dimensions are Approximate

Figure 3.1 Ice Dam Protection and Single Sheet Underlayment

2 Installing the Underlayment

Most problems with water-shedding roof installations occur from water that migrates through the joints of the tiles through capillary action, wind-driven rain, and runoff or ice damming. Because of this possibility, the underlayment is critical to the success of the roof.

As a minimum, all decks must be covered with two layers of No. 30 asphalt-impregnated roofing felt or one layer of No. 43 coated base sheet.

Note: Underlayment materials must be covered with tile as soon as possible to prevent degradation from exposure.

If wood cant strips and nailers are nailed directly to the deck, they must be covered with waterproof underlayment. If nailed on the underlayment, they should be pressure treated wood.

For single layer of No. 43 coated base sheet:

Lay base sheet parallel to eave. Side lap – 2″ and end lap – 6″.

IMPORTANT:
On low pitches, from 3:12 to the standard recommended product minimums, or in regions where ice dams may occur, it is required to apply a self-adhering modified bitumen membrane or waterproof underlayment, such as CertainTeed WinterGuard™ on the entire deck. Adequate ventilation will be required.

In regions where ice dams may occur, the waterproof underlayment should be extended a minimum of 24″ upslope from the inside of the interior wall line of the building directly to the roof deck.

For double layer, follow these steps:

1. First apply a 19″ starter sheet parallel to eave. Backnail sheets with corrosion resistant, 11-gauge, 3/8″ head standard roofing nails, sufficient to hold the felts in place.

2. Then completely cover the starter sheet with a full-width sheet.

3. Lap succeeding sheets 19″ over the preceding sheets, leaving a 17″ exposure (2″ lap). End laps should be a minimum of 6″ (see Figure 3.2).

Note: All roofing underlayment materials should be carried 6″ up all vertical surfaces and 4″ over gutter and valley metal.

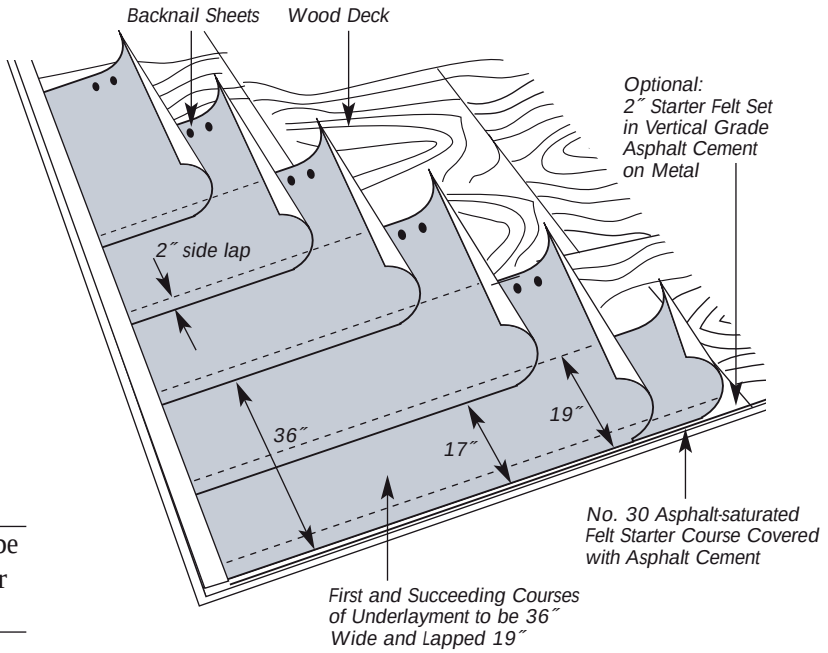


Figure 3.2 Application of Double Layer Felt Underlayment

Concrete Deck

If roof deck is poured concrete, embed pressure treated 1″ x 2″ beveled wood strips, extending from eave to ridge, spaced 20″ O.C. Concrete must be smooth and flush. A concrete primer is recommended especially in those areas where waterproof underlayment will be used. Apply No. 43 coated base sheet and fasten with 3/8″ x 1 1/2″ lath nailed from eave to ridge atop embedded strips. Apply 1″ x 2″ wood strips horizontally across lath spaced to accommodate the correct tile exposure and proceed as directed for a sheathed roof (see Figures 3.3 and 3.4).

Note: Where ice dam protection is required, install waterproof underlayment material up to a point 24″ inside the interior wall line of the building.

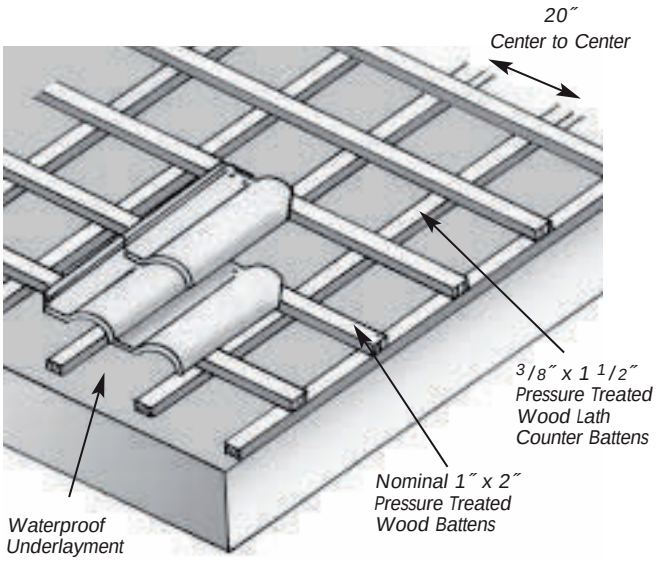


Figure 3.3 Batten System of Attachment for Concrete Deck

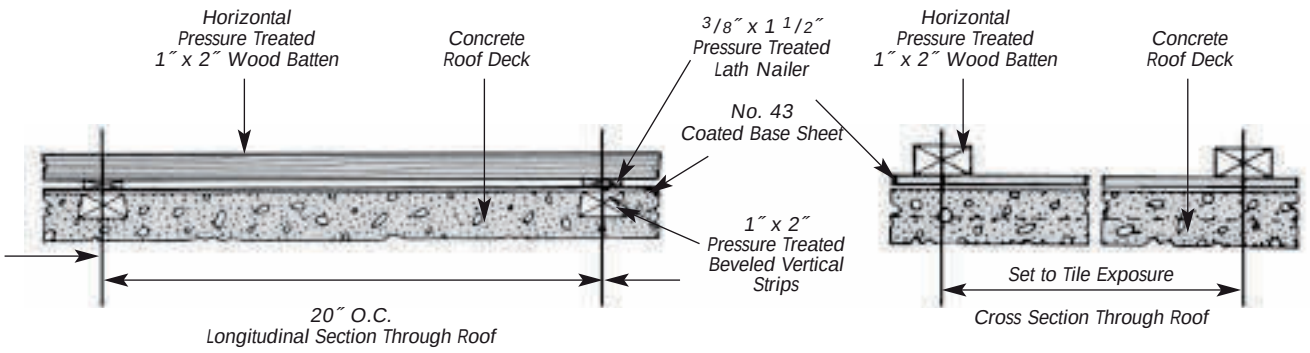


Figure 3.4 Application of Batten System to Poured Concrete Roof Deck

3 Ice Dam Protection

Ice dam protection is recommended in areas where the January mean temperature is 30° F or less and on all pitches below the standard minimums. This protection must be installed wherever there is a possibility of ice forming along the eaves which will cause a back-up of water and may cause building and interior damage. Consider your local weather conditions.

Apply self-adhering CertainTeed WinterGuard™, or equivalent, directly to the deck according to application instructions provided with the product. WinterGuard must extend up the roof to a point at least 24″ beyond the interior wall line, and in areas of severe icing at least up to and above the highest water level expected to occur from ice dams (see Figure 3.5).

Please note that the 24″ point beyond the interior wall line is a minimum recommendation. WinterGuard should be applied to all roof decking which past history and professional experience suggest might be subject to ice dam back-up. If considering using ice dam protection on the entire surface of the roof deck, insure that adequate ventilation is present to prevent the development of damaging condensation on the underside of the roof deck.*

If a wide eave overhang requires flashing wider than 36″, the necessary 6″ minimum horizontal lap must be located on the overhang outside the structure walls. End laps must be a 6″ minimum. Underlayment should meet ASTM D-1970.

CAUTION:
Solvent-based flashing cement must not come in contact with CertainTeed WinterGuard or other similar waterproofing underlayment, or damage to the underlayment could occur.

*For complete information on attic ventilation, obtain *The Principles of Attic Ventilation*, copyright 1997, or call 1-800-AIRVENT.

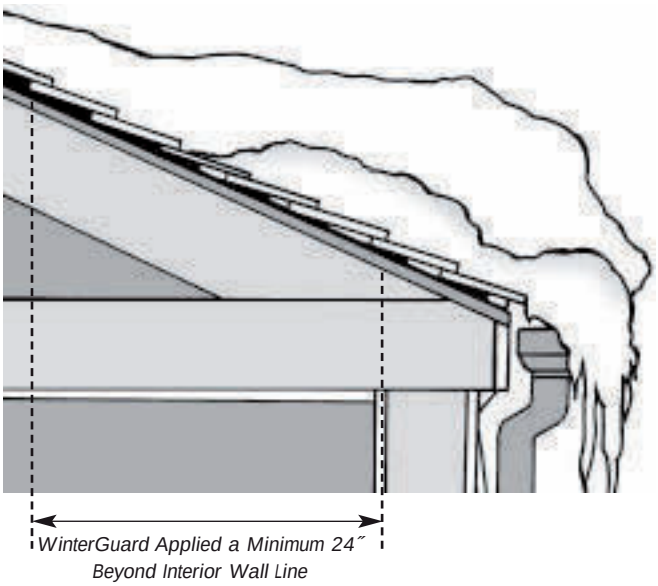


Figure 3.5 Ice Dam Protection

For more information on Alpine Conditions, obtain a copy of *The Concrete and Interlocking Tile Roof Design Criteria Manual for Snow and Ice Regions,* Leland E. Gillan, P.E. & Terry Anderson, published by NTRMA/WSRCA or from your local Ludowici sales representative.

4 Measuring and Chalking the Roof

Layout and chalking the roof accurately are critical to the roof's performance and appearance. If the eaves are straight and level, all horizontal lines must be parallel to the eaves, and all vertical lines must be perpendicular to the eaves. Check the roof deck to determine if the deck is square prior to layout.

Step 1: *Determine Width and Length Exposure*

Clay tiles, depending on the style and profile, vary in exposure and recommended head lap (see Chart 3.1). Pan and Cover styles begin with a full tile. Other types, such as flat and interlocking, are generally started with a half-width tile in order to offset the joints.

Before chalking the roof, the installer should verify the tile pattern being installed, and measure, noting *average* length and width exposures of the tile shipped. The usual overhang at the eave is 2˝; however, this may be adjusted slightly to accommodate full courses. Measure the roof from eave to ridge to ascertain whether the final course can be a full length tile or if a short course needs to be cut.

Some tile styles may allow the head lap to be increased over several courses to avoid cutting a short course. The tile styles which do not allow the head lap to be increased are Spanish, French, Greek, Roman, and tapered barrel mission tile.

Step 2: *Chalking Vertical Lines*

Vertical lines are chalked first. In the case of a hip roof, the first line is struck in the center of the roof equidistant from each hip (see Figure 3.6). The remaining vertical lines are then struck to the right and left at intervals equal to *your* average width exposure. Care must be taken to ensure that all vertical lines are parallel to the water flow.

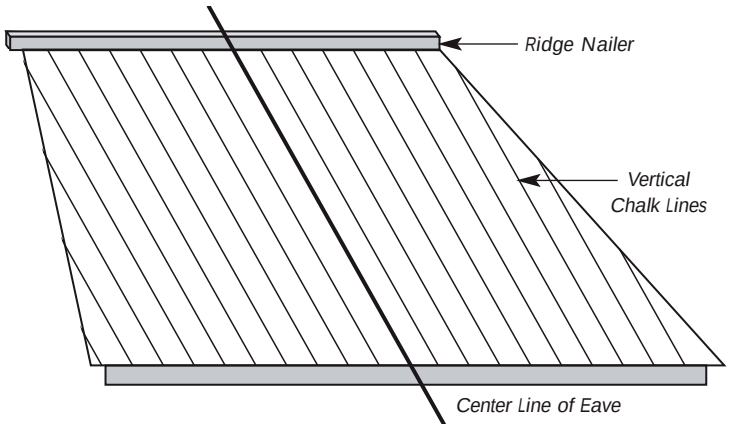


Figure 3.6 Chalking Vertical Lines to Guide Installation

IMPORTANT:
The tile dimensions can vary because of clay firing temperatures. Be sure to measure actual tiles in your shipment to determine their average width and length dimensions, so you can chalk your roof properly.

Step 3: *Chalking Horizontal Lines*

Horizontal lines are struck after the vertical lines are struck.

For S-Tile, Pan and Cover Tile, and Interlocking Profile Tile, the first line will equal the average length of the tiles minus the overhang. For example, a tile with an overall length of 16″ minus a 2″ overhang indicates the first line is to be 14″ up from the eave. Successive lines are then struck at intervals equal to *your* average length of exposure.

For Flat Shingle and Interlocking Tile, the first line will equal the average length of the under eave tile minus the overhang, typically 2″ (see Figure 3.7).

Length exposure of flat shingle tile is determined by subtracting 2″ from the tile length and then dividing by 2. Example:

15″ length – 2″ triple head lap = 13″÷2 = 6 1/2″ exposure.

For Flat Shingle Tile, the second line will equal the average length of the tile minus the overhang, laid directly over the under eave, then all successive lines will also be chalked as previously described.

For Flat Shingle, Interlocking, and Straight Barrel Mission Tile, your eave to ridge measurement may determine the average length exposure rather than the size of the tile itself. For example, suppose the eave to ridge measurement is 105 1/2″ and you were using Interlocking tiles (average length exposure of 11″). You might then determine to lay the first tile at an 11″ exposure as usual, and 10 1/2″ exposure for each of the remaining nine courses. Here is the calculation: eave to ridge measurement of 105 1/2″ minus 11″ for the first course equals 94 1/2″; therefore 94 1/2″ divided by 9 equals 10 1/2″.

Care must be taken to ensure that all horizontal lines are perpendicular to the water flow.

Note: Measuring and chalking for a tower tile installation is unique and deserves special attention – please see Section 10, Page 80.

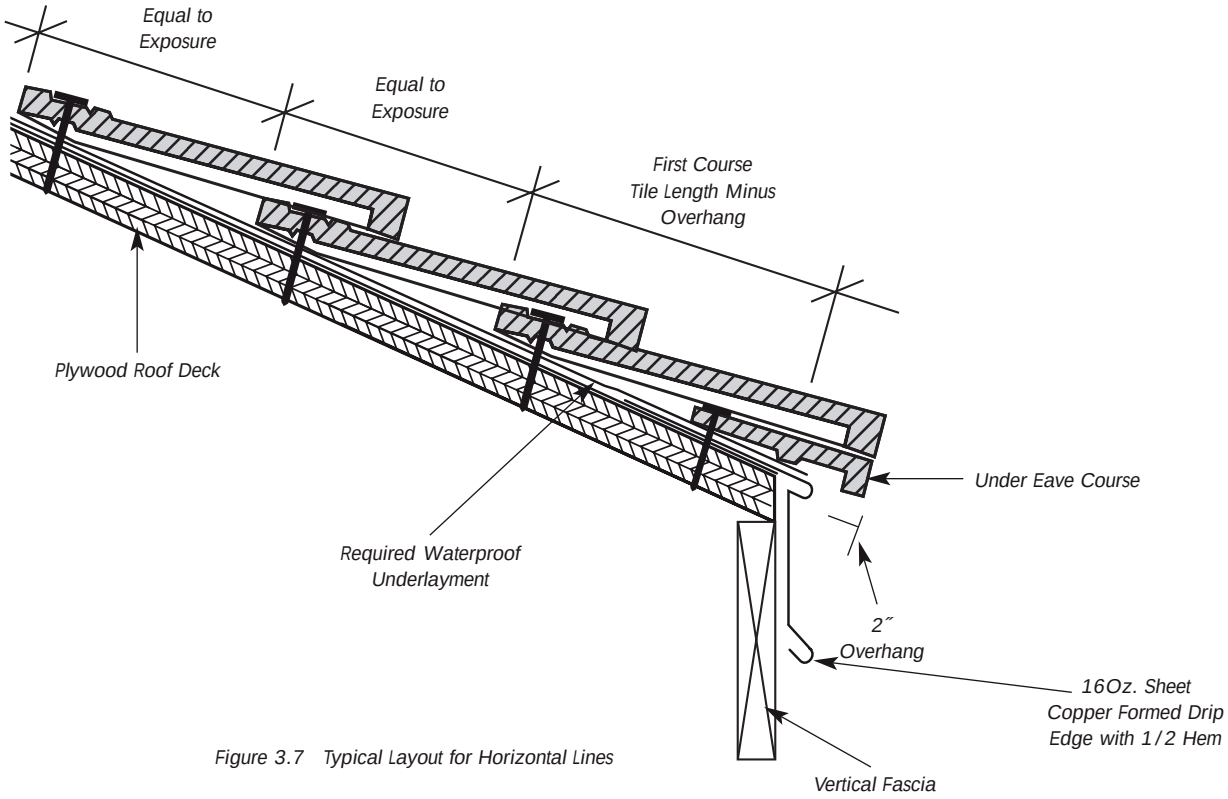


Figure 3.7 Typical Layout for Horizontal Lines

Chart 3.1: Average Length, Width, and Exposures of Tile Styles

The average length and width exposures are based on the usual sizes of these products.

Tile Name	Length	Width	Length Exposure	Width Exposure	Pieces/ Square	Under Eave Length	Under Eave Width	Average Weight/ Square
Flat Shingle Tiles								
Antique	12″	7″	5″	7″	412	7″	7″	1,650
Brittany	12″	7″	5″	7″	412	7″	7″	1,900
Calais	15″	7″	6 1/2″	7″	317	8 1/2″	7″	1,600
Colonial	14 5/8″	7 3/8″	6 5/16″	7 3/8″	310	8 5/16″	7 3/8″	1,800
Crude	12″	6″	5″	6″	480	7″	6″	1,935
Flat Slab Shingle 3/8″	12″	6″	5″	6″	480	7″	6″	1,300
5/8″								1,780
Georgian	15″	8″	6 1/2″	8″	276	8 1/2″	8″	1,600
Norman	15″	7″	6 1/2″	7″	317	8 1/2″	7″	1,600
Provincial	15″	7″	6 1/2″	7″	317	8 1/2″	7″	1,575
Interlocking Tiles								
Americana	14″	9″	11″	8 1/4″	158	4 5/8″	12″	800
Americana XL	16″	10 3/4″	13″	10 1/8″	109	4 5/8″	12″	750
Celadon	16″	10 3/4″	13″	10 1/8″	109	4 5/8″	12″	600
Classic	14″	9″	11″	8 1/4″	158	4 5/8″	12″	800
Classic XL	16″	10 3/4″	13″	10 1/8″	109	4 5/8″	12″	750
Imperial	15″	10″	12″	9 1/4″	129	4 5/8″	12″	860
Lanai	14″	9″	11″	8 1/4″	158	4 5/8″	12″	800
Lanai XL	16″	10 3/4″	13″	10 1/8″	109	4 5/8″	12″	750
Williamsburg	14″	9″	11″	8 1/4″	158	4 5/8″	12″	800
Williamsburg XL	16″	10 3/4″	13″	10 1/8″	109	4 5/8″	12″	750
Interlocking Profile Tiles								
French	16 1/4″	9″	13 3/8″	8 1/8″	133	NA	NA	1,025
S-Tiles								
Spanish 13 1/4″	13 1/4″	9 3/4″	10 1/4″	8 1/4″	171	NA	NA	900
18 3/8″	18 3/8″	9 3/4″	15 3/8″	8 1/4″	114			800
Pan and Cover Tiles								
16″ Tapered Mission and Straight Barrel Mission Pans	16″	**P** = 8″ **C*** = 7″	13″	**P** = 3 1/2″ **C*** = 7″ **CC** = 10 1/2″	212	NA	NA	1,230
16″ Tapered Mission Cover and Tapered Pans	16″	**P*** = 7″ **C*** = 7″	13″	**P** = 2″ **C*** = 7″ **CC** = 9″	246	NA	NA	1,300
Greek	12 3/4″	**P*** = 9 3/4″ **C*** = 6 1/2″	10″	**P** = 5 1/2″ **C*** = 6 1/2″ **CC** = 12″	240	NA	NA	1,550
Roman	12 3/4″	**P*** = 9 3/4″ **C*** = 6 1/2″	10″	**P** = 5 1/2″ **C*** = 6 1/2″ **CC** = 12″	240	NA	NA	1,550
Straight Barrel Mission	14 1/4″	**P** = 8″ **C** = 8″	11 1/4″	**P** = 3 1/2″ **C** = 8″ **CC** = 11 1/2″	225	NA	NA	1,250
Straight Barrel Mission	16″	**P** = 8″ **C** = 8″	13″	**P** = 3 1/2″ **C** = 8″ **CC** = 11 1/2″	192	NA	NA	1,190
Straight Barrel Mission	18 3/8″	**P** = 8″ **C** = 8″	15 3/8″	**P** = 3 1/2″ **C** = 8″ **CC** = 11 1/2″	163	NA	NA	1,165
Palm Beach	18 3/8″	**P** = 8″ **C*** = 8″	15 3/8″	**P** = 3 1/2″ **C*** = 8″ **CC** = 11 1/2″	163	NA	NA	1,100
Italian Pan and Cover	Note: Multiple combinations are possible. Please contact Ludowici Roof Tile for special instructions.							

