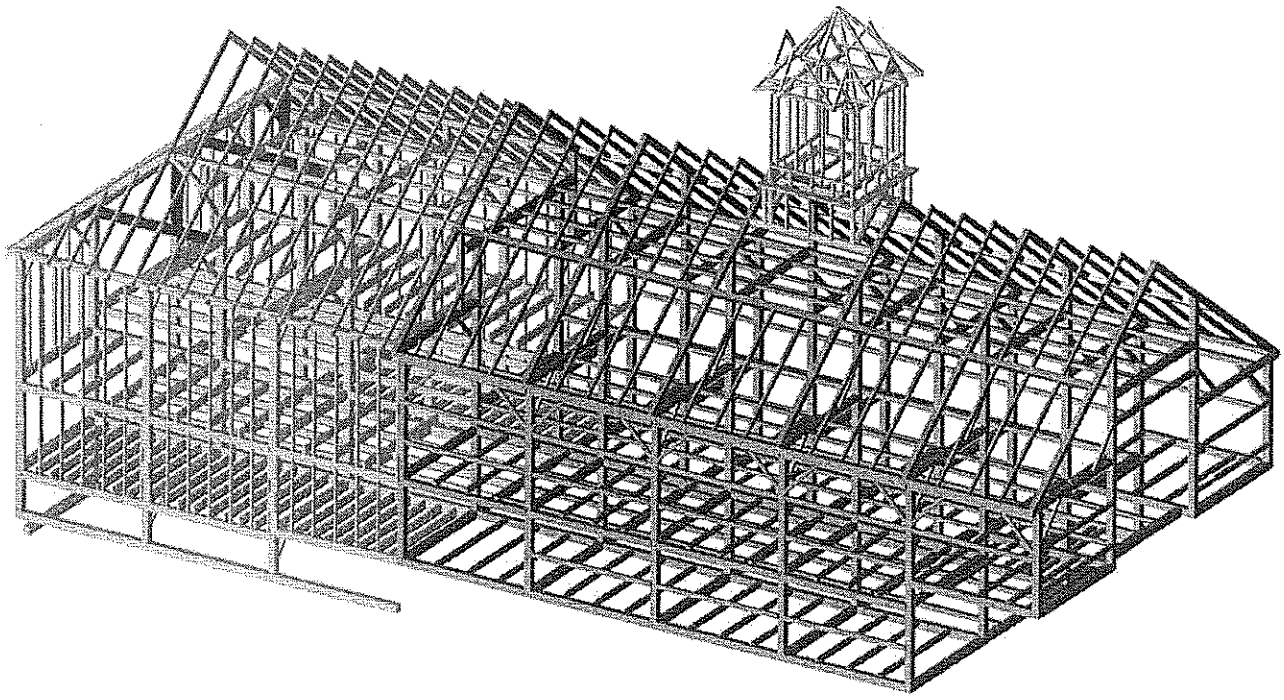
BENSON'S

Historic Structures Report

Benson's Property
Town of Hudson, New Hampshire
May 22, 2003 – 100% Submittal

The Haselton Barn



LCHIP
Investing in New Hampshire's Heritage
LAND & COMMUNITY HERITAGE INVESTMENT PROGRAM

Historic Structures Report

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Town of Hudson, New Hampshire
May 22, 2003 – 100% Submittal

The Haselton Barn

27 Bush Hill Road
Hudson, New Hampshire

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Executive Summary

Purpose of the Report

This Historic Structures Report (HSR) has been prepared under Contract for the Town of Hudson, New Hampshire, with assistance from the New Hampshire Land and Community Heritage Investment Program (LCHIP), grant ID: 2002-R3-06. The purpose of the report is to provide guidance for the interim stabilization/preservation and long term rehabilitation of historic structures in the former Benson's Wild Animal Park, as an element of the implementation of the 2002 Benson's Property Master Plan. Although specific functional programs have not been finalized for the remaining historic structures, the buildings individually possess substantial significance and integrity, and are structurally well suited to a broad range of compatible adaptive reuse.

This study of the Haselton Barn is undertaken to provide a comprehensive understanding of the structure through a careful investigation of its remaining physical fabric. With this information, coupled with a limited review of historical documents associated with the building, a clear understanding of existing conditions, and a chronology of historical significance can be attained. Upon assimilating this information, clear preservation goals for the use and maintenance of this important structure can be created and implemented.

Written historical data for barn structures is notoriously lacking. It is typical that they are mentioned only peripherally in our ancestors inventories and within recorded town documents. Photographs of these structures are also rare. It is therefore necessary to "read" the history of the barn from within. The farmers and their respective livestock over time leave clues as to how the building was designed to be used and how farming techniques required adaptations to the building. The joiner who constructed the building also leaves a legacy of craftsmanship that alludes to certain periods in history that we continue to strive to understand.

Research Methodology

The Historic Structures Report has been developed in the format established by the National Park Service in *NPS-28: Cultural Resources Management Guideline* (1993). Substantial documentary and archival research was completed in 1992 for the New Hampshire Division of Historical Resources Inventory. Archival research for this project was limited to a review of the holdings of the New Hampshire State Library, Hudson Town Library, Hudson Historical Society, and private collections as referenced. The principal focus of the investigation was on documentation of the individual structures, site assessment of existing conditions, and interpretation of evidence of physical evolution. Research goals were as follows:

- Existing conditions assessment
- Determination of structural condition
- Analysis of structural threats and causes of deterioration
- Identification of "character-defining features"
- Stabilization plan and cost estimate
- Development of rehabilitation guidelines and cost estimate
- ADA and code compliance assessment
- Projection of long-term maintenance needs and costs

Field research was conducted November 2002 – May 2003 to document the structure through measured drawings and photographs.

Significance

The Haselton Barn reveals a cornucopia of information about the ambitions and actions of the prominent Haselton family in Hudson, New Hampshire during the late 19th century. It also represents one of the few remaining structures utilized by Benson's Wild Animal Farm during the first two thirds of the twentieth century. In the last two decades however, the barn has remained idle and abandoned. Significant deterioration of the building is a direct result of this neglect. Without immediate action and long term planning for the continued use of this important landmark, the risk for accelerated deterioration and eventual loss of the structure is imminent.

Integrity

The Haselton Barn has gone through numerous changes over time. However, these changes are part of a continuum of use and evolution that reflect the qualities that make the barn historically significant. The overall form design, materials, and craftsmanship present in the structure retain a high level of integrity, both from the period of its original construction, and during the historic period of John T. Benson's ownership of the property.

Major Issues Identified in the Scope of Work

The most important immediate requirement to insure the preservation of the structure is stabilization. In particular, it was discovered that the cupola is in worse condition than anticipated. It is close to complete structural failure. Temporary removal of the cupola will allow repairs to be safely completed, so that it can be returned to the building in sound and maintainable condition.

Another important consideration in the long-term preservation of all the historic Benson's structures is the need for regular maintenance after repairs are completed. Development of a maintenance plan and checklist, and annual or semi-annual maintenance inspections are recommended.

Interim Treatment Recommendations

A stabilization plan has been developed to slow the existing deterioration of the barn. By executing these recommendations, the barn can be made safer and less exposed to the elements. These recommendations are provided as a beginning point for the complete preservation of the building. The work is necessary to ensure the structural integrity of the building, and to provide opportunity for careful planning and fund-raising for the eventual restoration of the barn. The estimated cost of the stabilization work is $26,500. It should be noted that funds spent on stabilization in the short term will keep the costs or long term treatment from rapidly escalating due to the worsening structural condition of the building.

Ultimate Treatment Recommendations

The Feature Inventory and Condition Assessment completed for this report by Principal Investigator Arron J. Sturgis of Preservation Timber Framing, Inc. details a complete, prioritized list of stabilization, preservation, and rehabilitation work developed to return the structure to sound, maintainable, and functional condition. Following stabilization of the building, these actions can be undertaken sequentially to support the goals that have been identified for use of the structure.

Preservation treatments include repair of foundation walls and timber frame joinery to reverse structural problems that have occurred due to settlement and loading. Restoration treatments are focused on repairing and preserving those features of the barn that express the architectural character of the barn through the Benson's Wild Animal Park Period. Rehabilitation work addresses issues of public accessibility and safety, and accommodations for public use.

Total treatment costs by treatment category:

Alternate A – Install Standing Seam Metal Roof on Barn and Silo

1. Stabilization and Preservation		$103,470
2. Restoration		$217,033
3. Rehabilitation		$298,618
	Total Cost	**$619,121.40**

Alternate B – Install 50-Year Architectural Asphalt Shingles on Barn and Silo

1. Stabilization and Preservation		$103,470
2. Restoration		$217,033
3. Rehabilitation		$283,618
	Total Cost	**$604,121.40**

Recommendations for Additional Research

It is possible that additional photographs and historic documentation exist for the Haselton Barn. Publicizing the preservation of the barn in Hudson and surrounding communities may provide an impetus for the location of other historic documentation.

Acknowledgments

Preparation of this report would not have been possible without the support and encouragement of all of the members of the Benson's Committee, past and present, and Sean Sullivan, Director of Community Development for the Town of Hudson. Betsy Hahn of the Nashua Regional Planning Commission kept the project on track as Project Manager for the LCHIP grant, and anticipated every liaison and coordination need. Special thanks go to Esther McGraw and Laurie Jasper of the Benson's Committee for generously sharing their prodigious knowledge and passion for Benson's, and also to Esther for looking out for the project team on cold days in the field.

Introduction

What is a Historic Structure Report?

The purpose of a historic structure report (HSR) is to develop an understanding of a building's physical history and condition, and provide specific, useable information for implementing a treatment plan. The New Hampshire Division of Historic Resources states that, "One of the first parts of a preservation project should be a historic structure report, which analyzes the physical evolution, condition, and potential of a historic building as documented by historical and architectural and technological evidence."[1] Buildings that are important in the history of a community have the potential to continue to serve that community in many ways after their original function is no longer viable. Like all cultural and natural resources, buildings have many levels of value – functional, economic, and other values that are intangible, but no less meaningful. A historic structure report is a tool for analyzing the multiple values that a building represents in a way that balances the relationship of meaning, use, and cost to realize maximum benefit to the community.

The decision to complete an HSR is part of a broader planning process, involving consultation from many sources and interest groups, leading to the conclusion that a historic resource should be preserved. The two major concepts that an HSR uses in assessing a building are *significance* and *integrity*. *Significance* considers the building's place in history through its context and associations. Is there a documented connection with a famous person or event? Is it a rare surviving example of a particular historic building type? Is it part of a story that illustrates an important theme in the history of a place or community? *Integrity* is the degree to which the ideas and values that make a building significant can be recognized in, and identified with its existing physical form, construction, and materials.

Documentation of a historic structure includes identifying the visual aspects and physical features that contribute to its distinctive architectural character. These *character-defining features* (CDFs) include the overall shape of the building, its materials, craftsmanship, decorative details, and interior spaces and features, as well as site and landscape elements. Character-defining features are those aspects of a building that define its particular aesthetic quality, and without which its architectural or historical integrity would be diminished or lost.

Finally, an HSR assesses the *condition* of the building to determine the extent and causes of deterioration and structural problems, and develop recommendations and cost estimates for treatment and future reuse. Resources available for the preservation of historic structures are typically extremely limited. Preservation is focused on means of finding compatible uses in the long term, and minimizing the loss of historic character in the short term.

Preservation Standards and Guidelines

Federal and state agencies use the *Secretary of the Interior's Standards for Treatment of Historic Properties* as the benchmark for reviewing proposed treatment of a historic structure (see Appendix I). The standards recognize four potential treatments for historic structures – preservation, restoration, rehabilitation, and reconstruction.

- *Preservation* focuses on the maintenance and repair of existing historic materials and retention of a property's form as it has evolved over time. (Protection and Stabilization have now been consolidated under this treatment.)

[1] "Alterations, Additions and Architects (Historic Resource Information)". New Hampshire Land and Community Heritage Investment Program website. Accessed November 27, 2002. <http://www.lchip.org/Alterations,%20Additions,%20&%20Architects.htm>

- *Rehabilitation* acknowledges the need to alter or add to a historic property to meet continuing or changing uses while retaining the property's historic character.
- *Restoration* depicts a property at a particular period of time in its history, while removing evidence of other periods.
- *Reconstruction* re-creates vanished or non-surviving portions of a property for interpretive purposes.

Rehabilitation is by far the most common treatment for structures that will be used for contemporary purposes. It is defined as *"the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values".*[2]

Although rehabilitation has been identified as the ultimate treatment for the Benson's historic structures, interim measures may be required to maintain them without additional loss of historic integrity until long term uses have been identified, and funding is available for rehabilitation. Stabilization consists of measures to slow or stop the process of deterioration by reestablishing a weather resistant enclosure, and providing temporary, reversible means of structural shoring or support where necessary.

The deed conveying the Benson's property to the Town of Hudson includes a preservation restriction on the historic property, which identifies the Secretary of Interior's Standards for Rehabilitation and Guidelines for Rehabilitation of Historic Properties as the principal standard for review. The preservation restrictions applied to the buildings and their settings require that, where possible, repair, replacement, alterations and additions should be made "in-kind", with forms, design, materials, and workmanship that match or complement and are compatible with the historic forms, design, and materials.

[2] Kay D. Weeks and Anne E. Grimmer, *The Secretary of the Interior's Standards for the Treatment of Historic Properties, with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings* (Washington, DC: U.S. Department of the Interior, National Park Service, Cultural Resources Stewardship and Partnerships, Historic Preservation Services, 1995), p. 61.

Part 1: Development and Use

Historical Background and Context

Historic Hudson: 1761-1910

The area comprising the present 168-acre Benson's Property lies to the southeast of Hudson Center, bounded by Route 111, Kimball Road, Bush Hill Road, and Falling Rock Road. Town records show that the Haselton family resided in Hudson (Nottingham West) during the 18th and 19th centuries. Previous documentation of the barn implies an early (c. 1761), date of construction for the Haselton Barn.[3] While it is possible that there was an earlier structure on the site, physical evidence precludes such an early date for the existing structure.

An 1852 Chase Map shows a building near this location, possibly the original homestead owned by A. Haselton, later demolished. Census records indicate that the property was divided into several farms during the second half of the 19th century, producing corn, oats, peas, beans, potatoes, apples, butter, wood, and hay. The earliest sections of the existing gable-front bank barn were constructed in the period 1860-1880, based on analysis of square-rule frame typology, floor plan design, and mixed use of hewn and circular sawn material in the construction of the frame. A late 19th century photograph of the Haselton Barn shows an extensive lumber milling operation. Architectural evidence dates a number of additions to the barn to the period 1885-1910. During this period the ornate cupola was constructed and three bays were added to the rear of the barn. A silage storage ell was added at the east side of the barn as well as a shell ell on the west side (since demolished).

Figure 1. Late 19th century view of Hazelton Barn. Collection of Esther McGraw, Hudson, NH.

[3] New Hampshire Division of Historical Resources – Area Form, A-28. Benson's Wild Animal Farm, Hudson, NH. November, 1992.

Interstate Fruit Farm: 1910-1924

Between 1910 and 1911, these farms were consolidated through purchase by the Interstate Hotel Corporation of Lexington, Massachusetts, which operated the property as the Interstate Fruit Farm. One unsuccessful aspect of the Interstate Fruit Farm tenure was the operation of a "health farm" for retired circus performers and animal trainers. In 1915, John T. Benson, President of the Interstate Hotel Corporation was appointed Manager of the Interstate Fruit Farm.

Benson's reputation as an animal trainer, adventurer, zoo curator, and entrepreneur was by this time firmly established. Born the son of a menagerie owner in Dewsbury, Yorkshire, England in 1871, Benson emigrated to the United States in the 1890s, where he quickly achieved recognition for importing wild animals from India, Africa, and Thailand for exhibit in zoos and circuses around the country. As a wild animal scout Benson is credited with capturing the first gorilla to be exhibited in captivity for the Ringling Brothers Circus. He participated in the development of a number of zoos including the Franklin Park Zoo in Boston where he served as curator. In 1914, Benson became the United States Manager for the world's largest wild animal training organization, Hagenbeck of Germany, importing exotic animals to a shipping depot in Hoboken, New Jersey, for sale to zoos and circuses. It is not known whether the Interstate Fruit Farm initially served as a staging area for the Hagenbeck organization during Benson's tenure as Manager, or whether this figured in the operation of the "health farm".