P = Pan *(*Pan Measurement at Butt of Tile)* **C** = Cover *(*Cover Measurement at Butt of Tile)* **CC** = Center to Center Dimensions

Chart 3.2: Guidelines for Horizontal Spacing with a 2″ Overhang at Eave using Standard Exposure Lengths

Course	*Antique, Brittany, Crude, Flat Slab Shingles*	*Calais, Georgian, Norman, Provincial*	*Colonial*	*Americana, Classic, Lanai, Williamsburg*	*Americana, Celadon, Classic, Lanai, Williamsburg "XL Series"*	*Spanish*		
						13 1/4″	*18 3/8″*	
1	10″	13″	12 5/8″	12″	14″	11 1/4″	16 3/8″	
2	15″	19 1/2″	18 15/16″	23″	27″	21 1/2″	31 3/4″	
3	20″	26″	25 1/4″	34″	40″	31 3/4″	47 1/8″	
4	25″	32 1/2″	31 9/16″	45″	53″	42″	62 1/2″	
5	30″	39″	37 7/8″	56″	66″	52 1/4″	77 7/8″	
6	35″	45 1/2″	44 3/16″	67″	79″	62 1/2″	93 1/4″	
7	40″	52″	50 1/2″	78″	92″	72 3/4″	108 5/8″	
8	45″	58 1/2″	56 13/16″	89″	105″	83″	124″	
9	50″	65″	63 1/8″	100″	118″	93 1/4″	139 3/8″	
10	55″	71 1/2″	69 7/16″	111″	131″	103 1/2″	154 3/4″	
11	65″	78″	75 3/4″	122″	144″	113 3/4″	170 1/8″	

Course	*French*	*16″ Tapered Mission Italian 16″ Length*	*Palm Beach with 18 3/8″ SBM Pans*	*Greek, Roman*	*Imperial*	*Straight Barrel Mission*		
						14 1/4″	*16″*	*18 3/8″*
1	14″	14″	16 3/8″	10 3/4″	13″	12 1/4″	14″	16 3/8″
2	27 3/8″	27″	31 3/4″	20 3/4″	25″	23 1/2″	27″	31 3/4″
3	40 3/4″	40″	47 1/8″	30 3/4″	37″	34 3/4″	40″	47 1/8″
4	54 1/8″	53″	62 1/2″	40 3/4″	49″	46″	53″	62 1/2″
5	67 1/2″	66″	77 7/8″	50 3/4″	61″	57 1/4″	66″	77 7/8″
6	80 7/8″	79″	93 1/4″	60 3/4″	73″	68 1/2″	79″	93 1/4″
7	94 1/4″	92″	108 5/8″	70 3/4″	85″	79 3/4″	92″	108 5/8″
8	107 5/8″	105″	124″	80 3/4″	97″	91″	105″	124″
9	121″	118″	139 3/8″	90 3/4″	109″	102 1/4″	118″	139 3/8″
10	134 3/8″	131″	154 3/4″	100 3/4″	121″	113 1/2″	131″	154 3/4″
11	147 3/4″	144″	170 1/8″	110 3/4″	133″	124 3/4″	144″	170 1/8″

Chart 3.2 should be used as a guideline to determine horizontal spacing, as long as Ludowici average length exposure is being used.

IMPORTANT:
The tile dimensions can vary because of clay firing temperatures. Be sure to measure actual tiles in your shipment to determine their average width and length dimensions, so you can chalk your roof properly.

5 Applying Cant Strips, Wood Nailers, and Battens

After lining the roof, wood stringers for ridges and hips, cant strips at eaves, and battens as field tile nailer strips (required for certain patterns) are applied. The heights of the stringers, battens and cant strips are determined by the tile pattern, and the type of fittings to be used.

Cant Strips

Method 1: Apply a properly sized cant strip (see Chart 3.3) 48″ long and pressure treated directly to the underlayment, with 1/2″ gap every 48″ to allow drainage.

Method 2: Apply a properly sized cant strip (see Chart 3.3) directly to the wood sheathing. Cover with copper flashing drip edge and underlayment (see Figure 3.8).

Method 3: Some tile patterns do not require the use of a cant strip. These tiles are laid with an under eave fitting, eave closure or copper flashing drip edge with underlayment (see Figure 3.9).

For flat shingle tiles only, both the cant strip and an under eave fitting are used.

Chart 3.3: Proper Sizing for Cant Strips

Tile Name	Height of Cant Strip
Flat Shingle Tiles	
Flat Slab Shingle 3/8″	3/4″ x 2″ + Under Eave
Flat Slab Shingle 5/8″	1″ x 2″ + Under Eave
Calais, Antique	1″ x 2″ + Under Eave
Georgian, Brittany	1″ x 2″ + Under Eave
Norman, Crude	1″ x 2″ + Under Eave
Provincial, Colonial	1″ x 2″ + Under Eave
Interlocking Tiles	
Americana, Americana XL	Under Eave
Celadon	1″ x 2″
Classic, Classic XL	Under Eave
Imperial	Under Eave
Lanai, Lanai XL	Under Eave
Williamsburg, Williamsburg XL	Under Eave
Interlocking Profile Tiles	
French	1 1/2″ x 2″
S-Tiles	
Spanish - 13 1/4″, 18 3/8″	Eave Closure
Pan and Cover Tiles	
Greek, Roman	Eave Closure
Italian	Eave Closure
Palm Beach	Eave Closure
Roman	Eave Closure
Straight Barrel Mission	Eave Closure
Tapered Mission	Eave Closure
Tower Tiles	Eave Closure

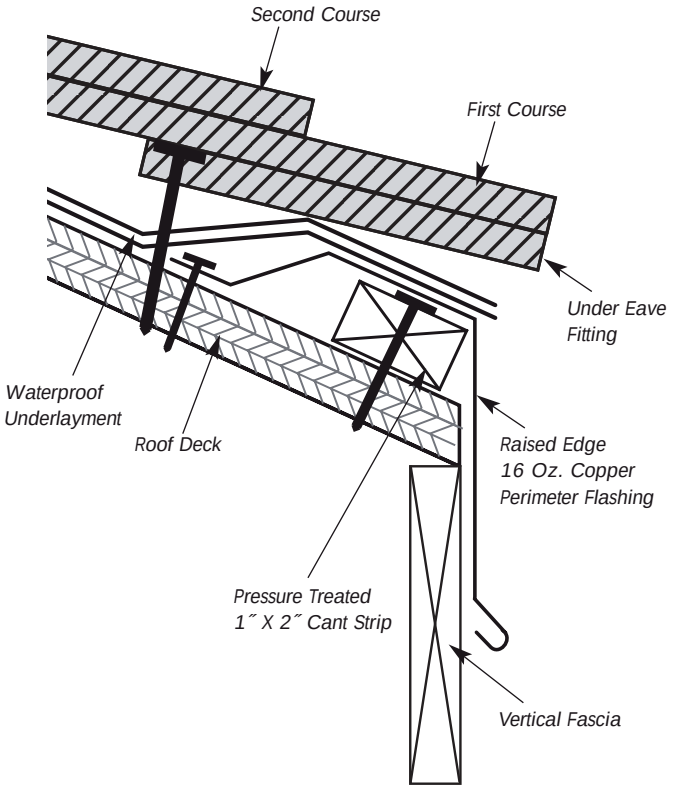


Figure 3.8 Cant Strip for Starter Course Example of Flat Shingle Tile

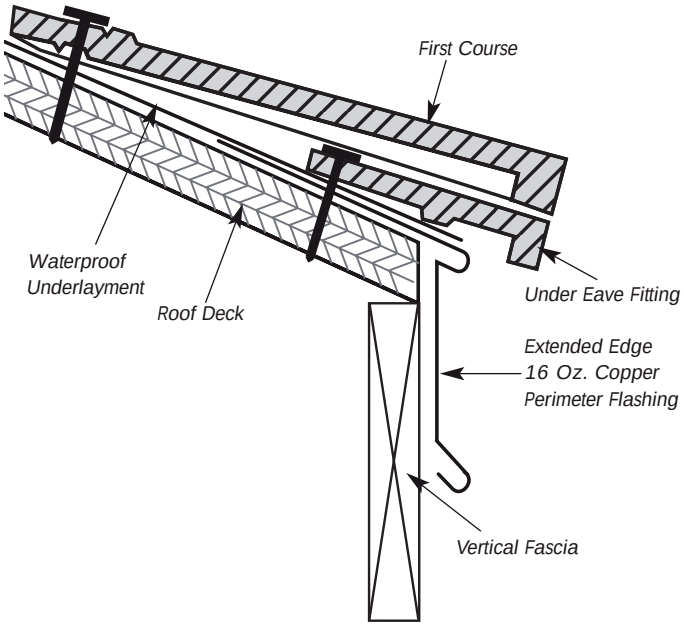


Figure 3.9 Under Eave Fitting for Starter Course Example of Interlocking Tile

Wood Nailers and Stringers

All wood stringers applied before the underlayment is applied to the roof deck must be covered with two layers of coated base sheet or a self-adhesive modified bitumen membrane. Stringers applied over the underlayment must be pressure treated and foundation grade wood. The sizes for stringers vary with tile type. Wood stringers must be a minimum of 1 1/2″ thickness and of proper height to carry hip and ridge pieces.

Specification for proper sizing of ridge stringers, hip stringers, and wood nailing strips (battens) for end bands, and field tile for covers will be addressed in the tile installation sections which follow.

6

Tile Distribution Over Deck

After all roof preparation has been completed, the tiles are evenly distributed on the roof, if pitch permits.

Note: Stacking distribution will depend on the number of tiles per square and the number of tiles per stack.

Spacing of the tiles is determined by the width of the exposed tile times the number of courses being fed per stack. If the tiles are stacked 8″ high and the tile exposure is 10″ and the stack feeds 2 courses, then the stacks would be placed 40″ O.C.

Tile stacks normally start at the third course from the eave and continue with alternate courses.

The important aspect of tile loading is to evenly spread the load across the roof using the proper spacing to assure the proper amount of tile is loaded on the roof.

Remember to utilize the color blending instructions (see Page 9).

WARNING:
Do not leave stacked tiles on the roof for extended periods of time. The concentrated load can begin to slide on the heated underlayment sheet. This sliding could cause injury to persons or damage to nearby property.

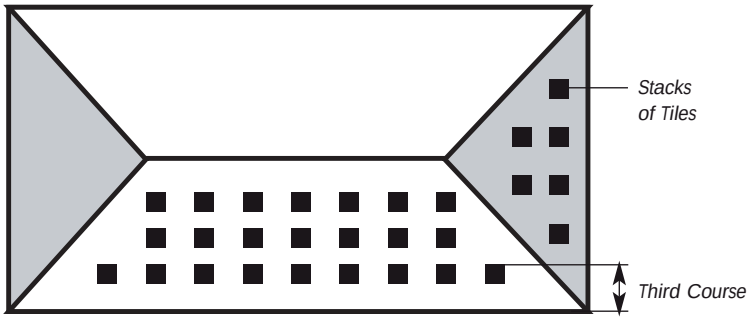


Figure 3.10 Distribution of Tile Over Roof

WARNING:
Roof Loaded Tile During Severe Weather

It is possible that strong winds could lift tiles off the piles and send them flying off the roof, resulting in injury to persons or damage to nearby property.

- *If tiles have been pre-loaded onto the roof deck and strong winds or severe storms are predicted, remove the tiles and place them on ground level.*
- *If tiles have not yet been loaded, then it is recommended not to do so until the threat of bad weather has disappeared.*

Pre-loading the roof deck with tiles prior to starting the actual installation will provide convenience and faster installation, but should only be done if weather conditions permit. Use common sense so that you do not become liable for damage or personal injury.

7 Cutting, Notching, and Drilling

Cutting

Tiles should be cut wet on the job with a masonry or tile saw equipped with a diamond blade. Segmented blades will be the most efficient. Slight surface chipping will occur during the cutting operation. The sliding saw table and tub should be as large as possible to accommodate cutting the tiles diagonally.

WARNING:
Always use protective eye and face wear when operating a masonry saw.

Ludowici tiles are extremely hard, which provides the tiles with low moisture absorption. Dry cutting techniques used on softer tile products will not work as fast with these hard tile. Dry cutting with a good segmented "turbo" diamond blade *is* possible. Best results have been obtained using a 4″ diamond tipped segmented blade mounted on a small right angle grinder motor.

Notching

One time saving option to drilling through the tiles is to notch it with the small 4″ diamond blade saw and then nail or wire in place. If using a field tile for the starter course or ridge, "dovetail" notches are cut. Make sure cuts are wide enough for nail or screw (see Figure 3.11).

Drilling

Additional nail holes may also be drilled if necessary. High torque electric drills may snap the carbide bits in the extremely hard Ludowici tile. Drills should be battery-powered, adjustable clutch-driven types. To drill out holes, the tile should be set in a pan with water to extend bit life and avoid the risk of eye injury due to fragments. Expect to drill only about 6 holes per carbide bit.

WARNING:
Dry drilling may result in serious eye injury. Always use protective eye and face wear when drilling tile.

Never use 115-240 volt AC-operated drills in water. Electrical shock could result.

Note: Unnecessary cutting and drilling time can add substantial cost to the job. Carefully consider tile layout before starting the work to minimize cutting and drilling.

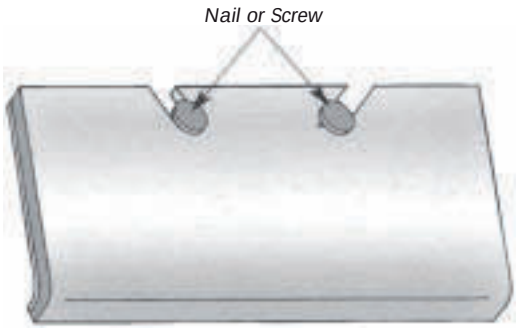


Figure 3.11 Ridge and/or Under Eave Course Notched and Fastened

Installing the Flashing

IMPORTANT:
Where roofs intersect other roofs, parapet walls, chimneys, ventilators, vent pipes and similar projections, flashings are required. There is a natural weakness at these intersections and properly installed flashings are required to make the intersection watertight. Contraction and expansion due to temperature changes contribute to the weakness, so it is extremely important to correctly design and install the flashings and to use durable flashing material (a minimum of 16 oz. sheet copper is recommended).

General flashing details are shown in this section but many more exist for each particular situation which cannot be covered in the context of this tile installation manual. Proper flashing installations are critical for a watertight roof.

1 Eave Flashing

Where eave metal flashing is used, it should be formed using a minimum of 16 oz. sheet copper with a drip edge along the bottom to allow water to drip off the edge of the roof. See Figure 4.1.

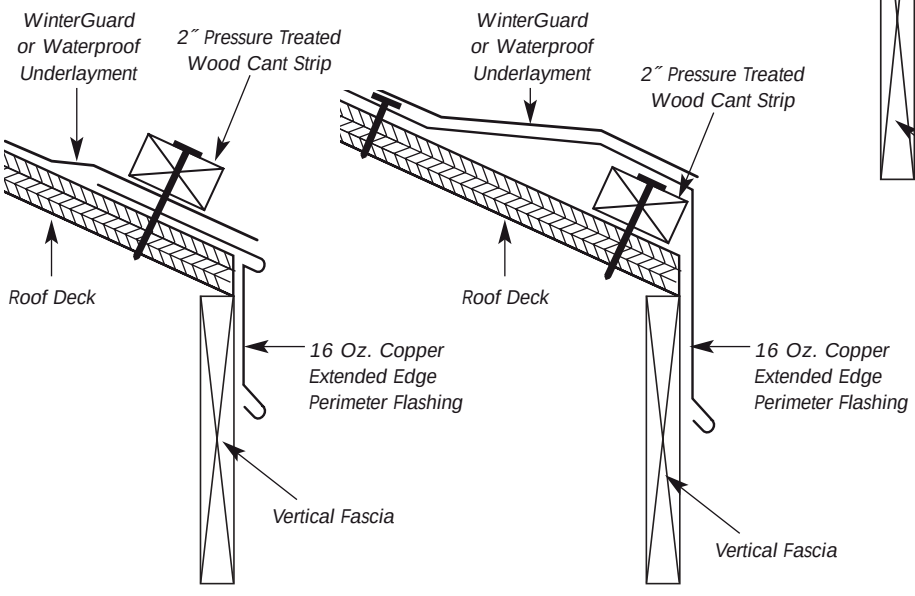


Figure 4.1 Perimeter Flashing with Cant Strips

2 Rake Edge Flashing

Usually rake edge flashing is NOT specified since Ludowici has specific rake tiles to finish the gable rakes. If a rake edge flashing is required, a formed, 16 oz. or heavier copper flashing should be installed to serve as a drip edge and as a finished edge.

The gable flashing is to be installed over the waterproof underlayment. The flashing must extend 5˝ onto the deck and must have a 1/2˝ hemmed edge (see Figure 4.2). At the edge of the roof deck, the flashing is to extend up (perpendicular to the deck) 2˝ and back down at least 5 1/2˝ along the gable fascia board with a 1/2˝ crimp at the bottom edge to serve as a drip edge. The gable flashing pieces are to lap each other to form an overlap of at least 4˝.

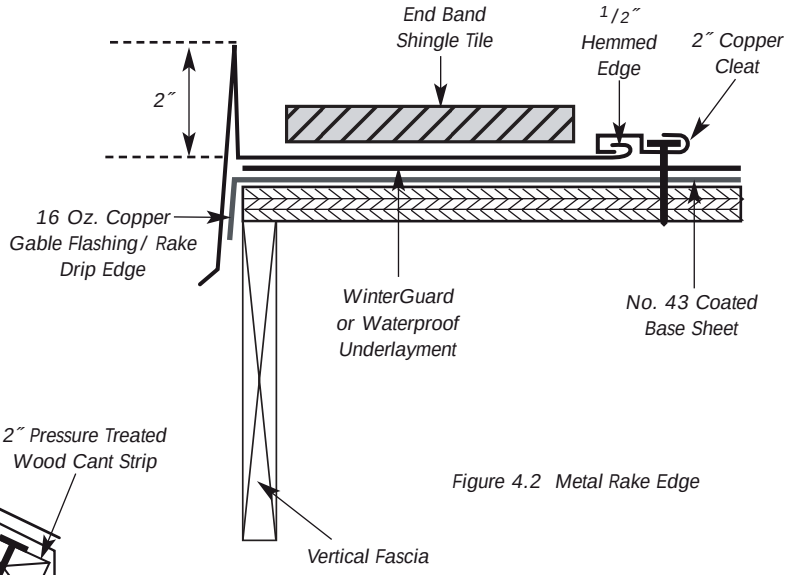


Figure 4.2 Metal Rake Edge

3 Flashing at Valleys

Valleys, since they collect the water runoff from the portions of the roof sloping into them, are particularly prone to water migration and leakage. A clear and unobstructed pathway for quick water drainage is essential in valleys. There are two basic types of valleys in tile roof installation: open and closed valleys.

Open Valleys

In an open valley construction the tiles are held back from the center of the valley to expose the copper flashing. The advantage of an open valley is that it permits unobstructed drainage. Open valleys are recommended in areas with surrounding foliage where the leaves, needles, and other debris can fall on the roof and potentially slow or block the runoff of water from the roof (see Figures 4.3 and 4.5).

The valley metal is to be secured with approved fasteners. At no time are nails to be placed in the area of the valley that will be carrying water.

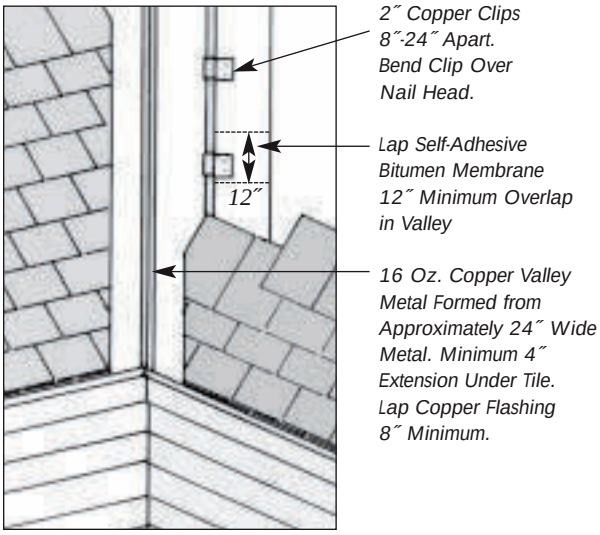


Figure 4.4 Typical Open Valley Flashing for Shingle Tile

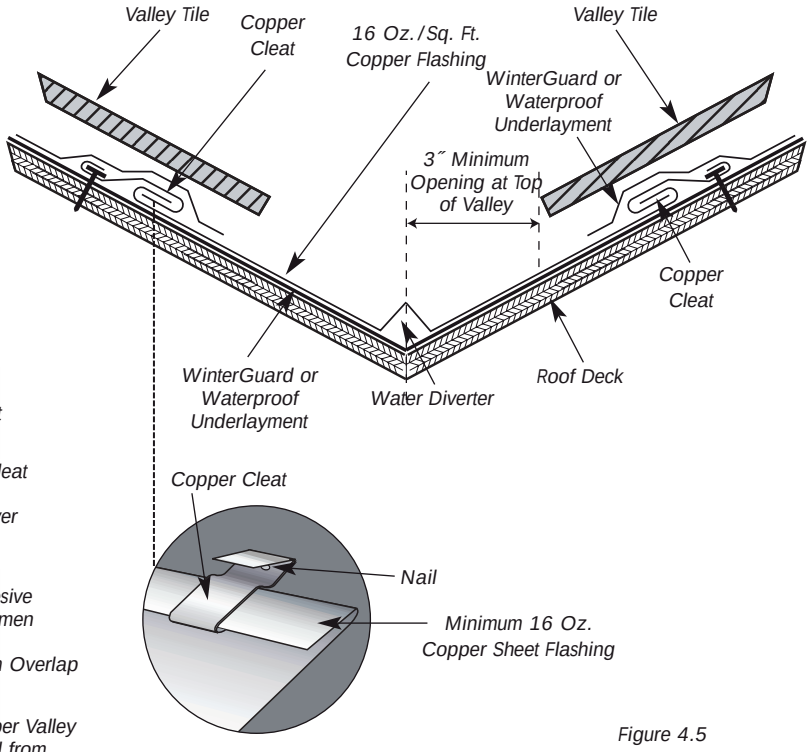


Figure 4.5
Cross Section Showing Valley Flashing on Wood Roof Base

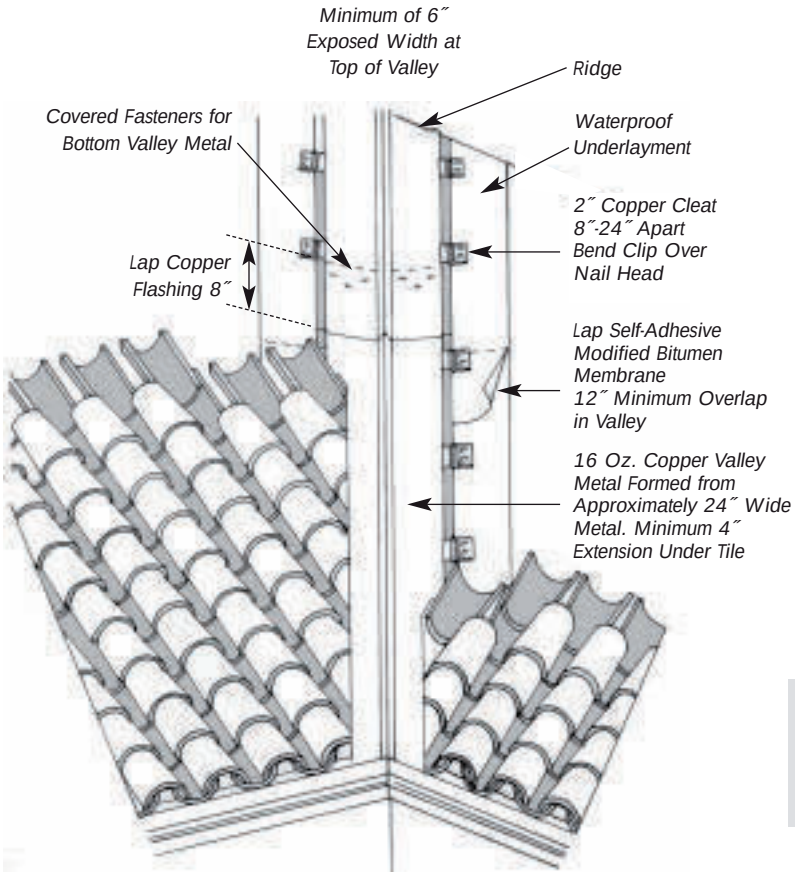


Figure 4.3 Typical Open Valley Flashing for Pan and Cover Tiles

IMPORTANT:
Metal exposure width shall increase 1˝ for every 8 feet of valley run towards the eave.

Closed Valleys

In a closed valley, the tiles from the adjoining roof are mitered and abutted. Since water migrates through a closed valley onto the sheet copper flashing which carries the runoff, this type of construction is considered decorative. Closed valleys should not be used where foliage debris can fall onto the roof. Another area where it is strongly discouraged is where the rafter length or pitch varies on adjacent roof planes. It is important that corresponding courses align coming into the valley.

Note: Underlayment for all valleys must be a full width sheet (36″) of two layers of No. 43 coated base sheet or a layer of self-adhesive modified bitumen membrane. Each course from the adjoining fields must overlap the valley underlayment by at least 12″.

All closed valleys should be step flashed with a 16 oz. copper sheet, at least 24″ wide with a 1/2″ edge turned over and fastened with cleats. Joints should be lapped at least 8″, but not soldered.

IMPORTANT:
Fasteners must never penetrate valley flashings. Cut valley tiles must be notched (existing holes can also be used) and wired to fasteners driven into the deck beyond the flashing (see Figure 4.8).

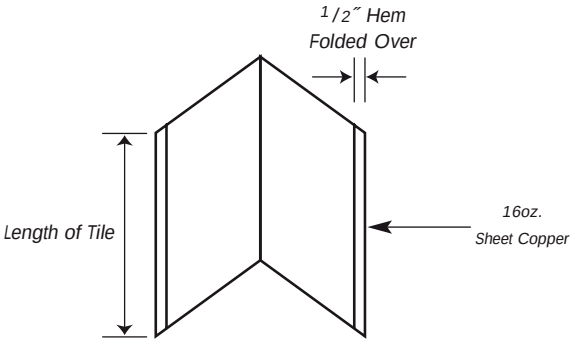


Figure 4.6 Closed Valley Flashing Pattern Using Standard Exposure

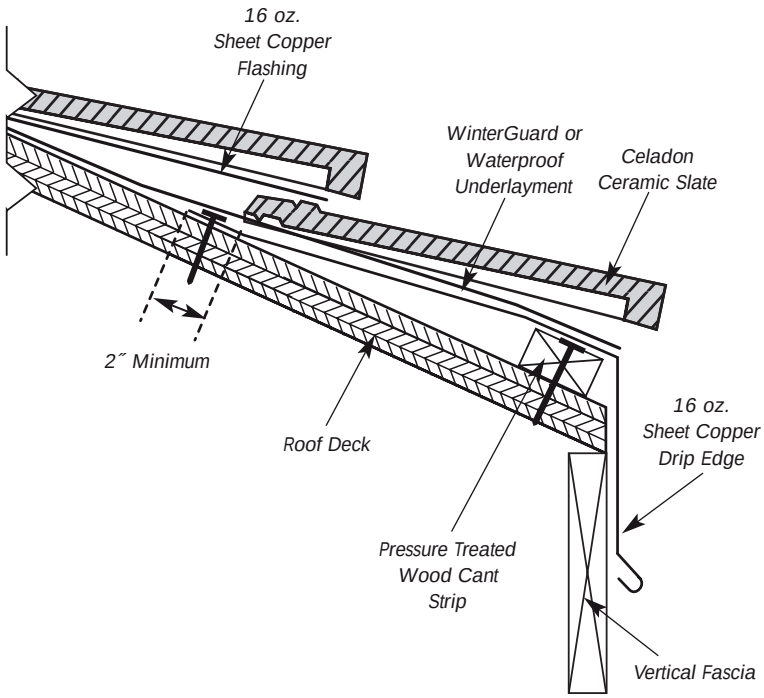


Figure 4.7 Section of a Closed Valley

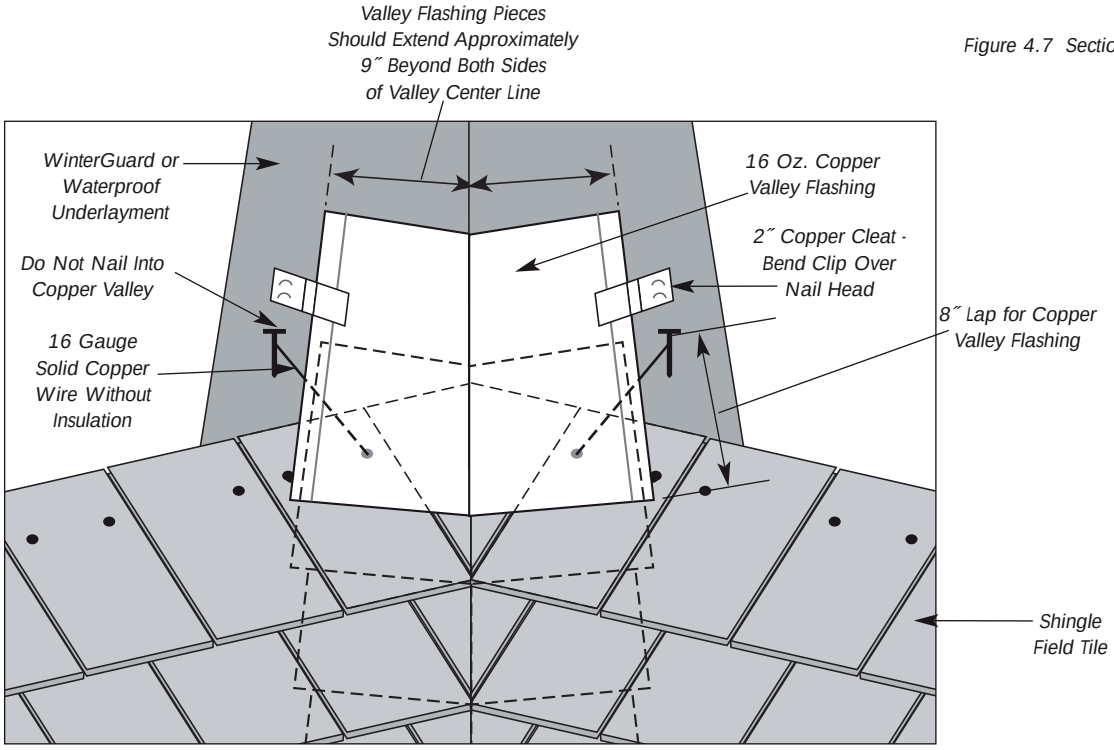


Figure 4.8 Typical Closed Mitered Valley for Flat Shingle Tile with Stepped Flashing

4 Flashing at Vertical Walls

Two methods of flashing at vertical walls are typically used: step flashing and channel or pan flashing. Generally, step flashing is used with flat tiles and channel flashing with pan and cover tiles.

Step Flashing

In the step method of flashing, individual 16 oz. sheet copper flashing is applied between each course of tile. A minimum head lap of 3″ must be provided from step flashing to step flashing. See Figure 4.9.

The following criteria should be used to determine the appropriate size for step flashing:

1. The step flashings should have a minimum of 3″ overlap over each other.

2. The step flashing should extend up the vertical surface a minimum of 4″ and a minimum of 2″ overlap of the siding, cladding or copper counterflashing.

3. The step flashing should extend a minimum of 5″ onto the roof so that there is at least a 5″ overlap of the underlying tile.

4. The flashing should be at least 16 oz. sheet copper.

Channel or Pan Flashing

Channel or pan flashing, used with profile tiles, is designed to extend under the tiles rather than being interwoven between courses. See Figure 4.10.

The following procedures are used to install channel or pan flashing:

1. Waterproof underlayment should extended 6″ up the vertical wall.

2. The copper flashing's vertical flange should extend approximately 4″ up the wall.

3. Each length of copper channel flashing should extend a minimum of 8″ over the underlying length of copper channel flashing.

4. The copper flashing channel should extend a minimum of 3″ under the tile.

5. The copper flashing should be fastened through the vertical flange, near the upper portion at approximately 12″ on center. (The flashing channel should not be penetrated with fasteners since it is acting as a gutter.)

6. The wall underlayment and the siding or cladding should be brought down a minimum of 2″ over the upper portion of the vertical flange.

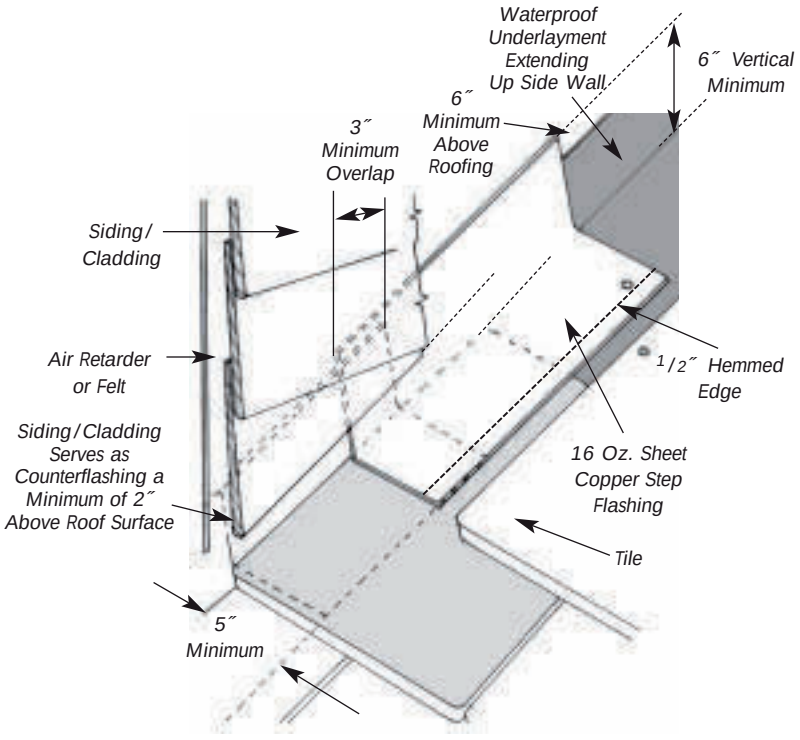


Figure 4.9 Copper Step Flashing with Flat Shingle Tile

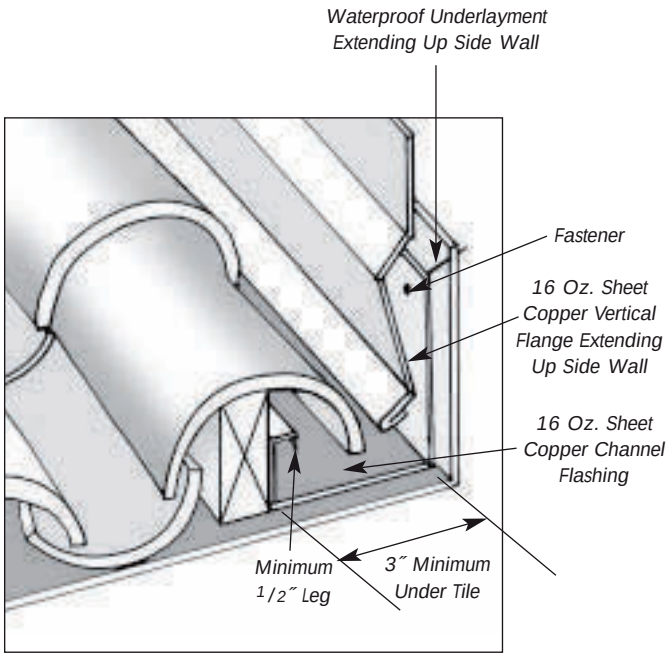


Figure 4.10 Channel Flashing with Pan and Cover Tile

5 Flashing at Open Valley at Main Roof to Dormer Juncture

For flashing where an open valley occurs at the intersection of a dormer roof and the main roof, the following steps should be taken.

1. The main roof tiles should be installed to just above the lower end of the valley, where the valley and the main roof intersect. Along the roof/wall juncture, step or channel flashing must be used and the last tile in the course should fit closely against the wall of the dormer. See Figure 4.11.

2. The bottom end of the copper valley flashing should be cut so that it extends 1/2″ below the down-slope edge of the dormer roof deck at the bottom of the valley. This lower cut edge should project a minimum of 2″ below the intersection of the dormer and main roof.

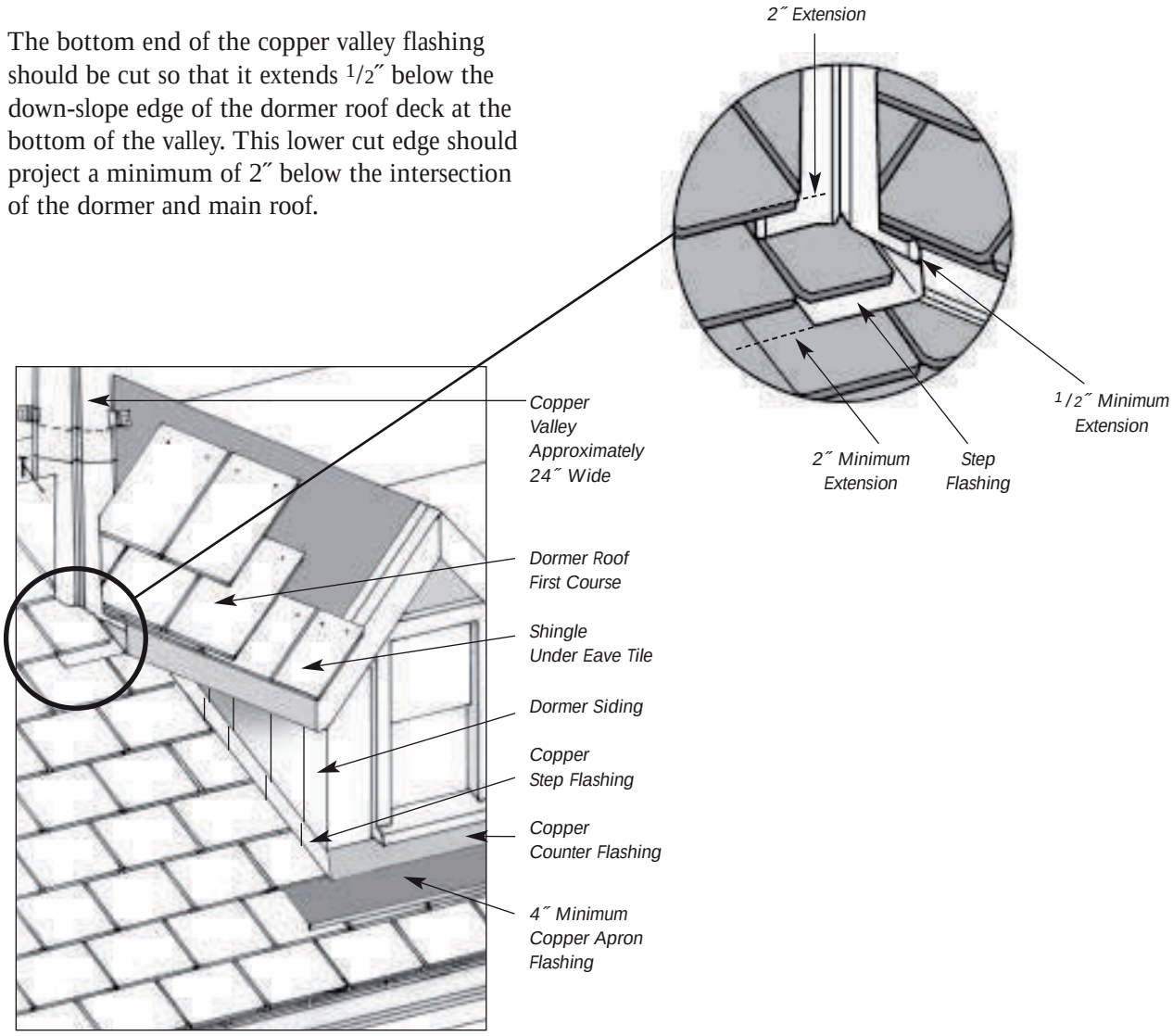


Figure 4.11 Open Valley at Main Roof to Dormer Juncture with Flat Shingle Tile

6 Flashing at Chimney

Since the foundations of chimneys are usually structurally separate, the flashing around chimneys needs to be able to accommodate movement from differential settlement without compromising the watertightness of the roof. Regardless of the climate, install WinterGuard or self-adhesive modified bitumen membrane around the base of the chimney before the underlayment is applied as a protection against ice dams. Four types of flashing are required to properly flash around chimneys.

1. Apron flashing at the downslope face over the installed tiles – 4″ minimum exposed width, 6″ up the face of the chimney and continuously counterflashed.

2. Step flashing (for flat tiles) or channel flashing (for profile tiles) along the sides of the chimney. Use the details from Figures 4.9 or 4.10, Page 24.

3. Cricket or backer flashing on the upslope side or back.

4. Continuous counterflashing embedded in masonry joints.

Counterflashing

Sheet copper counterflashing should be installed to overlap all vertical flashing flanges extended up the sides of chimneys. This is best accomplished by the mason during construction. See Figure 4.12.

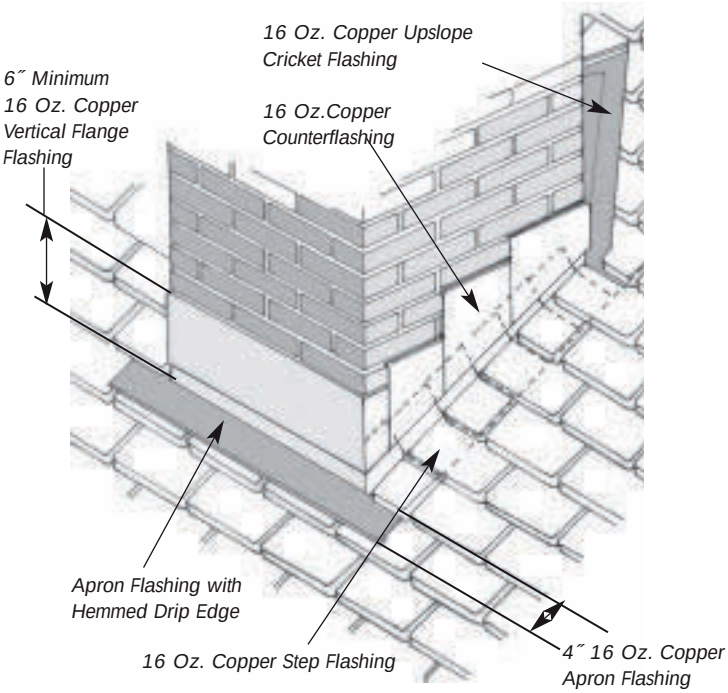


Figure 4.12 Chimney Flashing with Shingle Tile

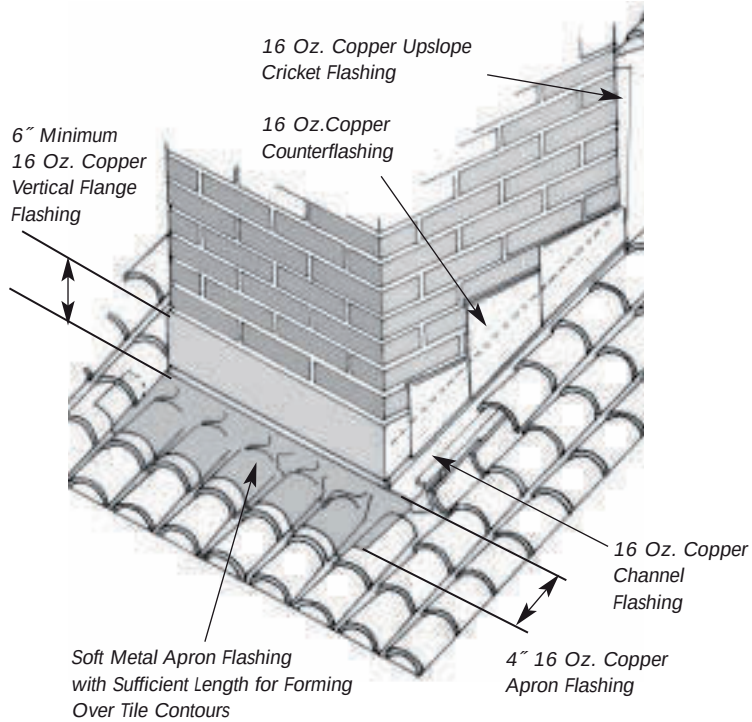


Figure 4.13 Chimney Flashing with Mission Tile

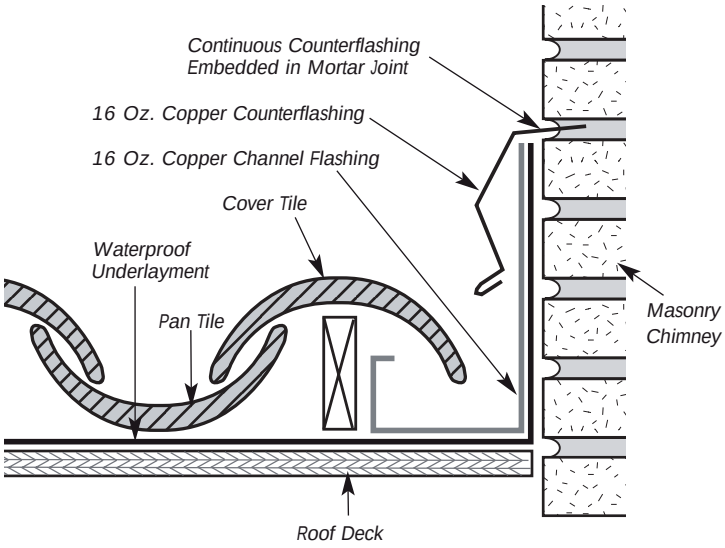


Figure 4.14 Examples of Counterflashing in Mortar Joint

Note: A cricket is required to direct water runoff around the upslope side of the chimney.

7 Additional Flashing Details

Plumbing pipe vents and stacks, skylights, roof-to-roof transition, and other penetrations all require special flashing.