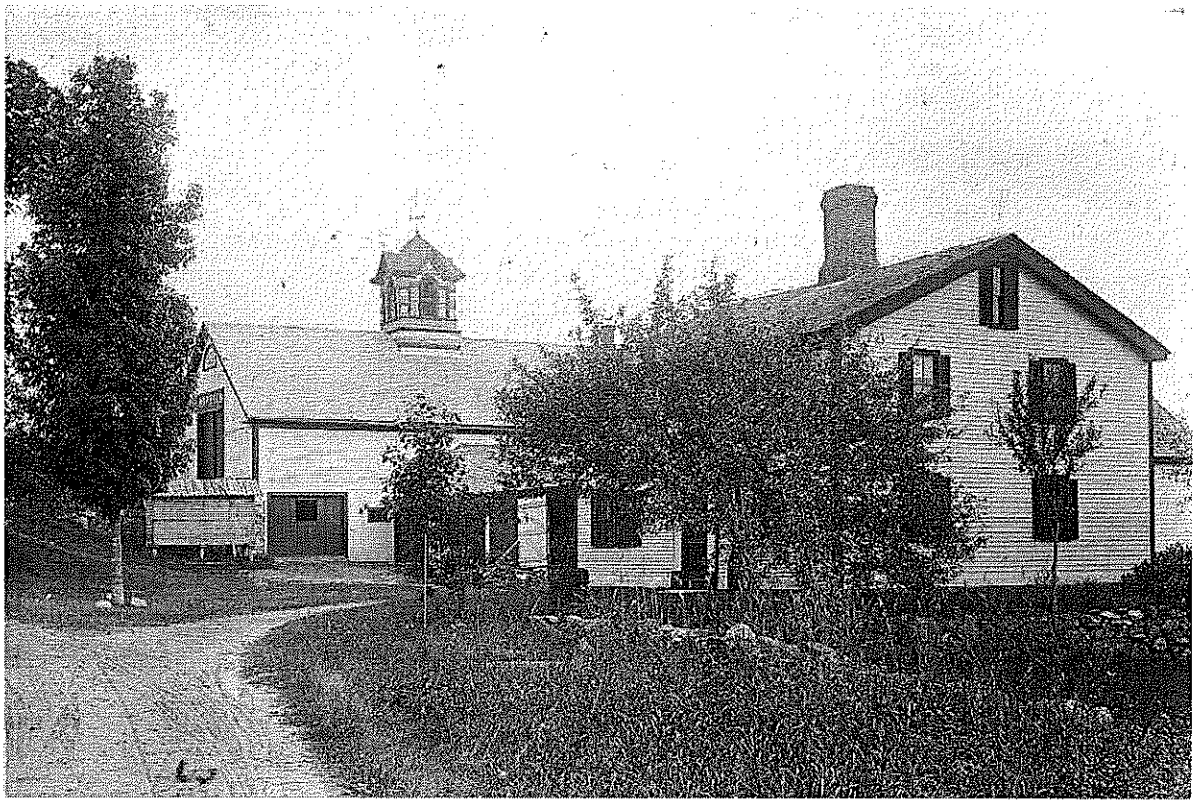

Figure 2. Photograph of Haselton Barn with farmhouse (later moved) in foreground. Late nineteenth or early twentieth century, date unknown. Collection of the Hudson Historical Society.

Benson's Wild Animal Farm: 1924-1943

In 1924, Benson purchased the Hudson property outright and renamed it Benson's Wild Animal Farm, using it as a quarantine station, training venue, and shipping base for animals imported from Hagenbeck in Germany. By 1926, use of the Hoboken, New Jersey terminal was discontinued, and animals were transported by rail from the port of Boston to the Rochester Railroad Station in Hudson Center, a short distance from the Benson's property.

Benson lived in the c.1880 farmhouse on the property (NHDHR Inventory #28.A). Two large existing barns, the "John T. Benson Barn" associated with the farmhouse (NHDHR Inventory #28.B) and the Haselton Barn (NHDHR Inventory #28.HH) were available to house animals to which those accommodations were suited. The Elephant House (NHDHR Inventory #28.D) was probably one of the earliest Benson's era structures, necessitated by the particular requirements of its inhabitants. Other pens, runs, and enclosures were undoubtedly constructed as needed. Another early Benson's structure was the rustic Office (NHDHR Inventory #28.C2). While Benson developed the infrastructure of the Wild Animal Park, he also assembled a cadre of animal trainers including: lion trainer, Joseph Arcaris; elephant trainer Carl Neuffer; horse trainer, Fred Pitkin; and chimpanzee trainer, George Marshall.

In 1927, Benson's Wild Animal Farm opened to the public for a small admission fee. Until his death in 1943, John T. Benson developed the property into a renowned regional attraction celebrated as "the strangest farm on earth". Adopting the model pioneered by his business associate Carl Hagenbeck with the creation of an "animal park" near Hamburg, Germany in 1907, Benson created a setting where exotic animals appeared in a naturalistic landscape. Financed largely by Benson's success as an animal merchant, the facilities were constantly expanded during the 1930s. Attractions included: enclosures for the largest collection of monkeys ever exhibited at one time; bear and lion cages; gorilla house; pony and zebra houses; sea lion pool and shelter; snake and reptile exhibits; and caged enclosures for exotic birds. The grounds were extensively landscaped, and featured picturesque paths, water features, and rustic bridges. Regular performances displayed trained tigers, lions, ponies, dogs, seals, and elephants. Rides on Betsey, the famous elephant were among the most popular of all the attractions at Benson's. In between animal acts, visitors enjoyed miniature golf, horse-shoes, lawn bowling, shuffleboard, and children's rides. Concession areas including a Bavarian style café and beer garden offered food and drink.

Lapham Era: 1944-1976

Following Benson's death, the Wild Animal Farm was sold in 1944 to a Boston investment group headed by Raymond W. Lapham. The Farm was closed during World War II. When it reopened in 1945, Benson's practice of selling animals to other zoos and circuses was discontinued. Under Lapham's management the number of animal species increased, and the Farm began to operate more along the lines of a traditional zoo operation. Additional amusement rides were also added. During the 1950s, Benson's was one of New Hampshire's top attractions, second only to Rockingham Race Track, with approximately 500,000 visitors annually. Raymond Lapham died in 1976, and Benson's was put up for sale again. During the Lapham period the cellar area of the barn was configured for equipment and auto maintenance. Overhead doors and contemporary windows were added, and additional lofts installed using dimension lumber and joist hangers.

Provencher Period: 1979-1987

Arthur P. Provencher, a Nashua businessman, purchased the property in 1979, and began the process of expanding the operation to include additional amusement rides, as well as a petting zoo, and changes in the animal habitat areas. In 1980, 125 different species were exhibited at Benson's for a total of more than 400 animals. By 1982, the number of animals increased to nearly 800. Benson's employed approximately 250 summer workers, many of them high school students from Hudson and surrounding towns. When Circus World, an expanded amusement ride area opened in 1982, up to 10,000 people visited the park daily. In 1983, Provencher acquired the Hudson Railroad Depot and moved it from its Greeley Street location in Hudson Center to the Park and remodeled it as a residence.

Despite its continuing popularity, Benson's Wild Animal Park filed for reorganization under federal bankruptcy statutes in 1985. The Park operated on a scaled-down basis until 1987, when it closed to the public. The animals were sold to zoos and other federally sanctioned destinations. All of the amusement rides, fixtures, and memorabilia, along with many of the post-1950 landscape features were sold and removed.

New Hampshire Department of Transportation: 1992-2002

In 1992, the New Hampshire Department of Transportation (NHDOT) acquired the Benson's property for the purpose of creating a wetland mitigation site for wetland impacts caused by construction of the Nashua Circumferential Highway. The proposed mitigation activity consists of restoration and/or construction of up to 44-acres of wetlands on the Benson's site. The Department of Transportation took steps to stabilize some of the historic structures, and provide security fencing. In November 1992, an intensive historic structures survey was completed for the New Hampshire Division of Historic Resources (NHDHR) by Lynne Emerson Monroe of the Preservation Company, Kensington, NH. All existing structures were field checked, documented and a NHDHR Inventory Form was completed. Based on this survey NHDHR determined the Benson's property to be eligible as a district for the National Register of Historic Places with 25 contributing structures.

To be eligible for the National Register, structures or districts must be found to have significance under one or more of the following criteria.