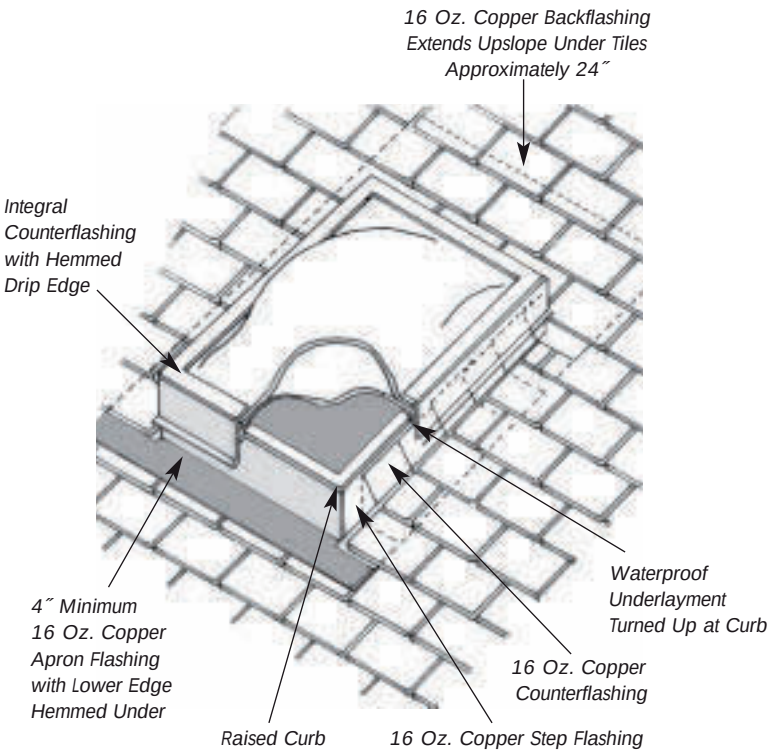


Figure 4.15 Flashing at Skylights

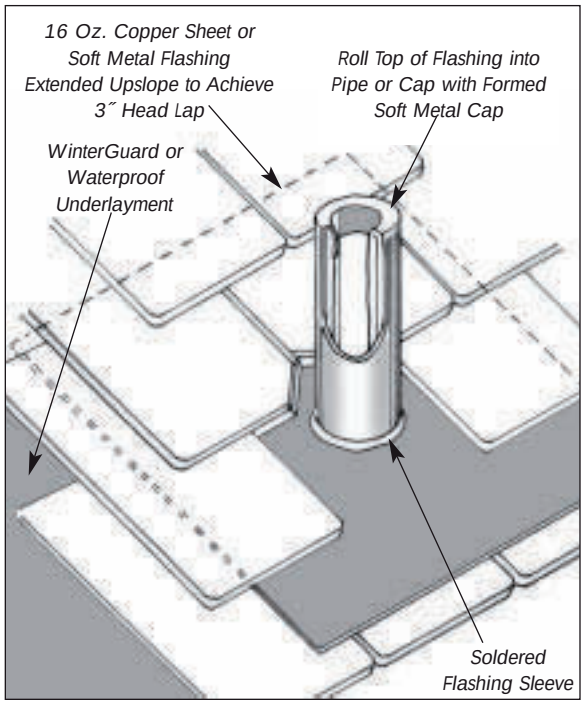


Figure 4.16 Pipe Penetration Flashing for Shingle Tile

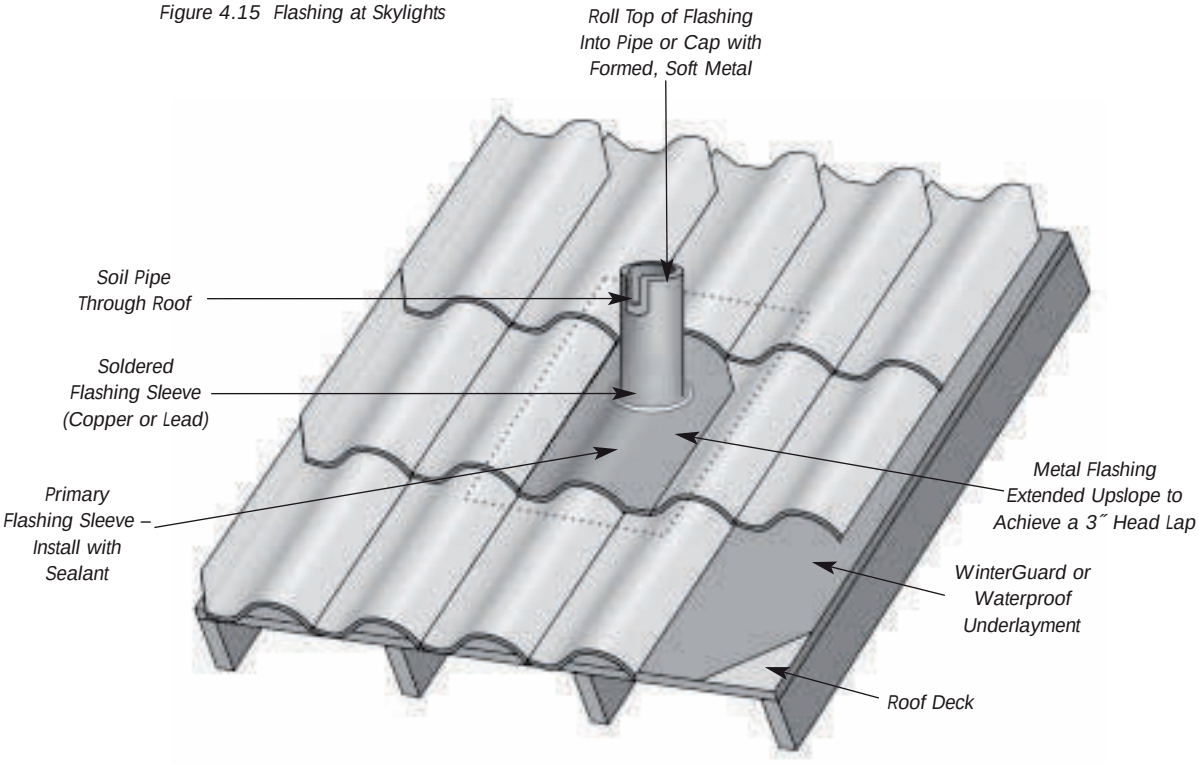


Figure 4.17 Pipe Penetration Flashing for Spanish Tiles

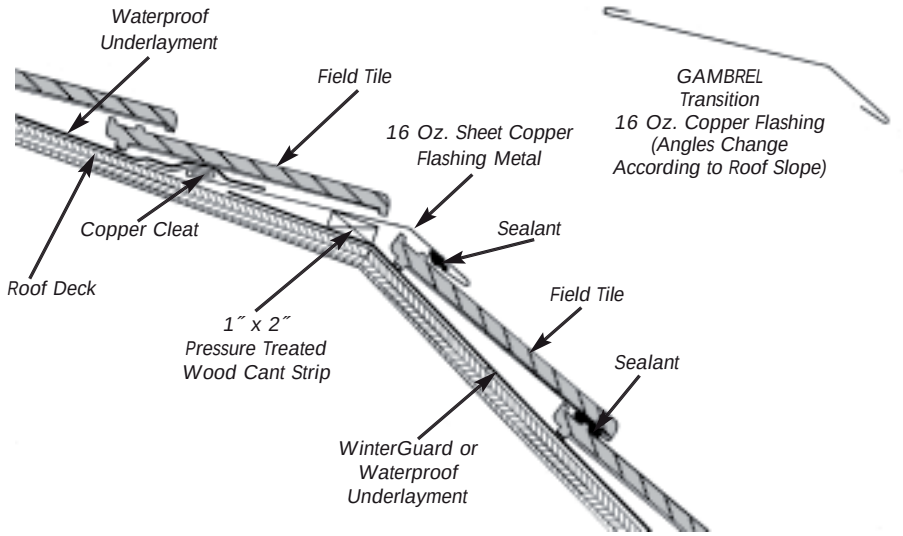


Figure 4.18 Flashing at High Slope to Low Slope (for Interlocking Tile)

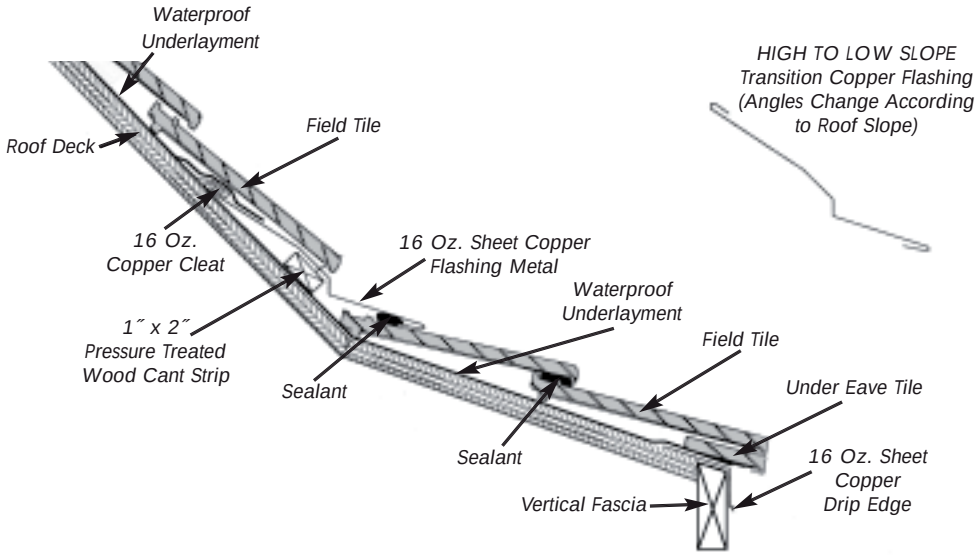


Figure 4.19 Flashing at Low Slope to High Slope (for Interlocking Tile)

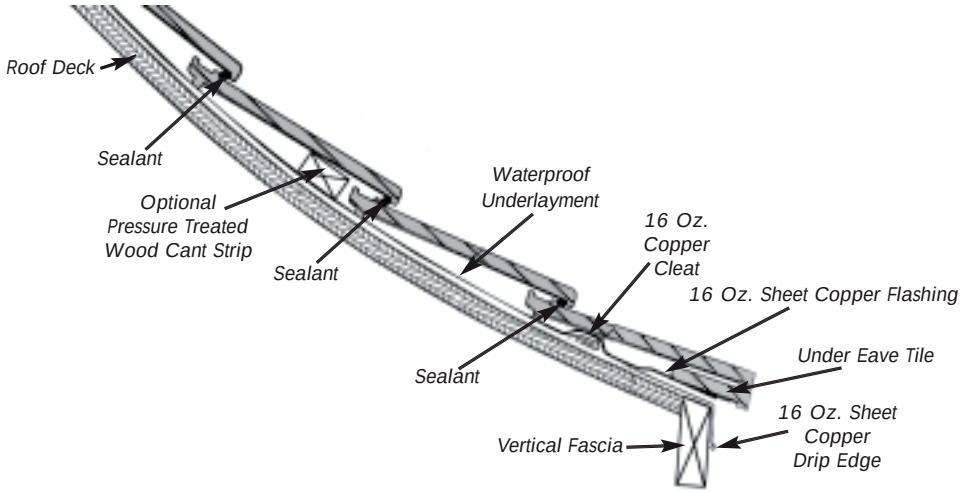
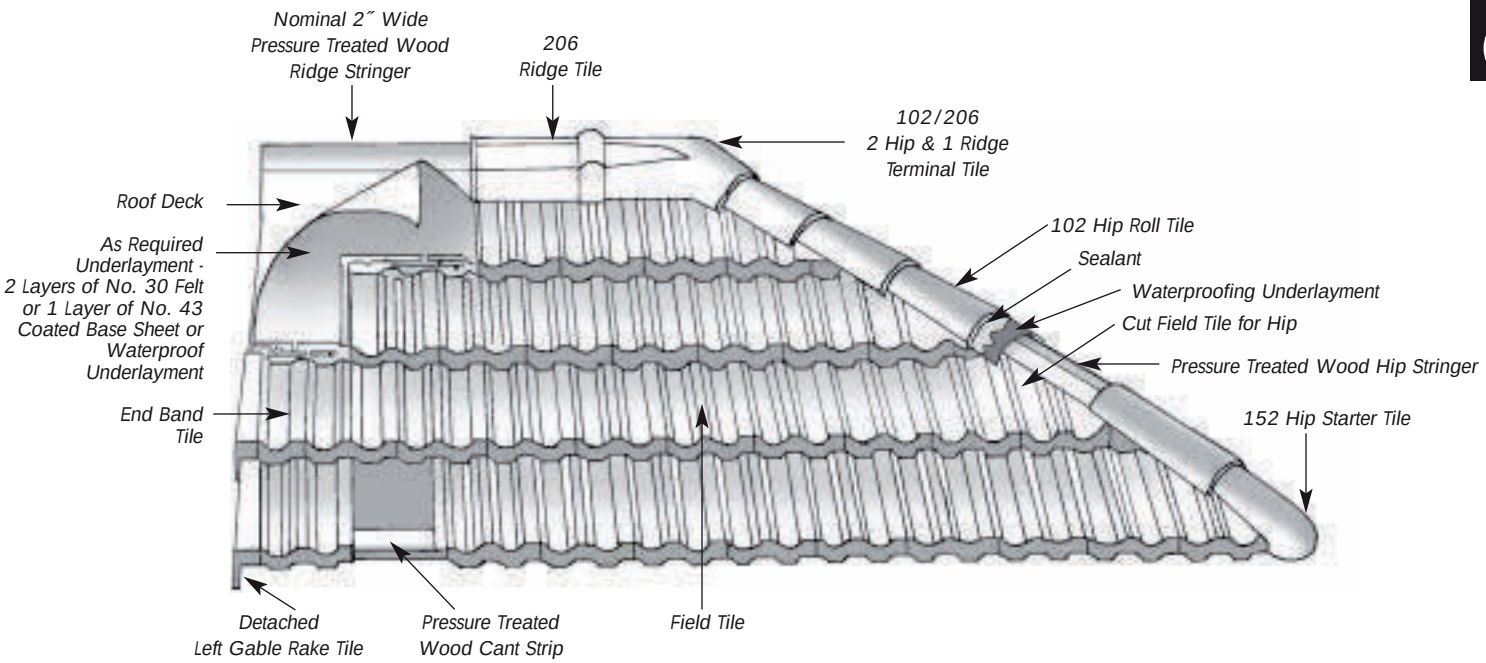


Figure 4.20 Flashing to Curved Rafter (for Interlocking Tile)

French Interlocking Profile Tile Installation



IMPORTANT:
Before starting tile installation, it is important that the roofer understand how the French Interlocking Profile tile pattern being installed relates to the roof design.

The following roof preparations must be completed before installing any roof tile.
For detailed information on these items refer to the previous sections in this book or the NRCA Manual on Steep Roofing.

- The flashings required for ensuring watertightness:
  - Eave Flashing
  - Valley Flashing
  - Dormer and Sidewall Flashing, Skylight Flashing, Chimney and Cricket Flashing
  - Vent Flashing
- Underlayment for the entire roof deck, including the appropriate waterproof underlayment required for all flashing, and, where required, the ice dam membrane
- Roof surface chalked with vertical and horizontal lines

Note: French Interlocking Profile Tiles utilize detached rake edge tile for both the right and left sides of the gables. Therefore, rake edge flashing is not required when these tiles are used. An attached rake tile can also be used if specified by the architect and custom ordered from the factory.

Instructions Specific to Installing French Interlocking Profile Tile

1 French Interlocking Profile Tile Cant Strips

Cant strips for Ludowici French Interlocking Profile tile are required at the eave line to provide the proper angle for the starter course. The cant strip nominal dimensions should be 1 1/2˝ x 2˝ with a maximum length of 48˝. Cant strips must be spaced 1/2˝ between ends.

Note: Reference Page 16 for additional French Tile statistics.

If the cant strip is to be installed **directly to the underlayment**, they are to be pressure-treated, foundation-grade wood and have a 1/2″ gap between ends of the 48″ cant strips.

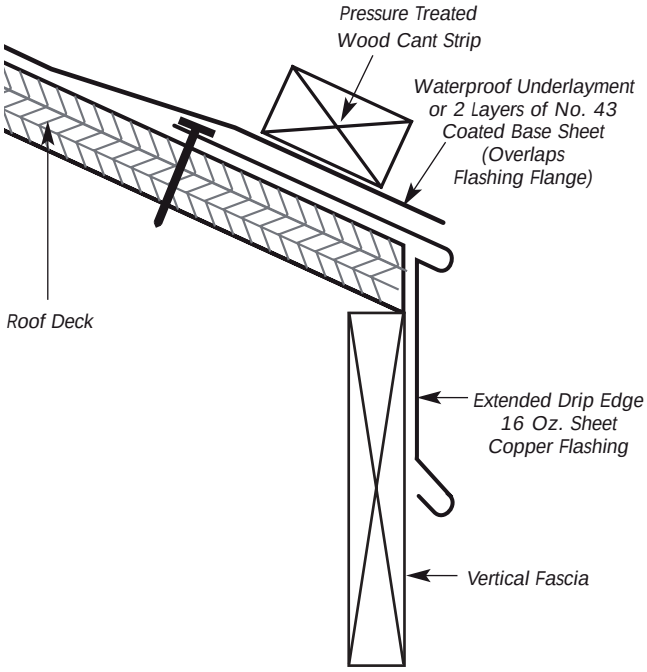


Figure 7.1
1 1/2″ x 2″ Cant Strip Installed Directly to the Underlayment

If the cant strip is installed **directly to the wood decking**, refer to Figure 7.2 for proper installation details.

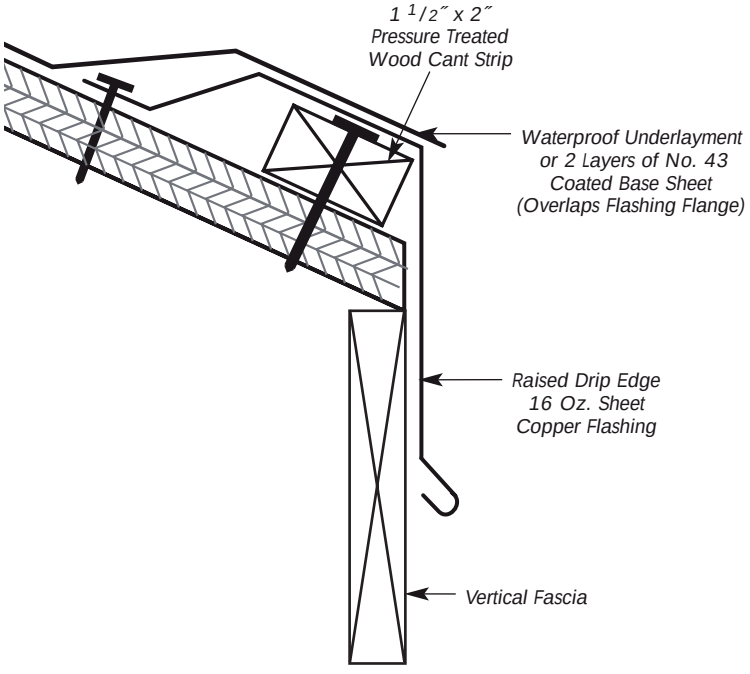


Figure 7.2
1 1/2″ x 2″ Cant Strip Installed Directly to the Wood Deck

2 Hip and Ridge Stringers

French Interlocking Profile tile typically use Hip and Ridge tiles to complete the roof and are installed on nominal 2″ wide wood stringers. All stringers should be pressure and treated foundation-grade wood and should be 36″ wide, self-adhesive modified bitumen membrane, such as CertainTeed WinterGuard, or 2 layers of No. 43 coated base sheet. Consult Chart 7.1 to determine the correct height of the nominal 2″ wide stringer for the hip and ridge tile to be used. Roof pitches exceeding 15″ rise to 12″ run requires the contractor to measure the roof for stringer height.

Chart 7.1: Hip and Ridge Stringer Heights

Roof Pitch	102 Hip	206 Ridge
4″ Rise to 12″ Run	4 3/4″	5 1/4″
5″ Rise to 12″ Run	4 5/8″	5″
6″ Rise to 12″ Run	4 5/8″	4 3/4″
7″ Rise to 12″ Run	4 1/2″	4 1/2″
8″ Rise to 12″ Run	4 1/2″	4 1/4″
9″ Rise to 12″ Run	4 3/8″	4″
10″ Rise to 12″ Run	4 3/8″	3 3/4″
11″ Rise to 12″ Run	4 1/4″	3 1/2″
12″ Rise to 12″ Run	4 1/4″	3 1/4″
13″ Rise to 12″ Run	4 1/8″	3″
14″ Rise to 12″ Run	4 1/8″	2 7/8″
15″ Rise to 12″ Run	4 1/8″	2 5/8″

3 First and Succeeding Courses of Tile

French Interlocking Profile clay tile are laid over the cant strip from right to left. The starting course begins with the right detached gable rake which is positioned to provide a 2˝ overhang at the eave. The detached gable rake serves as a flashing detail for the rake edge and is available in left- and right-hand versions. These tiles shall be installed with the fasteners typical to the field tile installation, but the proper installation requires flashing cement (meeting requirements of ASTM D-4586) applied between the contact areas of the field tile and the gable rake. The gable rakes to the right, when looking at the eave courses attaching to the field tiles, are the rights and vise-versa.

After installing the right detached gable rake, the starter course will begin with a full tile. See Figure 7.3.

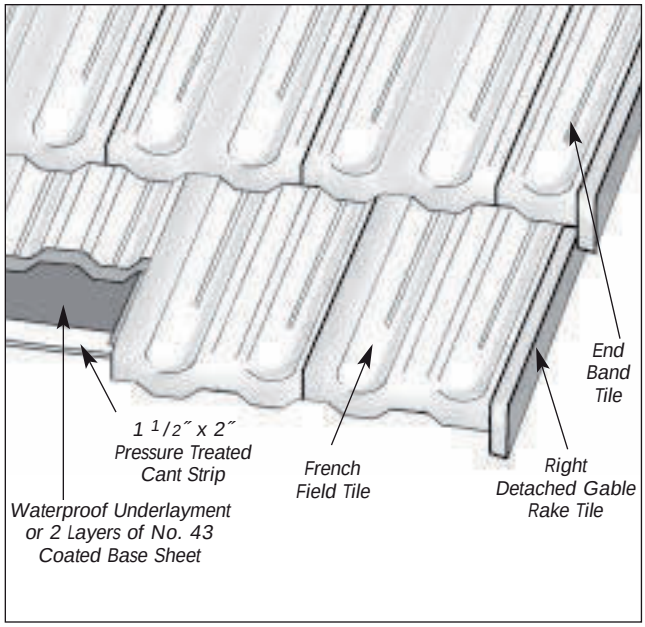


Figure 7.3 First and Succeeding Course for Interlocking Profile Tile

Note: Each profile interlocking field tile is provided with (1) one fastening hole. When installing field tiles or accessories, care should be taken to fasten each tile with nails or screws in every provided fastening hole.

The second course will be started with an end band (half tile) and will be laid to provide the proper vertical exposure and will provide a normal head lap of 3 1/8˝. This is continued through each successive course. All joints of the second course and succeeding courses should be at the center line of the previous course. If the French Interlocking Profile tile are to start at a valley, it is suggested to lay the tile loose across the slope on the cant strip to determine what adjustments, if any, are needed in the course before nails or screws are installed. See Section 5. Valley Tiles, Page 56, for more valley installation information.