A. That are associated with events that have made a significant contribution to the broad patterns of our history; or

B. That are associated with the lives of persons significant in our past; or

C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. That have yielded or may be likely to yield, information important in prehistory or history.[4]

The Benson's property was determined eligible as a district under Criteria A, B, and C, "for the information it conveys about the growing importance and evolution of naturalistic animal facilities/zoos inn the early half of the 20th century, for its association with John T. Benson, an animal trainer and showman of national, if not world-wide significance, and as a rare surviving collection of structures typifying modest zoos in the first half of the 20th century."[5] The Division of Historic Resources identified the principal period of significance as 1924-1947, the date of John T. Benson's ownership of the property. The Interstate Fruit Farm period, 1910-1924, was noted as a secondary period of significance.[6]

In 1997, the Benson's site was reviewed again by NHDHR, and found to be no longer eligible as a district for the National Register due to loss of integrity through physical decay, vandalism, and evidence of post-1947 alterations to contributing structures.[7] Removal of 16 structures and several animal pens was approved by NHDHR, and completed by the Department of Transportation. Additional architectural documentation was completed on the remaining structures by the Cultural Resource Group of Louis Berger and Associates, Inc. in 1998. Photographs and site sketches were completed by Richard M. Casella, Senior Architectural Historian at LBA. In 1998, the John T. Benson Barn, (NHDHR Inventory #28.B) was

[4] "How to Apply the National Register Criteria for Evaluation". U.S. Department of the Interior, National Register website. Accessed January 20, 2003. < http://www.cr.nps.gov/nr/publications/bulletins/nrb15/nrb15_2.htm>
[5] New Hampshire Division of Historical Resources – Area Form, A-28. Benson's Wild Animal Farm, Hudson, NH. November, 1992. Sheet 13 of 77.
[6] NHDHR Determination of Eligibility (DOE), with annotations. January 6, 1993. NHDHR files.
[7] Nancy C. Muller, Director, NH State Historic Preservation Officer to William Hauser, Bureau of Environment, NH Department of Transportation. October 17, 1997. Correspondence, NHDHR files.

destroyed in an arson fire. Ironically, the barn was lost just as a structural assessment was being completed by Arron Sturgis of Preservation Timber Framing, Inc.

Use of the Benson's property as a passive recreation area has been determined to be compatible with the wetland mitigation plan. Based on this finding, NHDOT negotiated the sale of the property to the Town of Hudson. The Town of Hudson, through the Board of Selectmen, appointed a citizen committee to study options for the use of the property. A Conceptual Master Plan for the development of the Benson's Property was completed in March 2002, by Vanesse Hangen Brustlin, Inc. Sale of the property to the Town of Hudson, under conservation and preservation easements is pending.

The Benson's Committee established by the Hudson Board of Selectmen on May 7, 2001 was charged with "the responsibility of recommending a site plan with proposed uses for the Benson's property." The Committee worked actively with consultant Vannasse Hangen Brustlin Inc. (VHB) during the development of the Benson's Property Master Plan. The Committee also solicited public input during the planning process and met regularly with NHDOT, the Town Planner, and representatives of the Nashua Regional Planning Commission. The Committee received significant input on proposed alternatives from local citizens through public informational sessions and questionnaires.

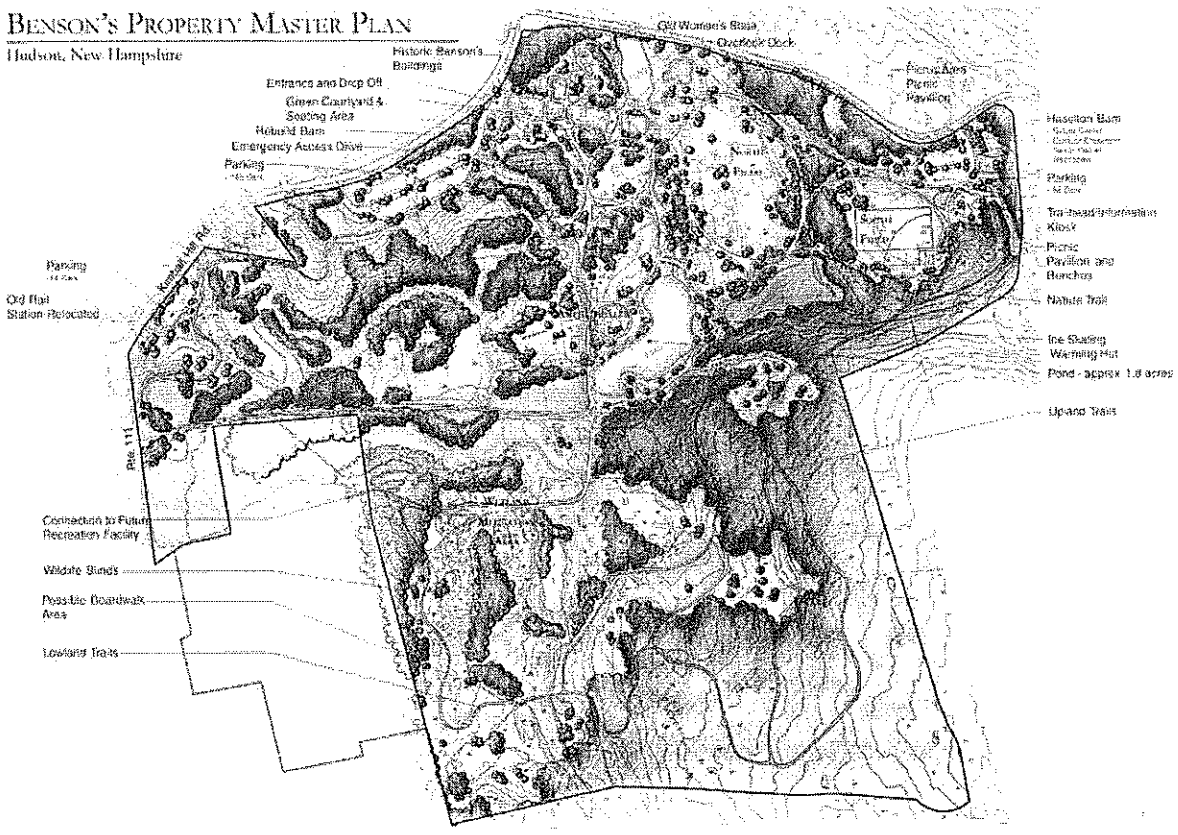

Figure 3. Benson Park Master Plan. (VHB, 2002).