4 Points to Remember During Tile Installation

Tile installation will generally progress in a diagonal fashion, moving from the right to left. The installer applying the lower course will always be to the left of those applying succeeding courses.

- Use the chalk lines as a guide.
- Watch for any irregularities in the roof deck construction.
- After the installation of about 75-100 tiles, the roof should be inspected from the ground at a distance greater than 40 feet to determine that there are no streaks or blotches. To ensure a good range of tones, this inspection must be done at regular intervals.
- When each course is 10 to 12 tiles from the terminating end, compare the remaining distance to the width of the tiles to determine if a slight crowding or stretching of the tile may be required to ensure the last piece in the course is an end band (1/2 tile) or a full tile. DO NOT crowd or pull to the extremes any more than 5 or 6 pieces positioned side by side.

5 Valley Tiles

Tiles to be installed in valleys can be mitered in the field or by ordering and using special factory cut and closed valley tiles. These special cut and closed valley tile generally result in less water entering underneath the tile. Whether field miter cut or factory cut and closed valley tiles are used, the tile fasteners should never penetrate the valley flashings. Tile to be installed over the copper valley flashing should be drilled or notched and wired with solid 16 gauge wire to fasteners driven into the deck beyond the flashing. See Figure 4.6, Page 23.

Note: In situations where valley tile pieces are so small that it is not practical to notch or drill, use the adhesive RT600 (an OSI product) or its equivalent.

If special factory closed valley tile are being applied prior to installation, it will be beneficial to loose lay the entire eave field tile course including the valley tile. This loose laying process of the valley's left side will advance as a typical installation would, from right to left. But, when loose laying the valley's right side, it will advance from left to right.

Once the spacing is approved, the tiles can be fastened in the typical right to left pattern.

The loose laying process becomes vitally important when the roof deck runs from valley-to-valley. The focus must be to space the eave course so it consists of all full field tile and is finished on both ends with the special cut valley tiles or so it consists of all full field tile, one end band (half tile) and is finished, as stated above, with the special cut valley tiles. Keep in mind not to allow any more than 5 pieces pulled to the extreme or crowded together. When the distance between valleys is so minimal it does not allow for the above mentioned spacing, one field tile per course will require field cutting to allow for proper lay up.

If field mitered valley tiles are applied, they should be trimmed to provide a clean, even, continuous edge along the entire valley length.

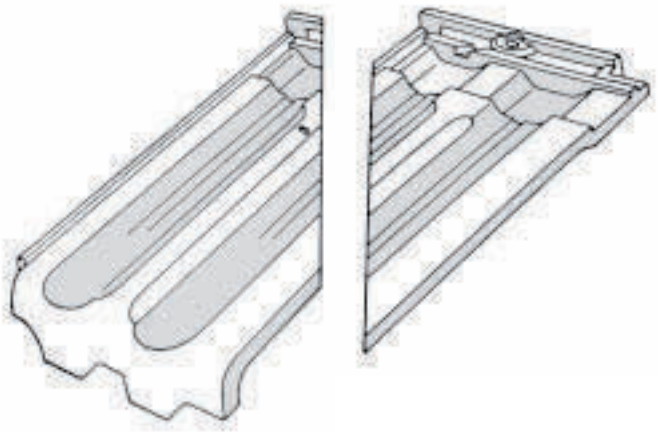


Figure 7.4 Cut Hip - Left and Cut Valley - Right

6 *206 Ridge Tile*

The ridge for French Interlocking Profile Tile is finished with a 206 Ridge Tile.

See Chart 7.1 for sequence of installation and dimensions of the stringers required.

Flashing cement must be used at the overlap of each ridge tile and where they rest on the field tile. Closed 206 Ridge pieces or 102/206 Hip and Ridge terminals are used to start and finish the ridge. The ridge finisher will have an exposed fastener which should be sealed with flashing cement meeting the requirements of ASTM D-4586. Some roof termination may require a combination of typical flashing details or a special tile piece. Consult the local Ludowici sales representative with the projects special roof requirements.

Note: It may be beneficial to lay out the chosen ridge system on the stringer to determine lap (no less than 2″). This will prevent having to traverse the installed tiles later.

Applying ridge tiles with the lap facing away from the prevailing winds helps the tile shed wind-driven rain.

Note: 206 Ridge tile is available in a vented version. See Figure 7.5.

Figure 7.5 206 Vented Ridge Vent

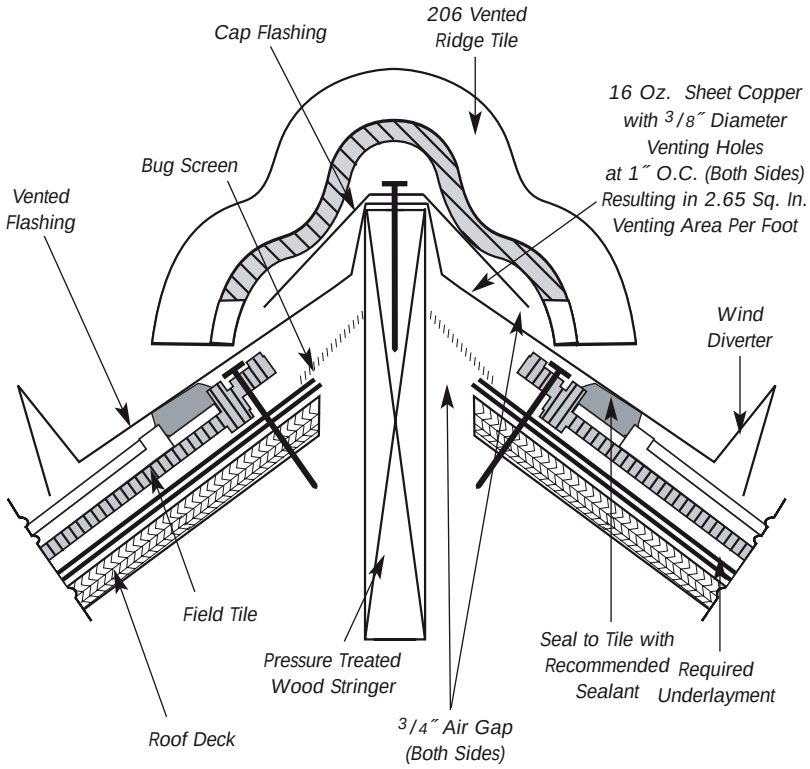


Figure 7.6 206 Vented Ridge Vent

Hip Tile

The hip area is finished by using the 102 Hip style tiles.

Hips are started with a 152 Hip Starter tile covering the field tile approximately 3″ on both sides. The 102 Hip Roll Tile is then installed by creating an approximate 2″ head lap on the 152 Hip Starter tile. This 2″ head lap is continued up the hip and flashing cement is used at each hip tile overlap, where the hip tile join the field tile, and at the hip stringer. The last fastener on the upslope end of the hip is typically covered with a 102/206 Hip and Ridge Terminal which must be specified as a starter or finisher depending on the direction of the ridge layout. Some roof termination may require a combination of typical flashing details or a special tile piece. Consult the local Ludowici sales representative with the project's special roof requirements.

7 Accessory Pieces

Standard Fittings

Standard tile fittings are manufactured for each style of field tile. These tile fittings provide better protection against water penetrating beneath the tile than field mitered pieces. Charts 7.2 and 7.3 provide overall lengths, standard exposures, weights, and pieces per box of these standard accessories.

Custom Fittings

All custom fittings are special order to specifications. Ludowici creates custom fittings from design sketches using Computer Aided Drafting (CAD) technology and company artisans who craft the tiles by hand.

Chart 7.2: Field Tile Accessories

Tile Type	**End Band** 	**Detached Gable Rake Right and Left (Left Shown)** 
Actual Size	16 1/4″	16 1/4″
Exposure	13 3/8″	13 3/8″
Pieces/Box	32	32
Weight	5.7 lbs./ft.	2.9 lbs./ft.

Chart 7.3: 102 & 206 Hip and Ridge Accessories

Tile Type	**102 Hip Roll** 	**152 Hip Starter** 	**206 Ridge** 	**206 Closed Ridge End* (Starter Shown)** 	**102/206 Terminal Regular 2H - 1R* (Starter Shown)** 
Actual Size	14 1/4″	14″	13 3/4″	14″	—
Exposure	12″	12″	12″	12″	—
Pieces/Box	30	4	12	2	2
Weight	5.2 lbs./ft.	6.3 lbs./pc.	11.5 lbs./ft.	18.0 lbs./pc.	17.0 lbs./pc.

*Starters and Finishers available, specify pitch of all sides of roof.

Architectural Details of Ludowici French Tiles and Fittings

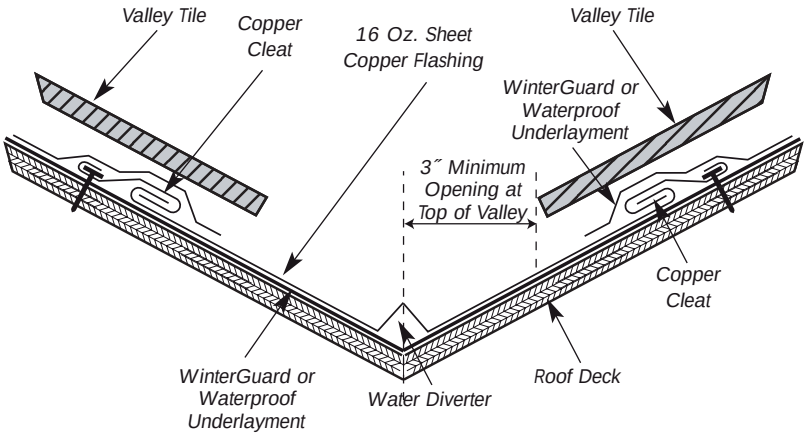


Figure 7.7 Cross Section Showing Valley Flashing on Wood Roof Base

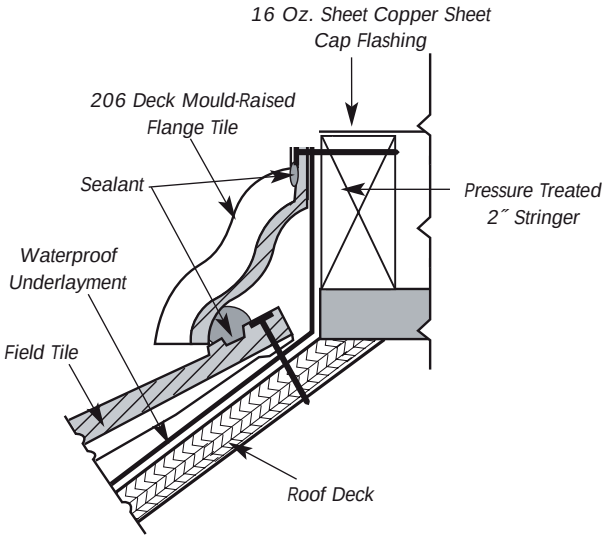


Figure 7.8 Deck Section Showing 206 Deck Mould-Raised Flange Tile

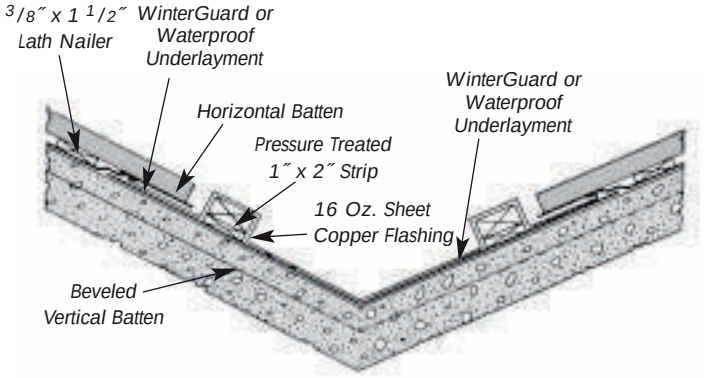


Figure 7.9 Section Showing Valley Flashing on Poured Concrete Roof Deck

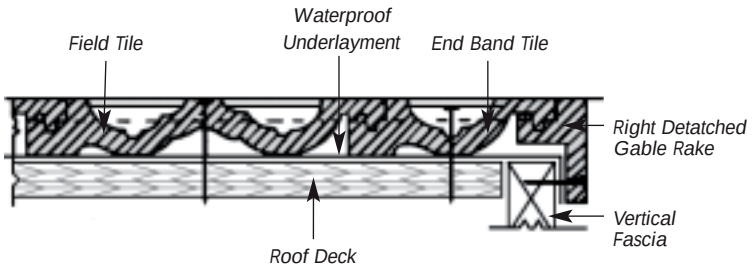


Figure 7.10 Section Showing Right Gable Rake and End Band

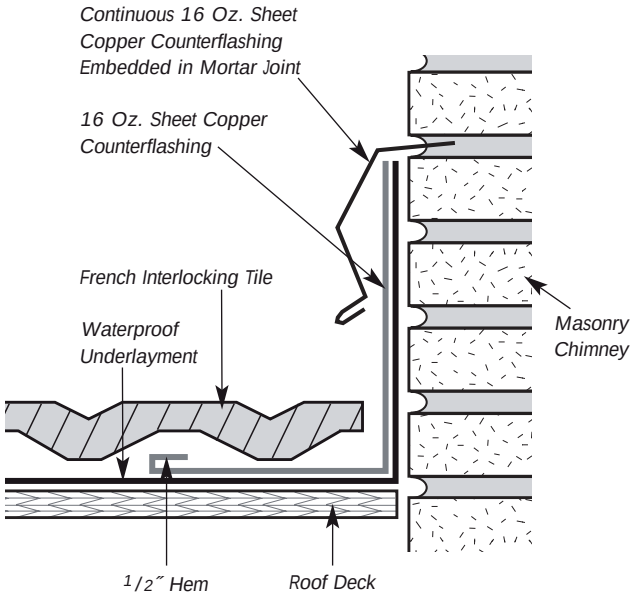


Figure 7.11 Section Showing Flashing Under Side of Tiles

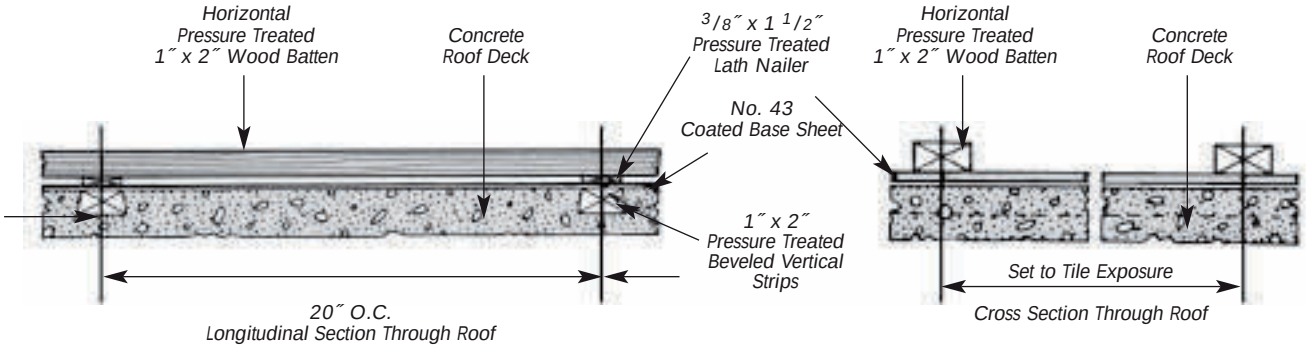


Figure 7.12 Application of Batten System to Poured Concrete Roof Deck

Architectural Details of Ludowici French Tiles and Fittings

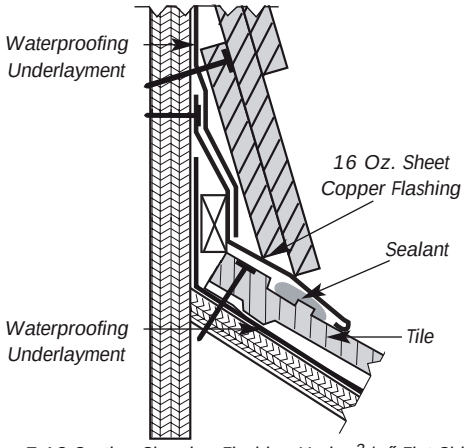


Figure 7.13 Section Showing Flashing Under 3/8˝ Flat Shingle Tiles

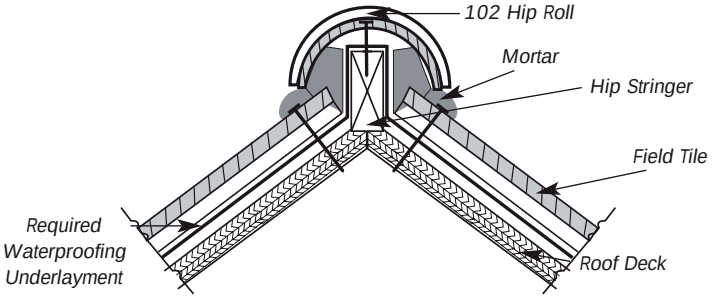


Figure 7.14 Hip Section Showing 102 Hip Roll

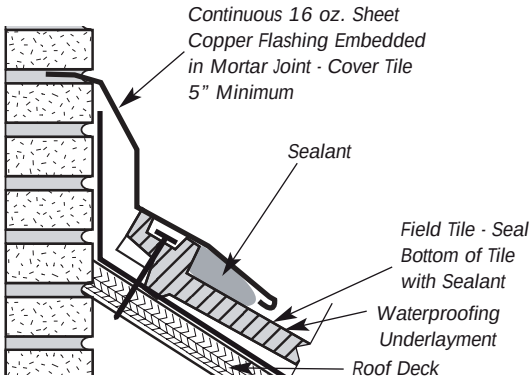


Figure 7.15 Section Showing Flashing Over Top of Tiles

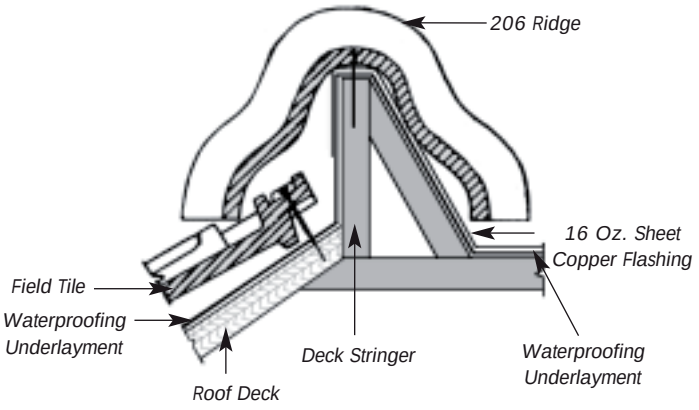
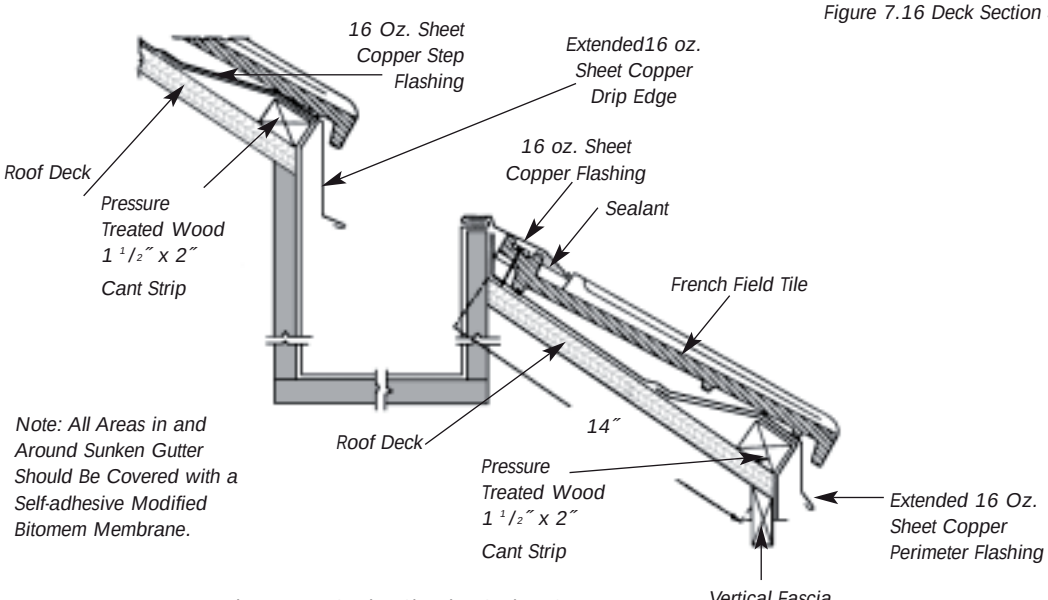


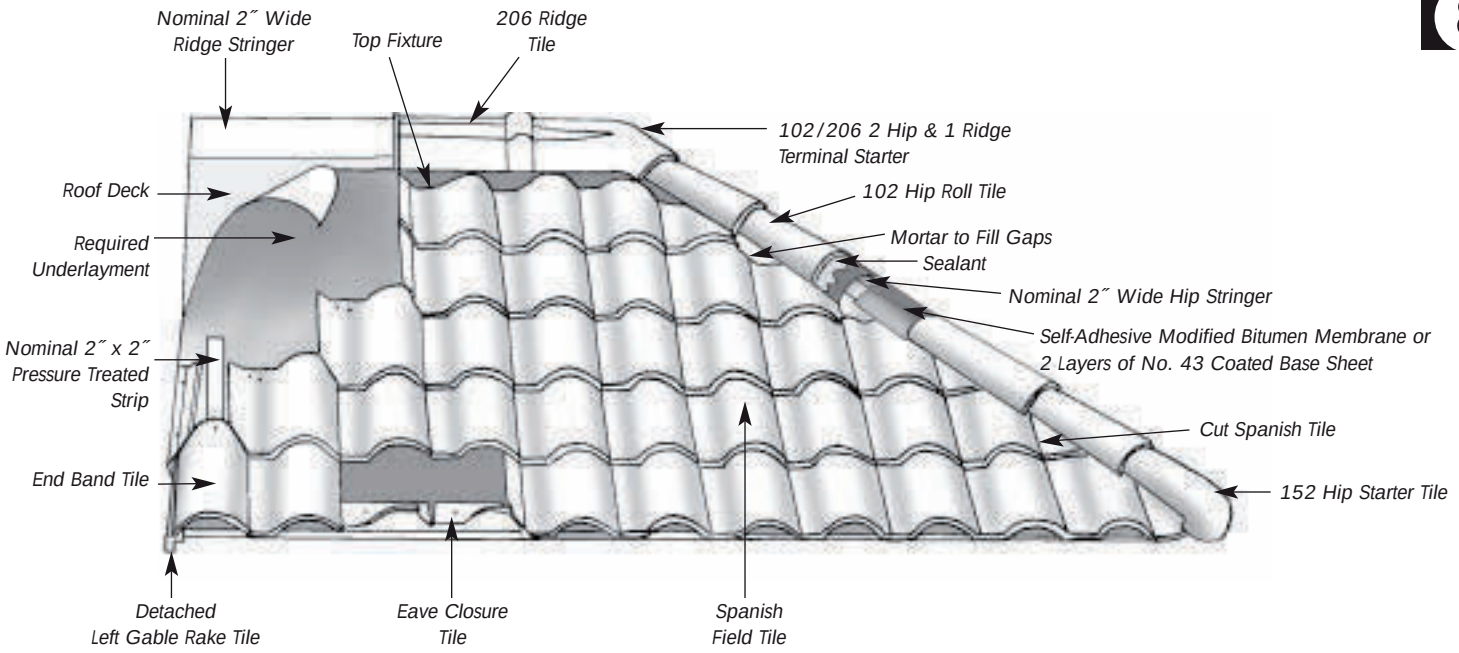
Figure 7.16 Deck Section Showing 206 Ridge



Note: All Areas in and Around Sunken Gutter Should Be Covered with a Self-adhesive Modified Bitomem Membrane.