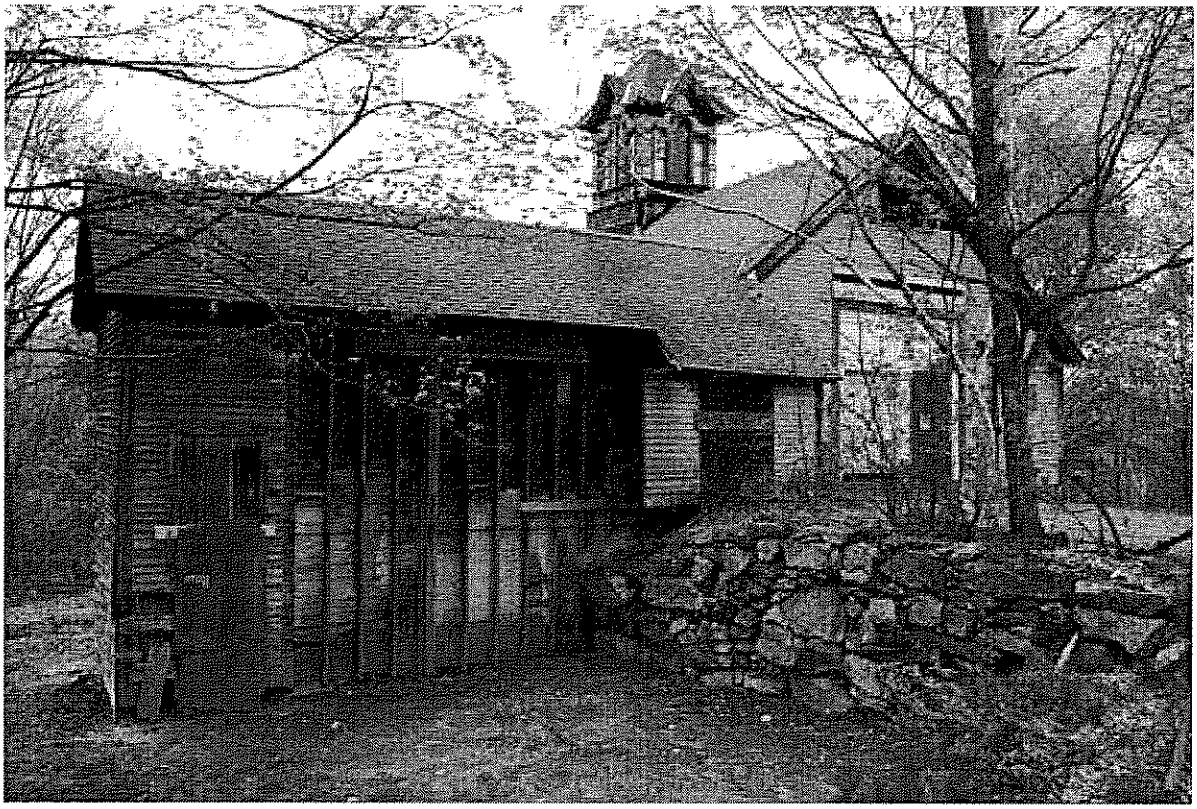

Figure 4. East (front) elevation with granary ell in left foreground. Photograph by John Butler. (May 15, 2003).

Architectural Description

The Haselton Barn is a three story barn set into a bank so that there are entrances at grade at each level of the structure. The barn is 36 feet wide and 96 feet long. The earliest original barn was 60 feet long. Three bays were later added at the rear of the barn to create its current foot print. At the South East corner of the barn an ell is attached. This structure is 14 feet wide and 39 feet long. It is completely sheathed on its interior and is believed to have been used for the storage of silage. Another shed ell once existed along the North eave wall. It measured 12 feet wide by 36 feet long. This ell has since been removed although the foundation remains. The front gable end of the barn faces Bush Hill road and the entry here allows direct access to the third floor center drive of the barn. Hay could be brought into the barn at this level and pitched to both the left and right sides of the center drive providing feed for animals at lower levels. Above the third floor center drive, is a final loft area that is designed for hay storage.

The Haselton barn was constructed in this manner to provide ample and accessible feed and shelter for both cows and horses. Hay from the third floor was dropped to hungry animals at the second floor. Stone ramps along the South eave wall allowed the cows to exit into the barn yard.

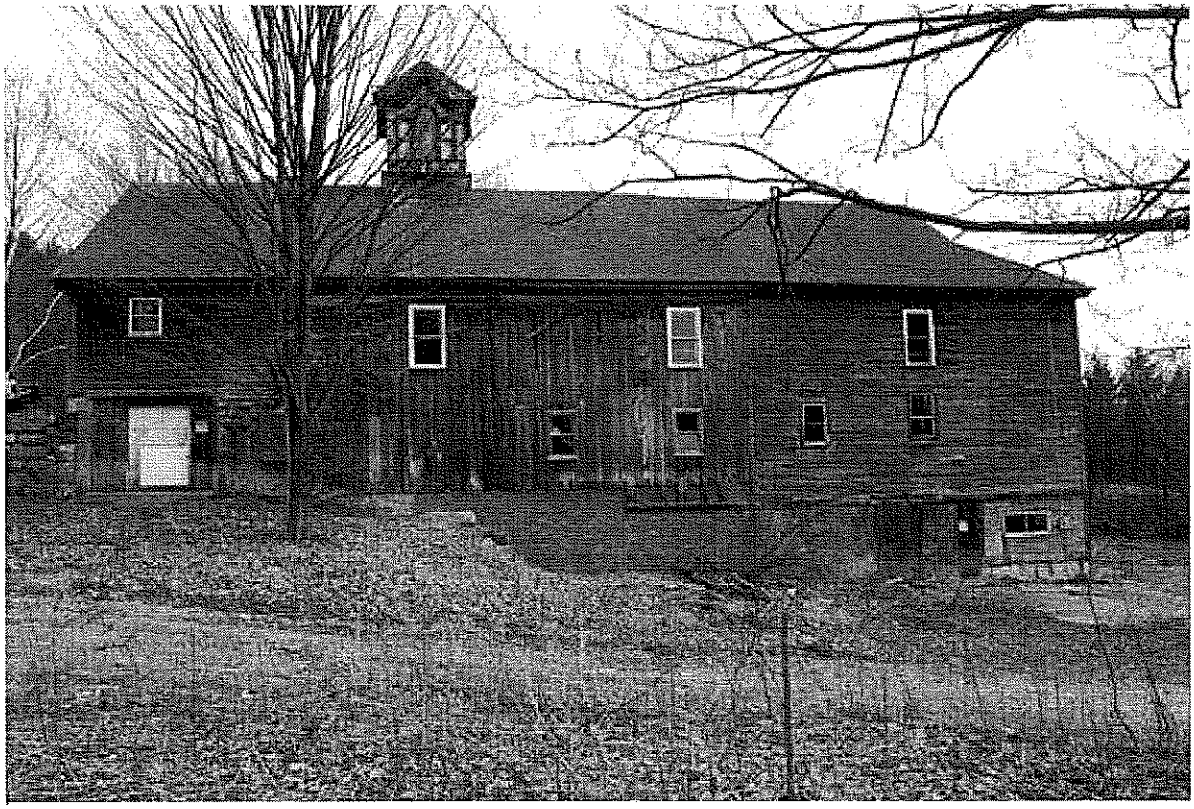

Figure 5. North elevation. Photograph by John Butler. (November 7, 2002)

At the first floor level manure was collected from the stanchion areas above along the South wall and exported to the fields. Stalls for horses would have traditionally been placed at the first and second floor levels as well. The North eave wall shed ell provided covered access to the barn cellar. The ell having been removed, left an opening along the North eave that has since been bricked in. The back gable end of the barn provides yet another first floor entrance at grade. This allowed for wagons to efficiently collect and carry animal waste from the barn.

The barn is constructed of native soft woods; primarily pine and hemlock. The original barn consists of six bents and five bays. Bents can be considered cross sections of the barn and the bays consist of structural elements that connect the bents. Attached drawings depict each bent and bay and provide an accurate representation of the timber frame.

When assessing and describing the frame components it is important to note the conversion method of the timbers and the joinery methods employed to lay out and join the timber. In this barn it is clear that the large elements within the original frame are all hand hewn. This means that they were made square from round logs with the use of a broad axe. Smaller framing members i.e. common rafters and angled braces are circular sawn. All of the exterior sheathing is also circular sawn. Timber frame components in the South East ell and in the three bays added to the rear of the building are also circular sawn.

The lay out system for the joinery in the original 36' by 60' barn is known as the square rule method of lay out. This is clearly represented at the wall girt/post connections where the post is reduced to 7-1/2 inches in width to accept the standardized length of the following wall girt. In this way a non-uniformly shaped beam, which is typical in hewn material, can be made uniform. By utilizing this method the joiner of the barn greatly enhanced the speed by which he could cut and install the framing elements with precise

accuracy. A full description of this lay out system is included in the appendix of this report.

The lay out system for the ells and the three added bays of the barn can be considered mill rule. This means that the joiner made the assumption that the timbers were uniform and therefore, did not reduce the elements to determined dimensions before joining the structural elements. Uniformity of timber is a direct result of improved sawing technology.

The bents within the original barn consist of two perimeter eave posts. A tie beam sits atop the perimeter post and engages each of two drive posts. Another tie beam set higher in the frame connects the two drive posts and provides support for the high drive loft joists. Angled braces support the lower tie beams. The lower two tie beams cross over the perimeter posts and provide support for the overhang. A large principle rafter is mortised and tenoned into the top of the tie beam at its end.

The roof system of the barn can be termed as a principle rafter, principle purlin, common rafter roof system. The principle rafter accepts a discontinuous large purlin which in turn supports the mid-span of the common rafters. This is a typical roof system for a barn of this size. The drive posts engage and support the principle rafters just above the rafter mid-span. At each joint in the frame a tenon is accepted by a mortise. The joint is pinned together with a one inch hardwood peg.

Of particular note in this frame is the addition of post extensions at every post in bents two through six. At each perimeter post in these bents the post has been lengthened by the installation of a post foot that is joined to the post using a traditional bladed scarf joint which is pinned together with four wooden pegs (see drawing sheet #18 of 18 for detail). At each drive post, an extension of the post has been added to the top of the post where it engages the principle rafter. Here, an extended mortise has been chopped into the top of the drive post and a short post top with corresponding extended tenon fits snugly therein. This addition is also pinned with wooden pegs. In bent six the left drive post accepts both a top and bottom fix to gain the joiners desired length.

Usually the addition of this type of joinery indicates that the barn had been damaged and repaired or that the frame had been significantly reworked at some time during its life. Upon careful scrutiny however, it is hypothesized that the additions to the posts in this frame were in fact original to its initial raising. This is

Figure 6. South elevation with silo ell at right. Photograph by John Butler. (May 15, 2003)

confirmed by closely studying the perimeter post feet additions.Evidence supporting this idea is best illustrated in the North perimeter post in bent six. Close examination of the bladed scarf joint reveals two girt mortises that are quite revealing. The mortise accepting the North eave wall girt has layout scribe lines that pass through the reference face of the original post and the scarfed post foot. This would indicate that the mortise was not chopped until the post and post foot addition were already joined.

The mortise accepting the lower gable end girt reveals anther clue as to when the post feet additions were installed. In this mortise a peg that secures the bladed scarf joint is interrupting the mortise. It is clear to see that the joiner drilled and chopped out the mortise with the peg in place as one half of the peg is removed to allow for the walls of the mortise while the remaining half of the peg remains to the outside of the mortise. If the bladed scarf joint had been added at a later date the peg would not have been chopped longitudinally. Instead it would have been driven into the back of the mortise where it would have run afoul of the installed tenon.

It is left for conjecture as to why the frame required that the posts be extended. It is important to consider however, that the bank in which the barn is nestled required substantial preparation before the frame could be erected. Bent one which orients on Bush Hill road, has an eave height of 9 feet. Bents two through six have an eave height of 18 feet from sill to tie beam. This means that the entire first bay of the barn is on a completely different foundation height than the rest of the original barn. In fact the bank is so tall that a retaining wall exists at bent two to restrain the bank. The granite foundation is substantial around the entire barn, but it is bolstered by this retaining wall and the infill of stone rubble in front of it.

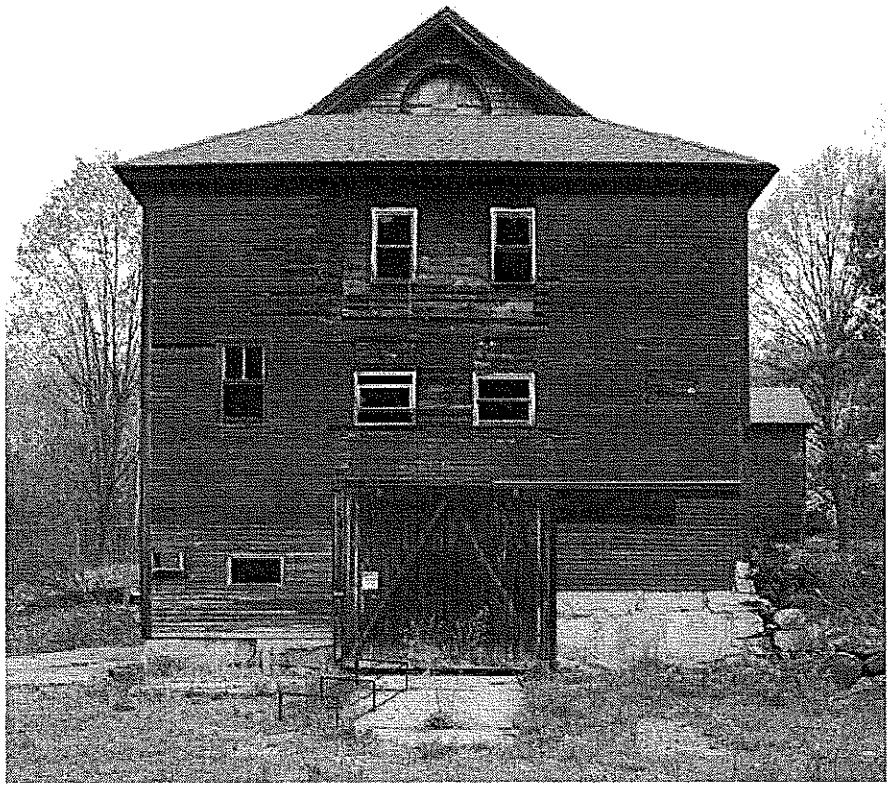

Figure 7. West elevation, silo ell to the right. Photograph by John Butler. (May 15, 2003)

It is entirely possible that the ramp and retaining wall and perhaps the entire foundation was created and ready for the frame while the frame was cut to accept a slightly different foundation configuration. Many timber frames were built off site at timber yards and transported to their respective sites. It may be then, that a miscommunication took place between framer and mason requiring the adaptation of the frame to meet the bank requirements. Regardless of the root cause of this adaptation, the post feet and post tops are well executed and the structural integrity of the frame is uncompromised.

A detailed analysis of the individual elements of the building, and their evolution, and existing condition is contained in the Feature Inventory and Condition Assessment appended to this report.

Figure 8. Drive bay looking west. Photograph by John Butler. (May 15, 2003)

Part 2: Treatment and Use

Character-Defining Features and Recommendations

Introduction

The proposed treatment for the Haselton Barn is rehabilitation. The Secretary of Interior's Standards for the Treatment of Historic Properties define rehabilitation as:

. . . the act of process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values.[8]

The "portions or features" to be preserved are known as character-defining features (CDFs), elements of a building which responsible for the particular visual and aesthetic qualities that cause a structure to be valued as a historic resource. CDFs may by architectural features and details, materials, craftsmanship, surface finishes, interior spaces, or architectural context.

Many of the Secretary of the Interior's Standards for Rehabilitation specifically address the retention of character-defining features.[9] These include the following:

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.

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.

4. Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.

5. Distinctive features, finishes, and construction techniques or examples of craftsmanship that characterize a property shall be preserved.

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.

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.

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.

A primary goal of an HSR is to define a buildings CDFs to insure that they are protected from alteration of demolition during the rehabilitation process. CDFs may also be missing or removed elements that were important to the historical character of a structure. The Secretary of Interior's guidelines states that:

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[8] Kay D. Weeks and Anne E. Grimmer, *The Secretary of the Interior's Standards for the Treatment of Historic Properties, with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings* (Washington, DC: U.S. Department of the Interior, National Park Service, Cultural Resources Stewardship and Partnerships, Historic Preservation Services, 1995), p. 61.
[9] Weeks and Grimmer, p. 62.

". . . where an important architectural feature is missing, its replacement is always recommended . . . if adequate historical, pictorial, and physical documentation exists so that the feature may be accurately reproduced.[10]

Exterior Elements

- Overall form and massing of the barn.
- Evolutionary development of the 19th and 20th century portions of the structure including the cupola, silo, and added three bays.
- Pre-1950 windows and doors.
- Exterior siding and foundation materials.
- Architectural detail including the decorative shingling patterns on the cupola, eaves and cornices.

Interior Elements

- Layout, joinery, and conversion methods exhibited in the timber frame.
- Arrangement of the interior spaces in bays and floor levels
- Flooring and interior siding.
- Interior bare wood and whitewashed finishes.

Recommendations

Identification of these character-defining features establishes a benchmark for making decisions about specific rehabilitation treatments for the barn. For example, contemporary windows were added after Benson's death in 1944, and other historic window openings were boarded over. Reproducing the historic windows in their original locations enhances the historic character of the building, reinforces the connection with its historic period of significance, and increases natural light to the interior for functional uses. Similarly, restoring the cow door on the south elevation of the lower floor level , both improves the accessibility of the structure, and enhances historic character. Viewed in this light, functional considerations and preservation values can complement each other.

The detailed treatment recommendations in the Feature Inventory and Condition Assessment section of this report are divided into stabilization, preservation, restoration, and rehabilitation treatments. Rehabilitation recommendations such as the creation of a finished space for year-round use in the cellar, and installation of an elevator for handicapped accessibility are designed to introduce new construction into those areas that are least intrusive to the historic construction and character of the building.