Figure 7.17 Section Showing Sunken Gutter Treatment

Spanish Tile (S-Tile) Installation



IMPORTANT:
Before starting tile installation, it is important that the roofer understand how the Spanish tile pattern being installed relates to the roof design.

The following roof preparations must be completed before installing any roof tile.
For detailed information on these items refer to the previous sections in this book or the NRCA Manual on Steep Roofing.

- Install the flashings required for ensuring watertightness:
  - Eave Flashing
  - Valley Flashing
  - Dormer and Sidewall Flashing, Skylight Flashing, Chimney and Cricket Flashing
  - Vent Flashing
- Underlayment for the entire roof deck, including the appropriate waterproof underlayment required for all flashing, and, where required, the ice dam membrane
- Roof surface chalked with vertical and horizontal lines

Note: Spanish Tile utilizes either rolled rake tiles or detached gable rake tiles for both the right and left sides of the gables. Therefore, rake edge flashing is not required when these tiles are used.

Note: Especially watch this tile for unsightly "snaking" that can occur due to size variations in the tile. Adjust as necessary using chalk lines as guides only.

Instructions Specific to Installing Spanish Tile (S-Tile)

1 End Band Nailer Strips (Stringers)

Spanish Tile (S-Tile) require only one nailer strip within the field of tile and it is to serve as a nailer strip and support for the end band tile. This nailer strip should be pressure treated wood sized nominal 2″ x 2″ or 1 1/2″ x 2″ (actual size).

Note: The use of an end band with Spanish tiles is only required on the left side vertical termination or interruption of the field tile (ie. gable rake, chimney, dormer, or a parapet wall).

The nailer strip should be a pressure treated foundation-grade wood. If the nailer strip is not treated, it should be covered with either a 36″ wide membrane similar to CertainTeed WinterGuard or 2 layers of No. 43 coated base sheet.

2 Hip and Ridge Stringers

Spanish Tile requires a Hip and Ridge tile to complete the roof and are installed with a nominal 2″ wide wood stringer. All stringers should be pressure-treated foundation-grade wood and should be covered with a 36″ wide, self-adhesive modified bitumen membrane, such as CertainTeed WinterGuard, or 2 layers of No. 43 coated base sheet. See Chart 8.1 to determine the correct height of the nominal 2″ wide material for the type of tile to be used at the hip and ridge. All wood stringers should be pressure-treated, foundation-grade wood. Roof pitch exceeding 14″ rise to 12″ run requires the contractor to measure the roof for stringer height.

Chart 8.1: Spanish Hip & Ridge Stringer Heights

Roof Pitch	102 Hip	206 Ridge	Circular Cover Hip	Circular Cover Ridge
4″ Rise to 12″ Run	5″	6 1/2″	4 9/16″	3 3/4″
5″ Rise to 12″ Run	4 7/8″	6 1/4″	4 1/2″	3 5/8″
6″ Rise to 12″ Run	4 7/8″	6″	4 3/8″	3 1/2″
7″ Rise to 12″ Run	4 3/4″	5 3/4″	4 1/4″	3 3/8″
8″ Rise to 12″ Run	4 3/4″	5 1/2″	4 1/8″	3 1/4″
9″ Rise to 12″ Run	4 5/8″	5 3/8″	4″	3 1/8″
10″ Rise to 12″ Run	4 5/8″	5 1/4″	3 15/16″	2 7/8″
11″ Rise to 12″ Run	4 5/8″	5 1/8″	3 15/16″	2 3/4″
12″ Rise to 12″ Run	4 1/2″	5″	3 7/8″	2 5/8″
13″ Rise to 12″ Run	4 1/2″	4 7/8″	3 7/8″	2 1/2″
14″ Rise to 12″ Run	4 3/8″	4 3/4″	3 13/16″	2 1/4″

3 Eave Closure Tile

Installation of all the Ludowici Spanish Tile requires Eave Closure Tile. The Eave Closure tiles are normally laid right to left. Normal practice requires the Eave Closure tiles to be laid flush with the eave and adjusted in from the right to allow for proper layup of the right rake tile and the first cover tile. Lay the Eave Closure tile course loose across the slope to the provided center to center width before nailing to determine what adjustments, if any, are needed in the course before nails or screws are installed.

Note: If the eave closures are being applied to a deck which includes a valley, and if special factory cut and closed valley tiles have been manufactured for the job, it is necessary to see special instructions provided in 7. Valley Tile, Page 64.

4 First and Succeeding Courses of Tile

Spanish Tiles are normally laid from right to left starting with a Right Detached Gable Rake or Rolled Rake Tile. This first rake tile will need to be installed allowing a 2″ overhang at the eave. The detached gable rakes are available in left- and right-hand versions. The rolled rakes are universal for both left and right gable rakes. All gable rake tiles shall be installed with fasteners typical of the field tile installations, but also require flashing cement (meeting ASTM D-4586 requirements) applied between all contact areas of the field tile and gable rakes. The Detached Gable Rake Tile to the right, when looking at the eave courses into the field tiles, are the rights and vise-versa.

Note: When rolled rakes are being installed in the first course of the tile, whether left or right, the eave closure next to these rake pieces will require some slight nipping and clipping for proper fit and installation.

After installing the right rake tile, the starter course will begin with a full tile placed directly over the first eave enclosure tile. The second course of the tile will lay up directly over the previously installed field tile to the proper exposure and with the normal 3″ head lap.

Note: Each Spanish Field Tile is provided with (3) three fastening holes. The (2) two holes in the flat portion of the tile are for installation with nails or screws. The third hole (elongated) in the tile's barrel portion is provided for installation with the wire-tie system. When installing the field tile, care should be taken to fasten tiles through the specific required nail holes. Also, when accessories are installed every tile shall be fastened through each of the provided fastening holes.

5 Top Fixture Tile

Recommended for the installation of Ludowici Spanish Tile is a Top Fixture Tile. This tile is attached to the ridge stringer to fill the void area left between the field tile and the ridge cover. If top fixtures are not specified, Portland Cement Mortar Type M and/or specialty metal closures also may be used. (Mortars shall meet requirements of ASTM specification C-270.)

6 Points to Remember During Tile Installation

Field tile installation will generally progress in a diagonal fashion, moving from right to left. The installer applying the lower course will always be to the left of those applying succeeding courses.

- Use the chalk lines as a guide.
- Watch for any irregularities in the roof deck construction.
- After the installation of about 75-100 tiles, the roof should be inspected from the ground at a distance greater than 40 feet to determine that there are no streaks or blotches. To ensure a good range of tones, this inspection must be done at regular intervals.
- When each course is 10-12 tiles from the end of the course, check the distance to the end with the width of the tile to determine if a slight crowding or stretching of the tile may be required to ensure a proper fit or size of the final piece of tile installed in that course. DO NOT crowd or pull to the extreme anymore than 5 or 6 pieces positioned side by side.

7 Valley Tiles

Tiles to be installed in valleys can be mitered in the field or special factory-manufactured cut and closed tiles can be used. These special cut and closed valley tiles generally result in less water entering underneath the tile. Whether field miter cut or special factory cut tiles are used, the tile fasteners should never penetrate the valley flashings. Tile to be installed over the copper valley flashing should be drilled or notched and wired with solid 16 gauge copper wire to fasteners driven into the deck beyond the flashing.

Note: In situations where valley tile pieces are so small that it is not practical to notch or drill, use the adhesive RT600 (an OSI product) or its equivalent.

If special factory cut and closed valley fittings are being applied prior to installation, it will be beneficial to loose lay the entire eave closure course, including the valley tile. This loose laying process of the valley's left side will advance as a typical installation would, from right to left. But when loose laying the valley's right side, it will advance from left to right. The installation of the Spanish Tiles will slow the process initially. Each tile when spaced on the deck will require a slightly upward lifting to allow for the proceeding tile to be laid into the next channel. Once the spacing is approved, the pace can return to the standard. The tiles can be fastened in the typical right to left pattern.

The loose laying process becomes vitally important when the roof deck runs from valley-to-valley. The focus must be to space the eave course so it consists of all full field tile and is finished on both ends with the special cut and closed valley tiles. Keep in mind not to allow any more than 5 pieces pulled to the extreme or crowded together.

If field mitered valley tiles are applied, they should be trimmed to provide a clean, even, continuous edge along the entire valley length.

Note: At a ventilating ridge, the ridge should be wrapped in a self-adhesive modified bitumen membrane or 2 layers of No. 43 base sheet.

8 Ridge and Hip Tiles

Ridge Tile

The ridge for Spanish Tile must be finished with a Circular Cover Tile or a 206 Ridge tile.

Circular Cover Tile or 206 Ridge Tile

Note: The 206 Ridge Tile is available in a vented version. See Figure 8.2.

See Chart 8.1 for sequence of installation and the dimensions of the stringers required.

Flashing cement must be used at the overlap of each Ridge Tile and where they rest on the field tile. See Figure 8.3. Closed Ridge Ends, Circular Cover or 206 Ridge, or Terminal Circular Cover or 102/206 Hip and Ridge Tile are used to start and finish the ridge. The ridge finisher will have an exposed fastener which should be sealed with flashing cement meeting the requirements of ASTM D-4586. Some roof termination may require a combination of typical flashing details or a special tile piece. Consult the local Ludowici sales representative with the project's special roof requirements.

Note: It may be beneficial to lay out the chosen ridge system on the stringer to determine lap (no less than 2″). This will prevent having to traverse the installed tiles later.

Applying ridge tiles with the lap facing away from the prevailing winds helps the tile shed wind-driven rain.

Note: The circular covers are 16″ Straight Barrel Mission field tile covers.

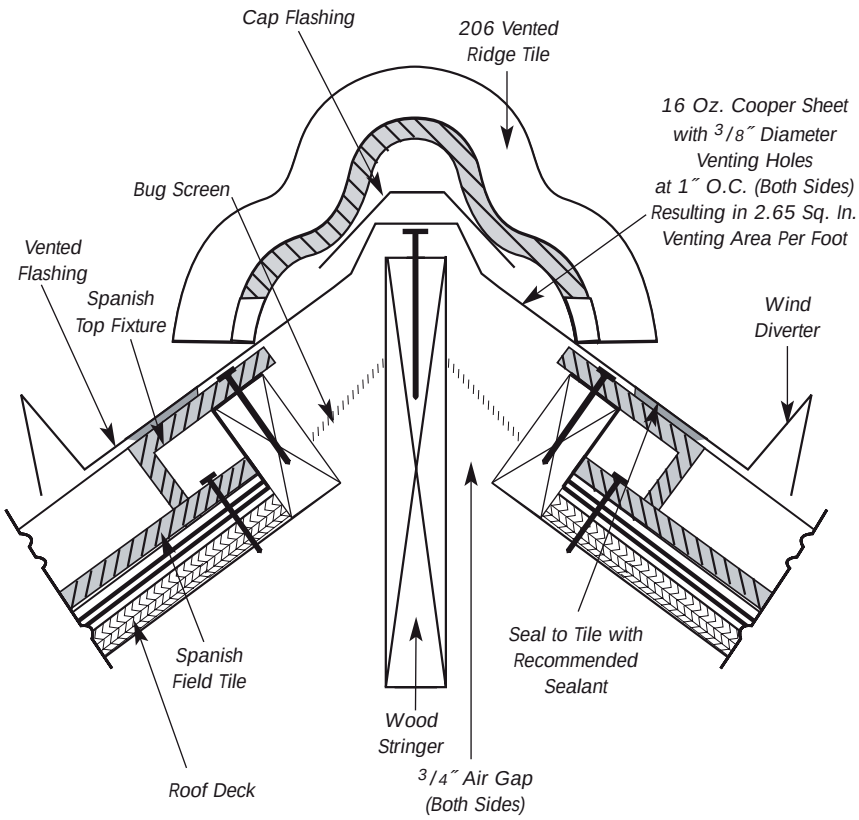


Figure 8.1 206 Vented Ridge Tile Detail

9 Hip Tiles

The hip area is typically finished by using a combination of either a Circular Cover Hip Starter, Circular Cover and a Circular Cover Terminal or a 152 Hip Starter tile, 102 Hip Roll tile and 102/206 Hip and Ridge Terminal.

Hips are started with a special Circular Cover Hip Starter Tile or 152 Hip Starter Tile covering the Field Tile approximately 3˝ on both sides. The hip tiles are then installed. The Circular Cover Tile creates a 3˝ head lap on the starter while the 102 tile creates an approximate 2˝ head lap over the starter tile. The specified head lap per tile is then continued up the hip. Flashing cement must be used at the overlap of each hip tile. The gaps created between the Hip Roll and the Field Tile should be filled with mortar tinted to match. The last fastener on the upslope end of the hip typically is covered with a Circular Cover Terminal or a 102/206 Hip and Ridge Terminal. These terminals must be specified as a starter or finisher depending on the direction of the ridge layout. Some roof termination may require a combination of typical flashing details or a special tile piece. Consult the local Ludowici sales representative with the project's special roof requirements.

Figure 8.2 206 Vented Ridge Vent

10 Accessory Pieces

Standard Fittings

Standard tile fittings are manufactured for each style of field tile. These tile fittings provide better protection against water penetrating beneath the tile than field mitered pieces. Charts 8.2, 8.3, and 8.4 provide overall lengths, standard exposures, weights, and pieces per box of these standard accessories.

Custom Tile Fittings

All custom fittings are special ordered to specifications. Ludowici creates custom fittings from design sketches using Computer Aided Drafting (CAD) technology and company artisans who craft the tiles by hand.

Chart 8.2: Field Tile Accessories

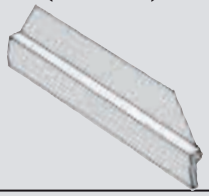
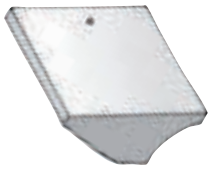
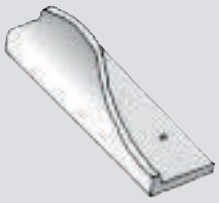
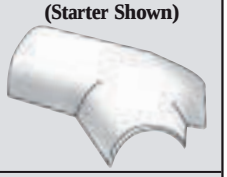
Tile Type	End Band	Detached Gable Rake Right and Left (Left Shown)	Top Fixture	Eave Closure	Rolled Rake
					
13 1/4″ Length					
Actual Size	13 1/4″	13 1/4″	—	—	13 1/4″
Exposure	10 1/4″	10 1/4″	8 1/4″	8 1/4″	10 1/4″
Pieces/Box	80	200	225	225	80
Weight	4.2 lbs./ft.	1.8 lbs./ft.	1.5 lbs./ft.	2.0 lbs./ft.	4.6 lbs./ft.
18 3/8″ Length					
Actual Size	18 3/8″	18 3/8″	—	—	18 3/8″
Exposure	15 3/8″	15 3/8″	8 1/4″	8 1/4″	15 3/8″
Pieces/Box	80	200	225	225	80
Weight	6.2 lbs./ft.	2.7 lbs./ft.	1.5 lbs./ft.	1.5 lbs./ft.	6.8 lbs./ft.

Chart 8.3: 102 & 206 Hip and Ridge Accessories

Tile Type	102 Hip Roll	152 Hip Starter	206 Ridge	206 Closed Ridge End* (Starter Shown)	102/206 Terminal* (Starter Shown)
					
Actual Size	14 1/4″	14″	13 3/4″	14″	—
Exposure	12″	12″	12″	12″	—
Pieces/Box	30	4	12	2	2
Weight	5.2 lbs./ft.	6.3 lbs./pc.	11.5 lbs./ft.	18.0 lbs./pc.	17.0 lbs./pc.

Chart 8.4: Circular Cover Hip and Cover Accessories

Tile Type	Circular Cover Hip & Ridge	Circular Cover Hip Starter	Circular Cover Closed Ridge End* (Starter Shown)	Circular Cover Terminal 2H-1R* (Starter Shown)
				
Actual Size	16″	14 1/4″	16 1/2″	—
Exposure	13″	12″	13″	—
Pieces/Box	40	4	4	2
Weight	5.8 lbs./ft.	9.0 lbs./pc.	9.8 lbs./pc.	10.0 lbs./pc.

*Starters and Finishers available, specify pitch of all sides of roof.

Architectural Details of Ludowici Spanish Tiles and Fittings

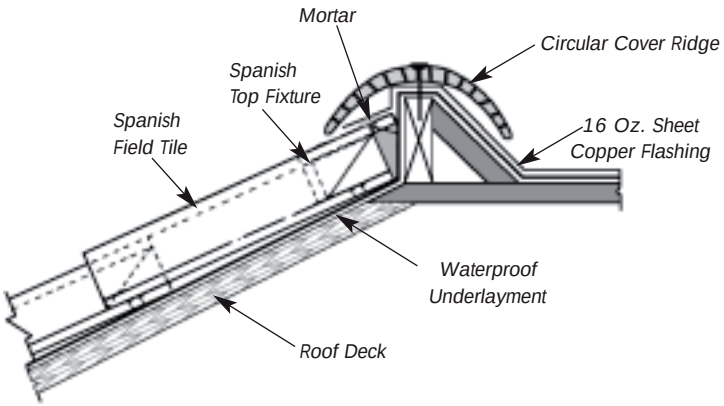


Figure 8.3 Deck Section Showing Circular Cover Ridge

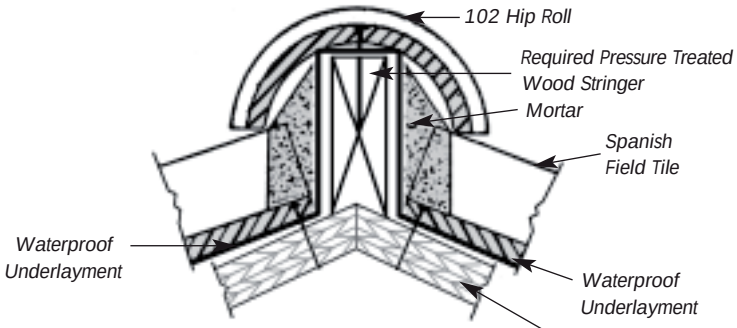


Figure 8.4 Hip Section Showing 102 Hip Roll

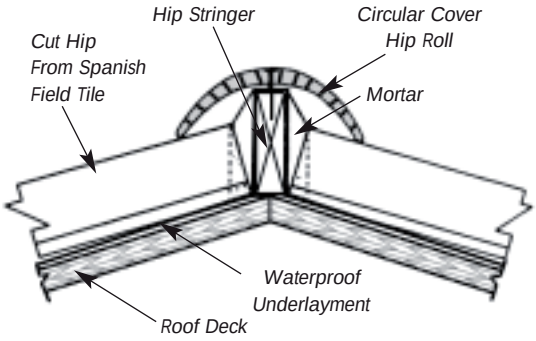


Figure 8.5 Hip Section Showing Circular Cover Hip

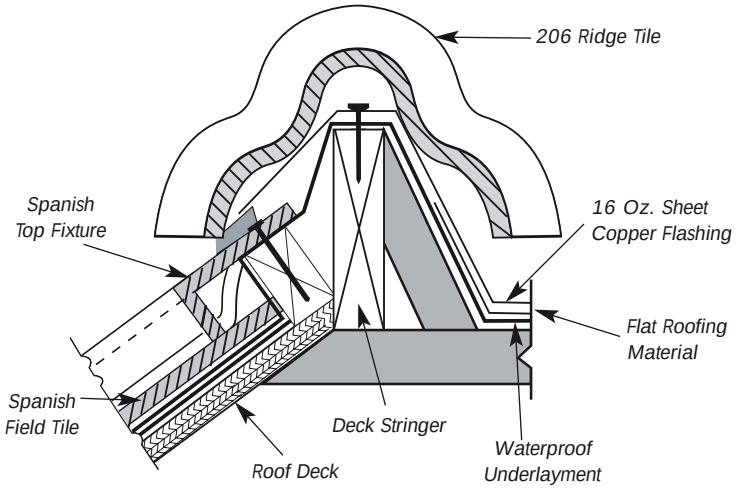
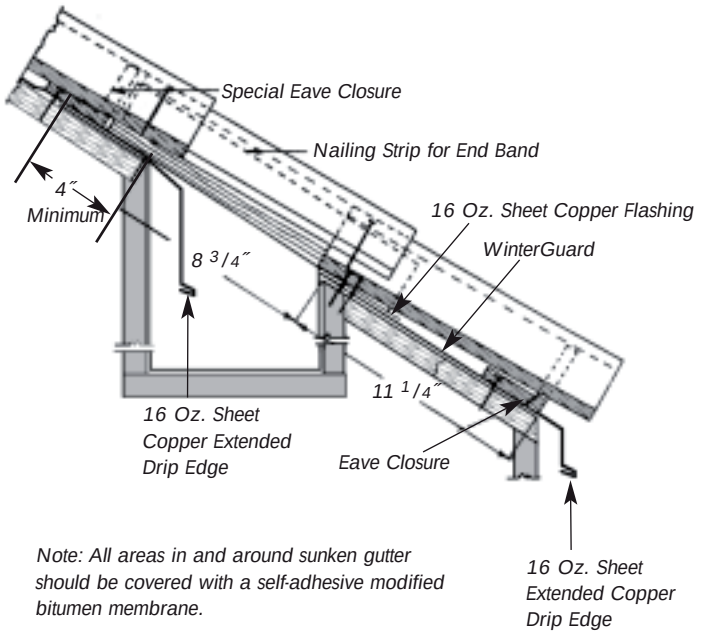


Figure 8.6 Deck Section Showing 206 Ridge



Note: All areas in and around sunken gutter should be covered with a self-adhesive modified bitumen membrane.

Figure 8.7 Section Showing End Band Over Concealed Gutter For 13 1/4˝ Spanish Tile

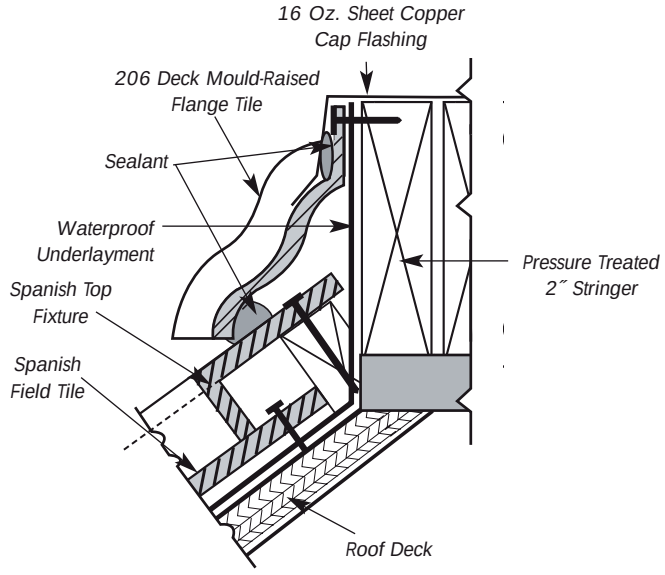


Figure 8.8 Deck Section Showing 206 Cut-Off Ridge

Note: 206 Ridge and 102 Hip Roll are special tile fittings. Standard tile fittings are Circular Cover Ridge and Hip Tile.

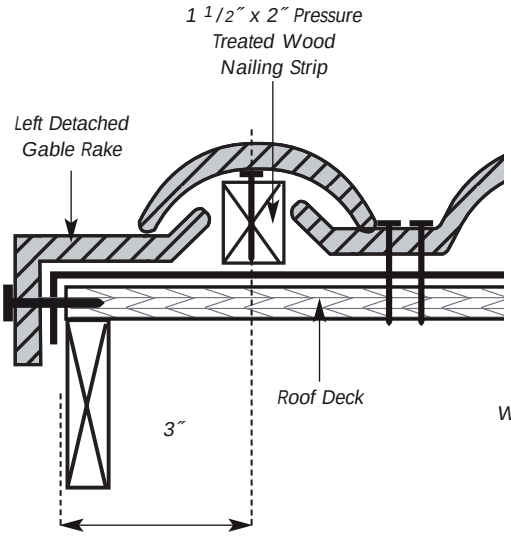


Figure 8.9 Section Showing Left Gable Rake Tile and End Band Tile

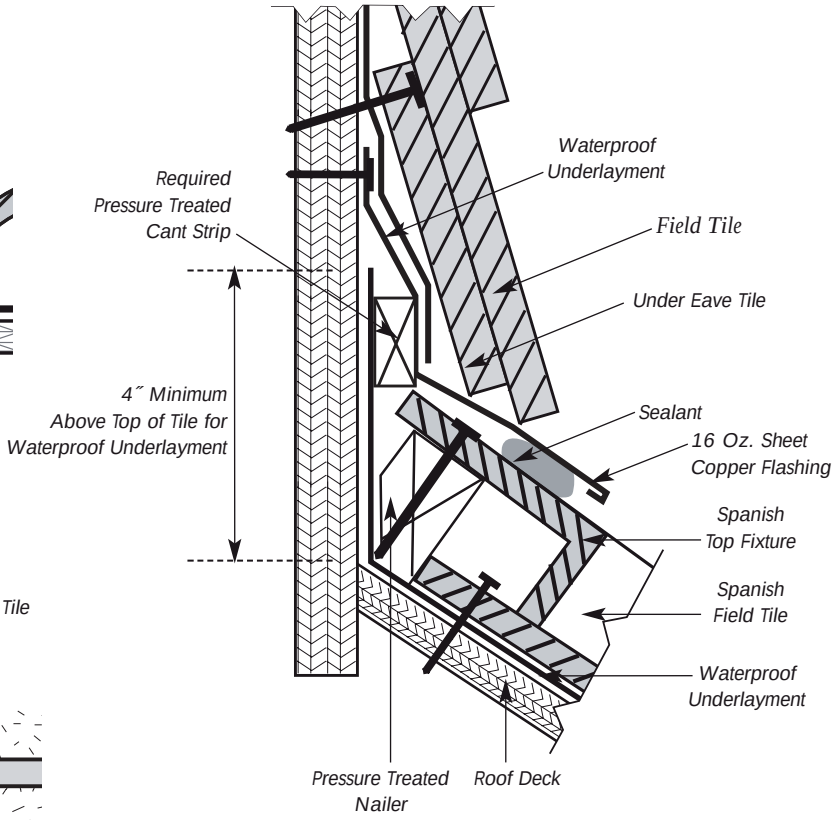


Figure 8.10 Section Showing Flashing Under Spanish Tiles

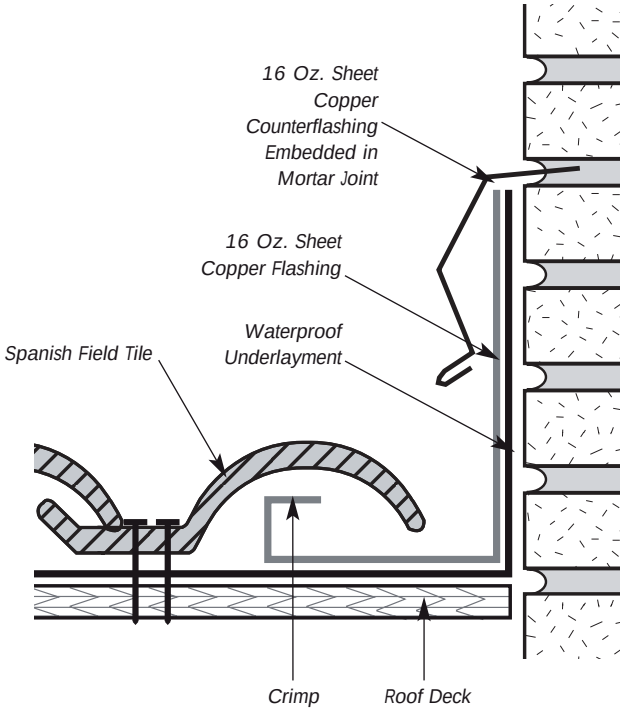


Figure 8.11 Section Showing Flashing Under Side of Tiles

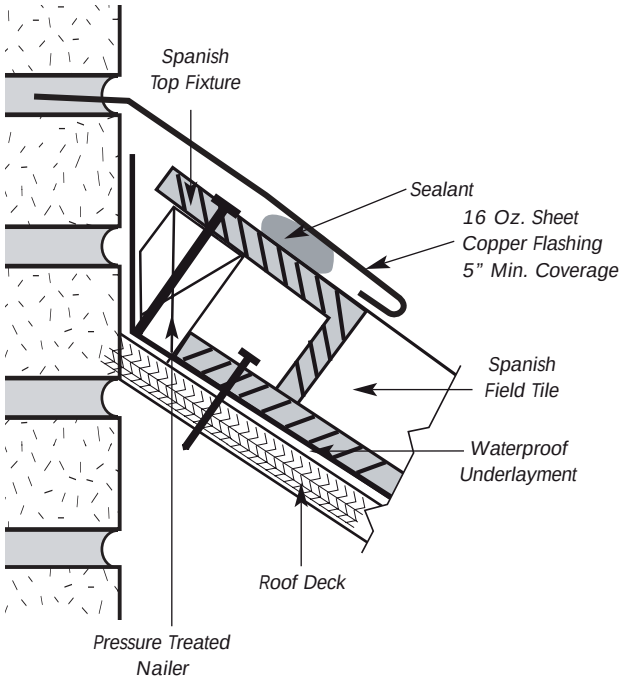


Figure 8.12 Deck Section Showing Flashing Over Top of Tiles

Problems Spots and How to Avoid Them

1 Wind Uplift at Eaves and Rakes

The effect of wind on the roof is determined by many factors, including building height, eave overhang, type of tile, roof slope, and securement method. Local and national building codes must be consulted to determine the wind loading and resistance of clay tiles in a given area.Wind uplift is caused by a drop in air pressure immediately above the roof surface initiated by the deflection of wind at roof edges, roof peaks or obstructions. Uplift may also occur when air pressure is introduced underneath the tile at roof edges. This can cause the tile to lift away from the deck.

Wind locks and storm clips are usually required at eaves and rakes (see Figure 12.1). Proper attachment of tiles at the perimeter will prevent the problems caused by wind uplift and are recommended to reduce wind noise and rattling at 19:12 and greater (see Chart 2.3, Page 7).

Figure 12.1
Storm Clips and Wind Locks

2 Ridge Cement, Underlayment and Direction

To avoid problems at the ridge, these guidelines must be followed.

The ridge should be covered with a self-adhering modified bitumen membrane material or two layers of No. 43 coated base sheet underlayment.

The tiles should be applied with the laps facing *away* from the prevailing winds.

Plastic cement should be a heavy body flashing cement composed of mineral ingredients to meet the requirements of ASTM D-4586.

3 Broken Tiles

If during the course of installation tiles are broken, the following method of tile replacement is recommended.

For Flat, Interlocking, Spanish, and Mission tile styles, use Ludowici Quik-Tach™ brackets (or equivalent) to replace individual tiles.

- Attach Quik-Tach bracket to back of replacement tile with a solid No. 16 copper wire.
- Clear area of debris where tile is to be replaced, including fasteners from the previous tile. These may be removed by using a slate ripper or, in the case of stainless steel screws, use a hacksaw blade.
- Lift butt of tile in course above. Then slide replacement underneath and down until bracket "L" hooks underneath top of course below.
- Adjust replacement tile to align or interlock (depending on tile type) with tiles to either side.

An alternative for interlocking tiles is to fasten a 12-gauge copper wire into the deck, replacing the tile and then bending the exposed wire back into the left interlock, thus hiding the wire. See Figure 12.2. A copper strip can also be used over the tile butt.

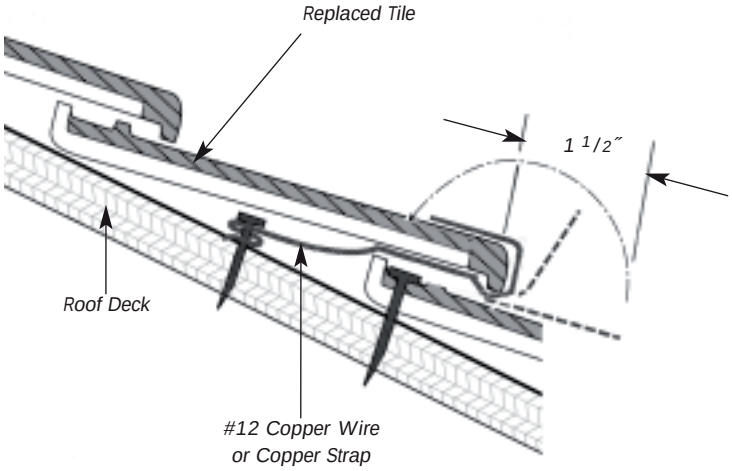
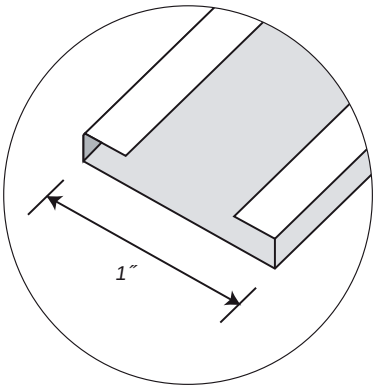


Figure 12.2 Replacement Detail



1˝ Hemmed Copper Strap
Minimum 16 Oz. Copper

Appendix D
Historic Sheffield Commission

Preservation Brief #30
The Preservation and Repair of Historic Clay Tile Roofs

30 Preservation Briefs

Technical Preservation Services
National Park Service
U.S. Department of the Interior

The Preservation and Repair of Historic Clay Tile Roofs

Anne E. Grimmer and Paul K. Williams

Clay tiles are one of the most distinctive and decorative historic roofing materials because of their great variety of shapes, colors, profiles, patterns, and textures. Traditionally, clay tiles were formed by hand, and later by machine extrusion of natural clay, textured or glazed with color, and fired in high-temperature kilns. The unique visual qualities of a clay tile roof often make it a prominent feature in defining the overall character of a historic building. The significance and inherently fragile nature of historic tile roofs dictate that special care and precaution be taken to preserve and repair them.

Clay tile was a popular roofing material for residential structures during the Romanesque Revival period. Photo: NPS files.

Clay tile has one of the longest life expectancies among historic roofing materials-generally about 100 years, and often several hundred. Yet, a regularly scheduled maintenance program is necessary to prolong the life of any roofing system. A complete internal and external inspection of the roof structure and the roof covering is recommended to determine condition, potential causes of failure, or source of leaks, and will help in developing a program for the preservation and repair of the tile roof. Before initiating any repair work on historic clay tile roofs, it is important to identify those qualities important in contributing to the historic significance and character of the building.

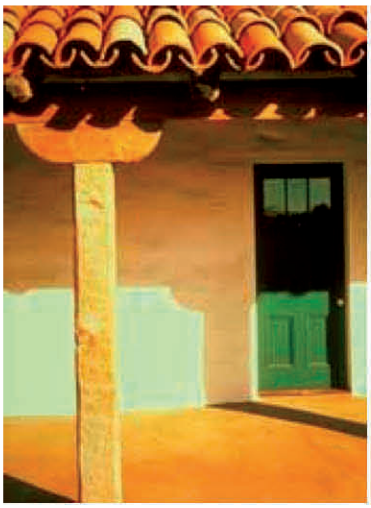
This Brief will review the history of clay roofing tiles and will include a description of the many types and shapes of historic tiles, as well as their different methods of attachment. It will conclude with general guidance for the historic property owner or building manager on how to plan and carry out a project involving the repair and selected replacement of historic clay roofing tiles.

Repair of historic clay tile roofs is not a job for amateurs; it should be undertaken only by professional roofers experienced in working with clay tile roofs.

Historical Background

The origin of clay roofing tile can be traced independently to two different parts of the world: China, during the Neolithic Age, beginning around 10,000 B.C.; and the Middle East, a short time later. From these regions, the use of clay tile spread throughout Asia and Europe. Not only the ancient Egyptians and Babylonians, but also the Greeks and Romans roofed their buildings with clay tiles, and adaptations of their practice continue in Europe to the present. European settlers brought this roofing tradition to America where it was established in many places by the 17th century.

Archeologists have recovered specimens of clay roofing tiles from the 1585 settlement of Roanoke Island in North Carolina. Clay tile was also used in the early English settlements in Jamestown, Virginia, and nearby St. Mary's in Maryland. Clay roofing tiles were also used in the Spanish settlement of St. Augustine in Florida, and by both the French and Spanish in New Orleans.



Tapered barrel clay roof tiles were custom made for the restoration of the 1820s Indian barracks at Mission Santa Cruz in California. Photo: NPS files.

Dutch settlers on the east coast first imported clay tiles from Holland. By 1650, they had established their own full-scale production of clay tiles in the upper Hudson River Valley, shipping tiles south to New Amsterdam. Several tile manufacturing operations were in business around the time of the American Revolution, offering both colored and glazed tile and unglazed natural terra-cotta tile in the New York City area, and in neighboring New Jersey. A 1774 New York newspaper advertised the availability of locally produced, glazed and unglazed pantiles for sale that were guaranteed to "stand any weather." On the west coast clay tile was first manufactured in wooden molds in 1780 at Mission San Antonio de Padua in California by Indian neophytes under the direction of Spanish missionaries.

By far the most significant factor in popularizing clay roofing tiles during the Colonial period in America was the concern with fire. Devastating fires in London, 1666, and Boston in 1679, prompted the establishment of building and fire codes in New York and Boston. These fire codes, which remained in effect for almost two centuries, encouraged the use of tile for roofs, especially in urban areas, because of its fireproof qualities. Clay roofing tile was also preferred because of its durability, ease of maintenance, and lack of thermal conductivity.

Although more efficient production methods had lowered the cost of clay tile, its use began to decline in much of the northeastern United States during the second quarter of the 19th century. In most areas outside city-designated fire districts, wood shingles were used widely; they were more affordable and much lighter, and required less heavy and less expensive roof framing. In addition, new fire-resistant materials were becoming available that could be used for roofing, including slate, and metals such as copper, iron, tin-plate, zinc, and galvanized iron. Many of the metal roofing materials could be installed at a fraction of the cost and weight of clay tile. Even the appearance of clay tile was no longer fashionable, and by the 1830s clay roofing tiles had slipped temporarily out of popularity in many parts of the country.

Revival Styles Renew Interest in Clay Roofing Tiles

By the mid-19th century, the introduction of the Italianate Villa style of architecture in the United States prompted a new interest in clay tiles for roofing. This had the effect of revitalizing the clay tile manufacturing industry, and by the 1870s, new factories were in business, including large operations in Akron, Ohio, and Baltimore, Maryland.

The clay tile roof is important in defining the character of the c. 1917 Mission-style Grove Park Inn, Asheville, North Carolina. Photo: NPS files.

Clay tiles were promoted by the Centennial Exhibition in Philadelphia in 1876, which featured several prominent buildings with tile roofs, including a pavilion for the state of New Jersey roofed with clay tiles of local manufacture. Tile-making machines were first patented in the 1870s, and although much roofing tile continued to be made by hand, by the 1880s more and more factories were beginning to use machines. The development of the Romanesque Revival style of architecture in the 1890s further strengthened the role of clay roofing tiles as an American building material.

Alternative substitutes for clay tiles were also needed to meet this new demand. By about 1855, sheet metal roofs designed to replicate the patterns of clay tile were being produced. Usually painted a natural terra cotta color to emulate real clay tile, these sheet metal roofs became popular because they were cheaper and lighter, and easier to install than clay tile roofs.

Clay roofing tiles fell out of fashion again for a short time at the end of the 19th century, but once more gained acceptance in the 20th century, due primarily to the popularity of the Romantic Revival architectural styles, including Mission, Spanish, Mediterranean, Georgian and Renaissance Revival in which clay tile roofs featured prominently. With the availability of machines capable of extruding clay in a variety of forms in large quantities, clay tiles became more readily available across the nation. More regional manufacturing plants were established in areas with large natural deposits of clay, including Alfred, New York; New Lexington, Ohio; Lincoln, California; and Atlanta, Georgia; as well as Indiana, Illinois and Kansas.

Clay tiles emphasize the prominence of the peaked roofs of these late 19th century rowhouses. Photo: NPS files.

The popularity of clay tile roofing, and look-alike substitute roofing materials, continues in the 20th century, especially in areas of the South and West-most notably Florida and California--where Mediterranean and Spanish--influenced styles of architecture still predominate.

Early Tiles

During the 17th and 18th centuries the most common type of clay roofing tiles used in America were flat and rectangular. They measured approximately 10" x 6" x ½" (25cm x 15cm x 1.25cm), and had two nail or peg holes at one end through which they were anchored to the roofing laths. Sometimes a strip of mortar was placed between the overlapping rows of tile to prevent the tiles from lifting in high winds. In addition to flat tiles, interlocking S-shaped pantiles were also used in the 18th century. These were formed by molding clay over tapered sections of logs, and were generally quite large. Alternately termed pan, crooked, or Flemish tiles, and measuring approximately 14 ½" x 9 ½" (37cm x 24cm), these interlocking tiles were hung on roofing lath by means of a ridge or lug located on the upper part of the underside of each tile. Both plain (flat) tile and pantile (S-shaped or curved) roofs were capped at the ridge with semicircular ridge tiles. Clay roofing tiles on buildings in mid-18th century Moravian settlements in Pennsylvania closely resembled those used in Germany at the time. These tiles were about 14"-15" long x 6"-7" wide (36cm-38cm x 15cm-18cm) with a curved butt, and with vertical grooves to help drainage. They were also designed with a lug or nib on the back so that the tiles could hang on lath without nails or pegs.

The accurate dating of early roofing tiles is difficult and often impossible. Fragments of tile found at archeological sites may indicate the existence of clay tile roofs, but the same type of tile was also sometimes used for other purposes such as paving, and in bake ovens. To further complicate dating, since clay tile frequently outlasted many of the earliest, less permanent structures, it was often reused on later buildings.

Clay Tile Substitutes

In addition to sheet metal "tile" roofs introduced in the middle of the 19th century, concrete roofing tile was developed as another substitute for clay tile in the latter part of the 19th century. It became quite popular by the beginning of the 20th century. Concrete tile is composed of a dense mixture of portland cement blended with aggregates, including sand, and pigment, and extruded from high-pressure machines.

Asphalt shingles are an incompatible replacement substitute for the original Spanish clay tiles. Photo: NPS files.

Although it tends to lack the color permanence and the subtle color variations inherent in natural clay tile, concrete tile continues to be a popular roofing material today because it reproduces the general look of clay tile, if not always the exact profile or proportions of historic clay tile, at a somewhat lower cost and weight. Another modern, slightly cheaper and lighter substitute for clay tile more recently developed consists of a mixture of mineral fiber and cement with pigments added to supply color. While these aggregate tiles also replicate the shape and appearance of clay roofing tiles, they have many of the same dissimilarities to clay tiles that are found in concrete tiles. Thus, like concrete tiles, they are seldom appropriate substitutes for clay tiles.

Traditional Tile Shapes and Colors

There are two types of clay roofing tiles: interlocking and overlapping. *Interlocking* tiles are designed in pairs so that an extrusion or "lip" on one of the tiles "hooks" over the other tile thereby "locking" or securing the two together; they are also usually nailed to the roof structure. *Overlapping* tiles, which can also function in pairs, generally do not have any sort of "lip" and must be nailed in place. There is a wide range of shapes of historic clay roofing tiles, and many, sometimes with slight variations, are still produced today. There are many variations, and the country of origin of some of them may be revealed in their names, but there are essentially only two kinds of shapes: pantiles and flat tiles. Both pantiles and flat tiles may be either interlocking or overlapping.

Pantiles. The shape most commonly associated with historic clay roofing tiles is probably that of convex or rounded tiles, often grouped together generically as "pan tiles" or "pantiles." These include Spanish tiles-sometimes called "S" tiles, or the similarly shaped Mission tiles, also known as Barrel or Barrel Mission tiles, straight or tapered, as well as Roman tiles, and their Greek variation.

Flat Tiles. Flat, shingle tiles are another type of historic clay roofing tiles. Flat tiles can be completely plain and flat, and, like roofing slates, overlap one another, attached with nails to the roof sheathing. Or they may interlock at the top and on one side. Although the "interlock" holds them together, most interlocking shingle tiles also have one or more holes, usually near the top, for nailing to the roof sheathing. Flat tiles are mostly variations of English or Shingle tiles, and include English Shingle, Closed Shingle, Flat, Shingle or Slab Shingle, as well as French tiles which have a slightly higher and more contoured profile.

Any of the standard tile shapes may be known by a different name in another region of the country, or in different parts of the world. For example, what are known as Spanish or "S" tiles in the United States, may be called Single Roman tiles in England. Sometimes Spanish and Mission tiles are equated despite the fact that the former are usually 1-piece interlocking tiles and the latter are single ½ cylinders that overlap. Since missions and the Mission style are associated with the Americas, Mission tiles in the United States are more commonly referred to as Spanish tiles in England and Europe. In a similar vein, Spanish or "S" tiles, or Barrel tiles, might seem to be more typical of some tiles used in France than what are marketed as French tiles by American manufacturers.