Some treatment decisions which might be desirable from a cultural resources point of view are less than optimal for reasons of initial cost and/or long-term maintenance. Although the building originally had a wood shingle roof, installation of a new wood shingle roof would be at least double the cost of a standing seam metal roof as detailed in the treatment recommendations. A wood roof would also have less than half the anticipated life span of a metal roof, and would require substantially more maintenance. Considered in the context of preserving the entire building with limited resources, the most focused effort should be on preserving existing historic materials and building fabric.

[10] Weeks and Grimmer, p. 65.

Interim Treatment and Use: Stabilization

The Haselton Barn has been largely abandoned for over ten years. Although some stabilization work was done in the early 1990's, deterioration of the building continues and accelerates. The following is a prioritized list of recommended stabilization efforts designed to slow the existing deterioration of the barn. By executing these recommendations, the barn can be made safer and less exposed to the elements. These recommendations are provided as a beginning point for the complete restoration of the building. The work is necessary to ensure the structural integrity of the building, and to provide opportunity for careful planning and fund-raising for the eventual restoration of the barn.

1. **Clean Up** –The barn is in need of an extensive clean up effort to remove debris from every level of the structure. Existing paper products as well as tires, engine parts and other debris must be removed to reduce the present fire hazard facing the building. Estimated Cost: A minimum of two 30-yard dumpsters will be necessary for the clean up effort. Labor must be equipped with respirators and protective clothing.

2. **Windows and Doors** – The barn must be made secure by closing in all window and door openings. This should include the removal of windows and doors that have been extensively damaged by vandalism and the elements. Window openings should be temporarily covered by clear lexan or plexiglass panels set in wood frames to protect the security of the building while still allowing light into the structure for continued investigation and preservation. Hinged 3/4 inch thick plywood temporary doors with proper hasp and padlock security should secure door openings. Keys should be procured by Police and Fire departments via an on site locked box designed for said purpose. Additional keys should be obtainable through the town office and a log of their use established.

3. **Stabilize Cupola** – The cupola on top of the original barn is in significant structural failure. It should be stabilized and removed to the ground in order to reduce the risk of continued damage to its architectural and structural elements. The extent of damage here also poses a significant safety risk should strong wind and heavy snow aid in its imminent collapse. The cupola is the one element of the barn that is highly decorated. Upon placing the structure on the ground, it should be sheltered inside the cellar bay at the rear of the barn or covered by a temporary structure that will protect and secure it. The remaining roof opening atop the barn must be covered with a temporary roof designed to prevent continued water penetration into the structure. (The Benson's Committee has suggested that the cupola be removed to the Hudson Highway Maintenance Facility pending restoration and re-erection).

4. **Weatherization** – Remaining areas around the perimeter of the barn where clapboards and or sheathing is missing, should be closed in. This can be done by installing 30 pound felt paper in such a way that water sheds onto the paper from above and sheds water out and away from the building. Wood shingles and strapping can be installed over the paper to secure it to the building.

5. **Landscaping** – Debris, shrubbery, trees, and other organic matter should be removed from the perimeter of the building up to a distance of about twenty feet. Surface grading where water passes directly to the building as a result of built up earth should be graded away from the structure. Large piles of branches etc., should be removed a safe distance from the building and burned or carted away.

Priority Stabilization Recommendations: Cost Summary

Structure clean-up (A minimum of two 30-yard dumpsters will be required)	$8,000.00
Windows and doors	$6,000.00
Cupola	$6,000.00
Weatherization	$1,500.00
Landscape grading	$5,000.00

Total Stabilization Cost **$26,500.00**

NOTE: Much of the work described above can be accomplished by a well-organized volunteer effort. With proper direction, volunteers can accomplish a great deal. The opportunity to build community awareness and support for the project is enhanced. The cupola work however, should be done by professionals.

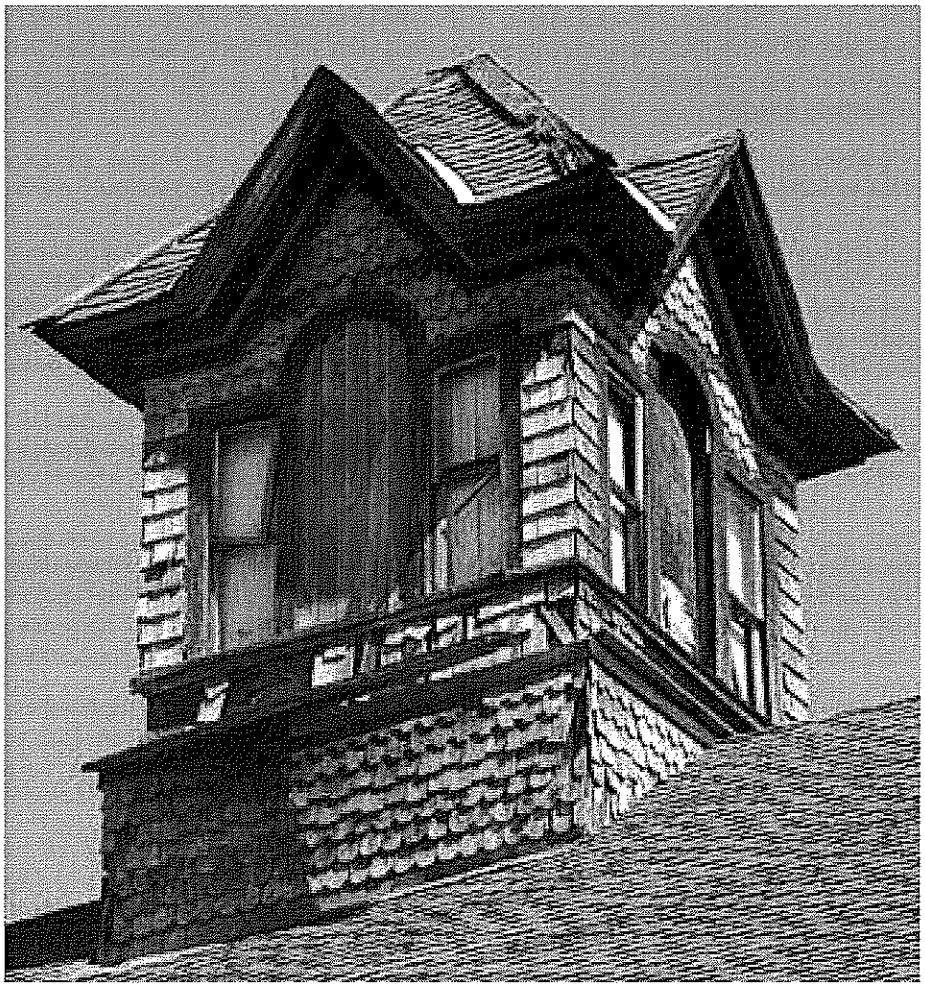


Figure 10. Extensive deterioration of cupola. Photograph by John Butler. (May, 2003)

Alternatives for Ultimate Treatment and Use

The 2002 Benson's Property Master Plan by Vanesse Hangen Brustlin Inc. (VHB) covers the proposed development of the entire 168-acre Benson's Property as a passive recreation area and local/regional park in a manner compatible with the NHDOT wetland mitigation plan. The Master Plan summarized the development program for the site as follows:

Proposed plan improvements are generally geared toward creating a pastoral park setting, with restoration of contributing historic structures, redevelopment of open field areas into multi-purpose play areas, building a system of trails that accommodates a variety of non-motorized activities, provision for vehicle access and parking for approximately 250 cars, development of new structures for picnicking, restrooms/concessions, an amphitheater with seating for approximately 500 people, and a warming house for winter ice skating and cross country skiing.[11]

The Master Plan emphasizes that identifying and implementing a successful reuse proposal for the remaining historic structures is "key to the long term success of the master plan".[12] The main limitation on reuse of the historic structures is a site-wide prohibition on commercial activity under the Memorandum of Agreement between NHDOT and the Town of Hudson. Another issue addressed by the VHB Report is need for the Town of Hudson to establish an adequately staffed and equipped Parks and Recreation Department to manage and maintain the Benson's grounds and buildings.

Based on the Benson's Property Master Plan completed by VHB in March 2002, the Benson's Committee identified 16 Management Units and associated management categories for development of the site. The Haselton Barn falls within the 12-acre South Field Management Unit.