Today some tile manufacturers have given their own trademark name to historic tile shapes. Other companies market uniquely shaped "S" tiles that are more in the shape of a true, but rather low profile "s" without the customary flat portion of traditional American "S" tiles.

An eave closure or *birdstop* to keep out birds is notably absent from the replacement tile in the center of the bottom row. Photo: NPS files.

Field and Specialty Tile. The tiles that cover the majority of the flat surface of the roof are called field tile. Some roof shapes, particularly conical towers or turrets, require tiles of graduated sizes, and some shapes or patterns of field tile also require specially shaped finish tiles to complete the roof covering package. Other uniquely-shaped tiles were made to fit odd-shaped spaces and places including dormers and valleys, roof hips, rakes, ridges and corners. There are also finish tiles that fulfill certain needs, such as eave closures or clay plugs called "birdstops." These are intended to keep out snow and rain, and birds from nesting in the voids under the bottom row of curved tiles. Different patterns and designs can also be created by combining, or mixing and matching flat tiles with dimensional tiles.

Tile Colors. A terra cotta red is the color most commonly associated with historic clay roofing tiles. The reddish color comes from clay with a large percentage of iron oxide, and there are many variations of this natural color to be found in tiles ranging from deep reddish browns to softer and paler oranges and pinks. Lighter buff and beige colors, as well as black, also appear on traditional tile-roofed buildings. Buff-colored tiles were made from nearly pure fire clay, and pouring manganese dissolved in water over the tile before firing resulted in smoke brown or black glazed tiles. Toward the end of the 19th century the popularity of colored glazes for roofing tiles increased, and their use and the range of colors continues to expand today.

Most historic glazed roofing tiles are in fairly natural hues that range from reds and browns and buffs, to blacks and purples, blues (often created with smalt, or powdered blue glass), and a wide variety of greens (usually created with copper slag). There could be a considerable range in the colors of tiles that were baked over a wood fire because the temperature within the kiln was so uneven; tiles closest to the fire cooked all the way through and turned a darker red, while tiles farthest from the flames were likely to be smoke-stained, and lighter orange in color.

How Tiles are Attached

The method used to attach clay roofing tiles varies according to the shape, size and style of the particular tile. For the most part, traditional and modern methods of installing clay roofing tiles are very similar, except that modern practice always includes the use of wood sheathing and roofing felt. But most of the earliest clay roofing tiles were laid without benefit of wood sheathing and hung directly on roofing laths and battens that were nailed to the roof rafters; this practice continued up into the mid-19th century in some regions. While this method of attachment allowed for plenty of ventilation, and made it easy to find leaks and make repairs, it also meant that the overall water-tightness of the roof depended entirely on the tiles themselves.

Gradually, the practice evolved of nailing roofing tiles directly onto continuous wood sheathing, or hanging them from "nibs" on horizontal lath that was attached to roof rafters or sheathing. Some kinds of tile, especially the later Mission or Barrel tiles were laid over vertical strips or battens nailed to the sheathing, or the tiles were fastened to wood purlins with copper wire.

Projections on the underside of these replacement Spanish clay tiles help them adhere to the cement mortar on the roof sheathing. Photo: NPS files.

Partly because they do not always fit together very closely, some tile shapes, including Spanish, Barrel or Mission as well as other types of interlocking tiles, are not themselves completely water-repellent when used on very low-pitched roofs. These have always required some form of sub-roofing, or an additional waterproof underlayer, such as felting, a bituminous or a cementitious coating. In some traditional English applications, a treatment called "torching," involved using a simple kind of mortar most commonly consisting of straw, mud, and moss. The tapered Mission tiles of the old Spanish missions in California were also laid in a bed of mud mortar mixed with grass or straw which was their only means of attachment to the very low-pitched reed or twig sheathing (*latia*) that supported the tiles.

More recent and contemporary roofing practices require that the tiles be laid on solid l" (2.5cm) wood sheathing felted with coated base sheets of at least 30 lbs., or built-up membranes or single-ply roof membranes. This substantially increases the water-tightness of the roof by adding a second layer of waterproofing. Horizontal and vertical chalk lines are drawn to serve as a guide in laying the tile and to indicate its patterning. Most tiles are designed with one or two holes so they can be attached by copper nails or hangers, and/or with projecting nibs, to interlock or hang on battens or lath attached to the base sheathing.

Before laying the tiles, the copper or lead gutters, flashings and valleys must be installed, preferably using at least #26 gauge (20-24 ounce) corrosion-resistant metal extending a minimum of 12" (30.5cm) under the tile from the edge, or in accordance with the manufacturer's specifications. The long life and expected durability of clay tiles require that, as with the roofing nails, only the best quality metal be selected for the flashing and guttering.

"Field tile" is usually ordered by the number of "squares"-that is, a flat section 10' x 10' (25cm x 25cm)--needed to cover a roof section. The tile company or roofing contractor should calculate the number of tiles needed according to the type of roof, and based on architect's drawings to ensure accuracy. This should include specialty ridge and eave tiles, decorative trim, partial "squares" approximately 10-20 per cent allowance for breakage, and extra tiles to store for repairing incidental damage later on. Once at the site, the tile is evenly distributed in piles on the roof, within easy reach for the roofers.

The tiles are laid beginning with the first course at the lower edge of the roof at the eaves. The method by which roofing tiles are laid and attached varies, depending on the type and design of the tiles and roof shape, as well as on regional practice and local weather conditions. A raised fascia, a cant strip, a double or triple layer of tiles, or special "birdstop" tiles for under the eaves, may be used to raise the first row of tiles to the requisite height and angle necessary for the best functioning of the roof. The tile is positioned to overhang the previously installed gutter system by at least 1-1/2" (4cm) to ensure that rainwater discharges into the central portion of the gutter. Once this first course is carefully fitted and examined from the ground level for straightness and color nuances, and adjusted accordingly, successive courses are lapped over the ones below as the roofer works diagonally up the roof toward the ridge. Positioning and laying tiles in a 10" x 10" (25cm x 25cm) square may take on the average of 16-1/2 man hours.

Flat Tiles

Most flat clay tiles have one or two holes located at the top, or on a "nib" or "lug" that projects vertically either from the face or the underside of the tiles, for nailing the tile to the sheathing, battens, or furring strips beneath. As successive rows of tile are installed these holes will be covered by the next course of tiles above. Traditionally, clay tiles on the oldest tile roofs were hung on roofing laths with oak wooden pegs. As these wood pegs rotted, they were commonly replaced with nails. Today, copper nails, 1-3/4" (4.5cm) slaters' nails, are preferred for attaching the tiles because they are the longest lasting, although other corrosion-resistant nails can also be used. Less durable nails reduce the longevity of a clay tile roof which depends on the fastening agents and the other roofing components, as much as on the tiles themselves. Clay roofing tiles, like roofing slates, are intended to hang on the nails, and nailheads should always be left to protrude slightly above the surface of the tile: Nails should not be driven too deeply into the furring strips because too much pressure on the tile can cause it to break during freeze/thaw cycles, or when someone walks on the roof.

Plain flat tiles, like roofing slates, are attached to the roof sheathing only with nails. They are laid in a pattern overlapping one another in order to provide the degree of impermeability necessary for the roof covering. Because plain flat tiles overlap in most cases almost as much of one half of the tile, this type of tile roof covering results in a considerably heavier roof than does an interlocking tile roof which does not require that the tiles overlap to such an extent. Interlocking flat tiles form a single layer, and an unbroken roof covering. Although most interlocking tiles on all but the steepest roofs can technically be expected to remain in place because they hang on protruding nibs from the roofing laths or battens, in contemporary roofing practices they are often likely to be nailed for added security. In most cases it is usually a good idea to nail at least every other tile.

Pantiles

With Mission or Barrel tiles, where one half-cylinder overlaps another inverted half-cylinder to form a cover and pan (cap and trough) arrangement, the fastening is more complicated. While the pantiles that rest directly on the sheathing are simply nailed in place, there are two ways of attaching the cover tiles that rest on the pantiles. They can be secured by a copper wire nailed to the sheathing or tied to vertical copper strips running behind the tiles. Another method requires the installation of vertical battens or nailing strips on the roof to which the cover tiles are nailed, or the use of tile nails or hooks, which are hooked to the pantile below and secured with twisted copper wire.

Sometimes cement mortar, or another underlayer such as grass, moss or straw, or hair-reinforced mortar was added under the tiles. Before the use of felting this was a particularly common practice on some of the plain flat tile or Spanish tile roofs with low rises that were themselves not especially waterproof. Mortar also helped to keep driving rain from getting under the pantiles, and it is still customary in contemporary roofing to add a dab of cement mortar to help secure them.

Ridge or Hip Tiles

At the roof ridge or hip, clay tile is usually attached to a raised stringer with nails and a

small amount of mortar, elastic cement or mastic. The joint is sealed with a flexible flashing such as copper or lead. Ridge tiles are often somewhat larger and more decorative than the field tile utilized on the broad sections of the roof.

Roof Pitch and Weather are Factors in Tile Attachment

The means by which clay tile is attached to the sheathing is also partly determined by the roof pitch. *Generally the fastening requirements increase with an increase of roof pitch*. For low-pitched rises of 4"-6" (10cm-15cm) in a 12" (30.5cm) run the weight of the tiles is usually sufficient to hold them in place on the lath by the ridge or "lug" on the underside of the tile, with only the perimeter tiles requiring metal clips to secure them to the sheathing. But the tiles on even these low-pitched roofs are usually nailed for added security, and additional fastening measures are necessary on roofs with a higher pitch, or in areas subject to high winds or earthquakes. For steeper pitched roofs, such as towers, 7"-11" (18cm-28cm), or 12"-15" (30.5cm-38cm) in a 12" (30.5cm) run the tiles are nailed and a band of perimeter tiles three to four tiles thick is secured with clips. For roof rises over 16" (41cm) in a 12" (30.5cm) run, and in areas prone to earthquakes or hurricanes, every tile may be secured with both a nail and a copper or noncorrosive metal clip, and often also with a dab of roofing mastic or mortar.

The installation of clay roofing tiles in areas with significant amounts of snowfall-over 24" (61cm) per year-also varies somewhat from the normal guidelines. Larger battens may be necessary, as well as additional clipping or tying of the tile to securely attach it to the sheathing. The roof structure itself may also need added bracing, as well as the insertion of small snow clips or snow birds that protrude above the surface of the tile to prevent snow and ice from sliding off the roof and damaging the tile.

Preservation and Repair

Identifying Common Problems and Failures

While clay roofing tiles themselves are most likely to deteriorate because of frost damage, a clay tile roof system most commonly fails due to the breakdown of the fastening system. As the wooden pegs that fastened the early tiles to hand-riven battens rotted, they were often replaced with iron nails which are themselves easily corroded by tannic acid from oak battens or sheathing. The deterioration of metal flashing, valleys, and gutters can also lead to the failure of a clay tile roof.

Another area of potential failure of a historic clay tile roof is the support system. Clay tiles are heavy and it is important that the roof structure be sound. If gutters and downspouts are allowed to fill with debris, water can back up and seep under roofing tiles, causing the eventual deterioration of roofing battens, the sheathing and fastening system, or even the roof's structural members. During freezing weather, ice can build up under tiles and cause breakage during the freeze/thaw cycle. Thus, as with any type of roof, water and improperly maintained rainwater removal and drainage systems are also chief causes for the failure of historic clay tile roofs.

Clay tiles may be either handcrafted or machine-made; in general, roofs installed before the end of the 19th century consist of hand formed tiles, with machine-made tiles becoming more dominant as technology improved during the 20th century. Clay tile itself, whether made by hand or made by machine, can vary in quality from tile to tile. Efflorescence of soluble salts on the surface may indicate that a tile has excessive

porosity which results from under-burning during its manufacture. Poor quality porous tiles are particularly susceptible to breaking and exterior surface spalling during freeze-thaw cycles. By letting in moisture, porous tiles can permit the roof battens and roof structure to rot. The problem may be compounded by waterproof building paper or building felt laid underneath which can, in some instances, prevent adequate ventilation.

Clay roofing tiles can also be damaged by roofers walking carelessly on an unprotected roof while making repairs, or by overhanging tree branches, falling tree limbs, or heavy hail. Broken tiles may no longer provide a continuous waterproof surface, thereby allowing water to penetrate the roofing structure, and may eventually result in its deterioration if the broken tiles are not replaced in a timely manner.

Although modern, machine-made clay tiles are more uniform in appearance than their handmade counterparts, they also have the potential for failure. Occasionally, entire batches of mass-produced tile can be defective.

Regular Inspection and Maintenance

Broken or missing tiles, or leaks on the interior of the building, are obvious clues that a historic clay tile roof needs repair. Even though it may be clear that the roof is leaking, finding the source of the leak may not be so easy. It may require thorough investigation in the attic, as well as going up on the roof and removing tiles selectively in the approximate area of the roof leak. The source of the leak may not actually be located where it appears to be. Water may come in one place and travel along a roofing member some distance from the actual leak before revealing itself by a water stain, plaster damage, or rotted wooden structural members.

Temporary Protection during Repair

In some instances temporary protection and stabilization may be necessary to prevent further damage or deterioration of a historic clay tile roof. Plywood sheets, plastic, roll roofing, or roofing felt can provide short-term protection until repair or replacement materials can be purchased. Another option may be to erect a temporary scaffold that is encased or covered with clear or semitransparent polyethylene sheeting over the entire roof. This will not only protect the exposed roofing members during repair or until repairs can be made, but also lets in enough natural light to enable the reroofing work to take place while sheltering workmen from cold or wet weather.

General Repair Guidance

Once the source and cause of a leak has been identified, appropriate repairs must be made to structural roofing members, wood sheathing, felt or roofing paper if it is part of the roofing membrane, or possibly to vertical roof battens to which the tiles may be attached. If the problem appears limited to gutters and flashing in disrepair, repair or replacement will probably require temporary removal of some of the adjacent tiles to gain access to them. If the roofing tiles are extremely fragile and cannot be walked on even with adequate protection (see below), it may also be necessary to remove several

rows or a larger area of tiles and store them for later reinstallation in order to create a "path" to reach the area of repair without damaging existing tiles. Even if most of the tiles themselves appear to be intact but no longer securely attached to the roof substrate due to deterioration of the fastening system or roofing members, all the tiles should be labeled and removed for storage. Regardless of whether the repair project involves removal of only a few damaged tiles, or if all the tiles must be removed and relaid, historic clay roofing tiles are inherently fragile and should be pulled up carefully with the use of a slate ripper. The tiles can be reattached one-by-one with new corrosion-resistant copper nails, copper straps or tabs, "tingles', or another means after the necessary repairs have been made to the roof.

Replacing Individual Tiles

The most difficult aspect of replacing a single broken clay roof tile is doing so without breaking neighboring tiles. While flat shingle tiles can generally be walked on by a careful roofer without likelihood of much damage, high profile pantiles are very fragile and easily broken. By using sheets of plywood, planks, or burlap bags filled with sand to distribute weight, the professional roofer can move about the roof to fix broken tiles or flashing without causing additional damage. Another method involves hooking a ladder on the ridge to support and evenly distribute the weight of the roofer.

A broken tile should be carefully removed with a slate ripper or hacksaw blade inserted under the tile to cut the nail or nails holding it in place. If successive layers of tile are already in place covering the nailholes, it will not be possible to attach the replacement tile with nails through the holes, so an alternative method of attachment will be necessary. By nailing a tab of double thickness copper stripping on the sheathing below the tile, the new replacement tile can be slipped into position and secured in place by bending the copper strip up with a double thickness of the copper over the tile. A slate hook or "tingle" can be used in the same way. This fastening system functions in place of nails.

When replacing hard-to-match historic tile, and if matching clay tile cannot be obtained, it may be possible to relocate some of the original tiles to the more prominent locations on the roof where the tile is damaged, and insert the new replacement tile in secondary or rear locations, or other areas where it will not show, such as behind chimney stacks, parapets, and dormer windows. Even though replacement tile may initially match the original historic tile when first installed, it is likely to weather or age to a somewhat different color or hue which will become more obvious with time. Thus, care should be taken to insert new replacement tile in as inconspicuous a location as possible. New, machine-made clay tile or concrete tiles should generally not be used to patch roofs of old, handmade tile because of obvious differences in appearance.

Sources for Replacement Tiles

When restoring or repairing a clay tile roof it is always recommended that as many of the original tiles be retained and reused as possible. Sometimes, particularly when working with "pan and cover" type tile roofs, while many of the "cover" tiles may be broken and require replacement, it may be possible to reuse all or most of the "pan" tiles which are less susceptible to damage than the "cover" tiles. But, in most cases, unless matching replacements can be obtained, if more than about 30 per cent of the roofing tiles are lost, broken, or irreparably damaged, it may be necessary to replace all of the historic tiles with new matching tiles. When counting the number or percentage of missing or broken tiles that need to be replaced, it is important to order extra tiles to

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layer of waterproofing, while providing temporary protection during reroofing.

Even if the tiles were originally attached with wooden pegs, it is generally recommended that they be rehung with corrosion-resistant, preferably heavy copper, or aluminum alloy nails or hooks. Today there are numerous nontraditional fastening systems for clay tile roofs, and many of them are patented. Roofing contractors and architects may have individual preferences, and some systems may be better suited than others to fit a particular roof shape or to meet a specific climatic or seismic requirement. Original battens or other roof members that may have deteriorated should be replaced to match the original using pressure-treated wood. Additional support may be necessary, particularly if the original roof was inadequate or poorly designed.

Replacing Flashing

Deteriorated flashing, gutters and downspouts should generally be replaced in kind to match the historic material. Copper or lead-coated copper, if appropriate to the building, or terne-coated stainless steel, is often preferred for use on historic clay tile roofs because of their durability and long lasting qualities. However, copper staining from downspouts can sometimes be a problem on light-colored masonry walls which should be taken into consideration when planning replacements to rainwater removal systems. Clay tile roofs usually have an open valley system where the tiles are separated by metal flashing at intersections of roof sections with different angles. This makes the insertion of new flashing quite easy, as only a few surrounding tiles must be removed in the process. New copper flashing that is too "bright" can be made to blend in and "mellowed" by brush-coating it with boiled linseed oil or proprietary solutions.

Inappropriate Repairs

The most important repair to avoid is replacing broken or missing roof tiles on a historic building with materials other than matching natural clay tiles. Concrete, metal or plastic tiles are generally not appropriate substitutes for clay roofing tiles. They lack the natural color variations of clay tile, and they do not have the same texture, shape, thickness or surface irregularities.

Although much concrete tile and composition tile is produced to resemble the general shape, if not the exact profile, of clay roofing tiles, concrete tile is generally too thick and also lacks the range of colors inherent in natural clay tile. Concrete tile is not a compatible substitute material to repair or replace individual historic clay tiles.

Patching a historic clay tile roof with roofing tar, caulk, asphalt, pieces of metal, or non-matching clay tiles is also inappropriate. Such treatments are visually incompatible. They also have the potential for causing physical damage. Water can collect behind these patches, thus accelerating deterioration of roof sheathing and fastening systems, and during the expansion and contraction of a freeze-thaw cycle ice buildup at patches can break surrounding tiles.

Summary

Clay roofing tile itself, when correctly installed, requires little or no maintenance. Often, it is the fastening system used to secure the tiles to the sheathing that fails and needs to be replaced rather than the tiles themselves. In fact, because clay tiles frequently outlasted the building structure, it was not unusual for them to be reused on another building. When the fastening system has deteriorated, or the roofing support structure

has failed, clay tiles can be removed relatively easily, necessary repairs can be made, and the historic tiles can be relaid with new corrosion-resistant nails or hooks. Broken or damaged tiles should be replaced promptly to prevent further damage to neighboring tiles or to the roof structure itself.

As with any kind of historic roofing material, regular maintenance, such as cleaning gutters and downspouts, can add to the life of a tile roof. Additional preventive measures may include placing wire mesh over downspout openings or over the entire gutter to prevent debris from collecting and water from backing up. Periodic inspection of the underside of the roof from the attic after a heavy rain or ice storm for water stains may reveal leaks in their early stages which can be eliminated before they escalate into larger, more serious repair problems.

If replacement tile is required for the project, it should match the original tile as closely as possible, since a historic clay tile roof is likely to be one of the building's most significant features. Natural clay tiles have the inherent color variations, texture and color that is so important in defining the character of a historic tile roof. Thus, only traditionally shaped, clay tiles are appropriate for repairing a historic clay tile roof.

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Selected Sources of Clay Roofing Tiles

Boston Valley Terra Cotta
6860 South Abbott Road
Orchard Park, NY 14127

Custom-made architectural terra cotta and clay roofing tiles

C.C.N. Clay Roof Tiles (Canteras Cerro Negro S.A.)
8280 College Parkway, Suite 204
Ft. Myers, FL 33919

Distributors of C.C.N. clay roofing tiles from Argentina

Earth/Forms of Alfred
5704 East Valley Road
Alfred Station, NY 14803

Made-to-order reproduction clay roofing tiles

Gladding, McBean & Co.
P.O. Box 97
Lincoln, CA 95648

Manufacturer since 1875 of terra cotta and clay roofing tiles, and custom reproductions

Hans Sumpf Company, Inc.
40101 Avenue 10
Madera, CA 93638

MADE-TO-ORDER Mission-style clay roofing tiles

International Roofing Products, Inc.
4929 Wilshire Blvd., Suite 750
Los Angeles, CA 90010

New clay roofing tiles, some suitable for historic buildings

London Tile Co.
65 Walnut Street
New London, OH 44851

MADE-TO-ORDER reproduction clay roofing tiles

LudowiciCeladon, Inc.
4757 Tile Plant Road
New Lexington, OH 43764

Manufacturer since 1880s of clay roofing tiles, and custom reproductions

M.C.A. (Maruhachi Ceramics of America, Inc.)
1985 Sampson Avenue
Corona, CA 91719

New clay roofing tiles, some suitable for historic buildings

The Northern Roof Tile Sales Company
P.O. Box 275
Millgrove, Ontario LOR 1VO, Canada

Traditional clay roofing tiles imported from England and South America

Raleigh, Inc.
6506 Business U.S. Route 20
P.O. Box 448
Belvidere, IL 61008-0448

Inventory of new and salvage clay roofing tiles

Supradur Manufacturing Corp.
P.O. Box 908
Rye, NY 1~580

Imports Spanish ("S") clay roofing tiles from France

TileSearch
P.O. Box 580
Roanoke, TX 76262

Computerized network for new and salvage clay roofing tiles

United States Tile Company
P.O. Box 1509
909 West Railroad Street
Corona, CA 91718

New clay roofing tiles, some suitable for historic buildings

Note: Measurements in this publication are given in both the U.S. Customary System and International (Metric) System for comparative purposes. Metric conversions are, in some cases, approximate and should not be relied upon for preparing technical specifications.

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