The Master Plan and the Benson Park Management Site Unit Descriptions have identified the following potential alternative uses for the Haselton Barn:

- Storage, display, and interpretation of large antique items such as farm and fire fighting equipment.
- Education about the history of agriculture and barn buildings in Hudson, and
- Natural resource education and access to the Benson Park trails.

All of these options are both functionally and structurally feasible, and in keeping with the historic character of the building. Each of these alternatives has been developed within the context of an ambitious long-range development program for the entire Management Unit and Benson Park. Unit and Park development needs fall into the following general categories:

- Public safety, and protection of the site and structures
- Conservation of natural and cultural resource values
- Visitor orientation and education
- Infrastructure development and maintenance
- Public services (restrooms, community meeting and event space, etc.)

By taking the initial steps to stabilize and preserve the Haselton Barn, rehabilitation work can continue in the context of development of the entire Benson Property.

[11] *Benson's Property Master Plan.* Vanasse Hangen Brustlin, Inc. Bedford, New Hampshire. March, 2002. p. 11.
[12] *Benson's Property Master Plan.* p. 13.

Part 3: Technical Data

Appendix I: Secretary of the Interior's Standards for Rehabilitation

The Secretary of the Interior is responsible for establishing standards for all programs under Departmental authority and for advising Federal agencies on the preservation of historic properties listed in or eligible for listing in the National Register of Historic Places.

The Standards for Rehabilitation (codified in 36 CFR 67 for use in the Federal Historic Preservation Tax Incentives program) address the most prevalent treatment. "Rehabilitation" is defined as "the process of returning a property to a state of utility, through repair or alteration, which makes possible an efficient contemporary use while preserving those portions and features of the property which are significant to its historic, architectural, and cultural values."

Initially developed by the Secretary of the Interior to determine the appropriateness of proposed project work on registered properties within the Historic Preservation Fund grant-in-aid program, the Standards for Rehabilitation have been widely used over the years--particularly to determine if a rehabilitation qualifies as a Certified Rehabilitation for Federal tax purposes. In addition, the Standards have guided Federal agencies in carrying out their historic preservation responsibilities for properties in Federal ownership or control; and State and local officials in reviewing both Federal and nonfederal rehabilitation proposals. They have also been adopted by historic district and planning commissions across the country.

The intent of the Standards is to assist the long-term preservation of a property's significance through the preservation of historic materials and features. The Standards pertain to historic buildings of all materials, construction types, sizes, and occupancy and encompass the exterior and interior of the buildings. They also encompass related landscape features and the building's site and environment, as well as attached, adjacent, or related new construction. To be certified for Federal tax purposes, a rehabilitation project must be determined by the Secretary to be consistent with the historic character of the structure(s), and where applicable, the district in which it is located.

As stated in the definition, the treatment "rehabilitation" assumes that at least some repair or alteration of the historic building will be needed in order to provide for an efficient contemporary use; however, these repairs and alterations must not damage or destroy materials, features or finishes that are important in defining the building's historic character. For example, certain treatments – if improperly applied – may cause or accelerate physical deterioration of the historic building. This can include using improper repointing or exterior masonry cleaning techniques, or introducing insulation that damages historic fabric. In almost all of these situations, use of these materials and treatments will result in a project that does not meet the Standards. Similarly, exterior additions that duplicate the form, material, and detailing of the structure to the extent that they compromise the historic character of the structure will fail to meet the Standards.

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.

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.

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.

4. Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.

5. Distinctive features, finishes, and construction techniques or examples of craftsmanship that

characterize a property shall be preserved.

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.

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.

8. Significant archeological resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.

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.

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.

Appendix II: Old Ways of Measuring

(used with permission of the author)

Rudy R. Christian
President, Christian & Son Inc.
President, Timber Framers Guild of North America

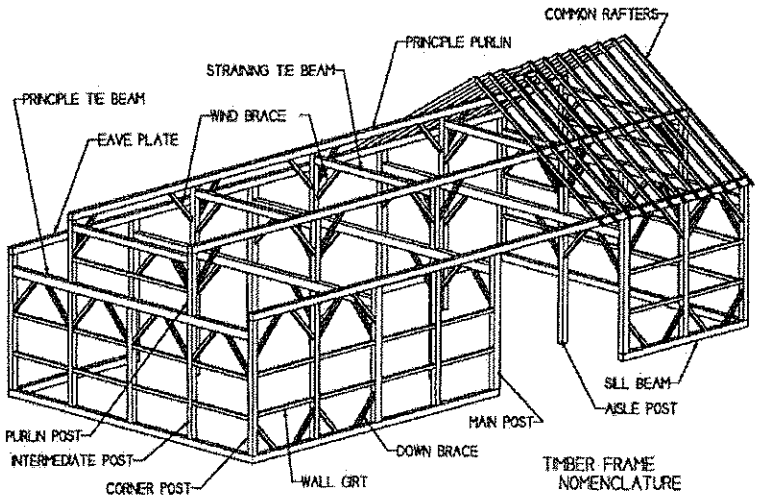
Introduction

In recent years a great deal of work has gone into researching, documenting and exploring historic timber framed buildings. Much of this research has lead to articles and books on the subject. Some have focused on the ancient timber fame buildings in England, Europe and the far East. Many have studied the architectural types and peculiarities specific to the New England settlement areas, while others have traced the agricultural structures that allowed farming to flourish in both the old and new lands.

In general these books are about the people who built these monuments to structure, or about the buildings themselves. However, most often the work tends to study the cultural influences and architectural vernaculars rather than the methods by which these magnificent frames were created. It's not difficult to find a chronological interpretation of the Dutch barn and it's variations, or the transitional bent typologies of the German bank barn as it's use in agriculture caused the form to rapidly move across the Midwest. The student of timber frame building architecture has a relatively accessible resource for this kind of information.

On the other hand, the architect, builder or historian who is asked to document a timber frame structure often realizes that the task of drawing the framework is quite complex, and the sources of information as to how to proceed are, for the most part, nonexistent. This problem is compounded by the many variations in frame typologies, timber sizes, conversion techniques and layout methods. To further complicate the issue, most timber frame buildings have been modified or repaired over their lifetime. All too often the solution to this documentation dilemma is to attempt to apply contemporary methods of measuring and drawing, or to "invent" a method in hopes of recording the important information hidden in the frame.

This text is intended to serve as an introduction to the measuring and layout techniques used by the master builders responsible for the great architectural heritage we find in the timber frame buildings and bridges that still stand as credit their abilities. It is not meant to serve as a textbook or study guide, but as a starting point from which an understanding of the underlying principles of accurate documentation may begin to develop.



Mathematical Patterning

A good first step in learning to survey timber structures is to attempt to decipher the mental or mathematical pattern the builder used as reference. S .E. Todd stated in his 1870 work entitled **Todd's Country Homes and How to Save Money** "The builder, while laying out a frame, needs to set up a regular "air castle" before his imagination, so that he can perceive how every piece of timber, when he is laying it out, or framing it, will appear after the structure is raised and every part is in it's proper place.". This air castle can be easily interpreted as a structure made of playing cards. Each card within the structure can be thought of as a plane or two-dimensional surface. These surfaces represent the planes of reference used to locate all of the timbers in the frame. The intersections of these planes of reference form lines, each referred to as an "arris", which establish a wire model of the structure itself.

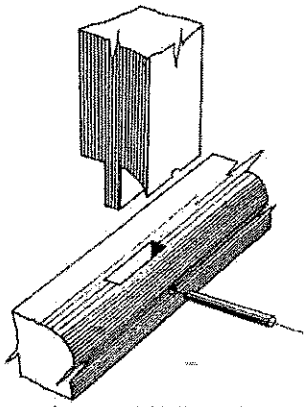


Fig. 1 Sampling, scribed shoulder to central tenon.

By establishing the planes of reference, and the intersections of those planes, the critical or "layout" dimensions of a frame begin to become obvious. Part of this understanding comes from the practical knowledge of the way this layout work was done. In early timber framing, timbers were worked by a method of scribing each intersection or joint (see fig. 1) in a setting where large sections of the frame could be assembled and fitted up. The dimensions of the frame were established by taking accurate measurements and blocking up the timbers to represent a level plane (see fig. 2). Richard Harris refers to this plane as the "upper face" in his 1978 book entitled **Discovering Timber-Framed Buildings**, because it was the face of the frame or "bent" that was up during scribing. In the completed frame this face would actually be the side of the bent.

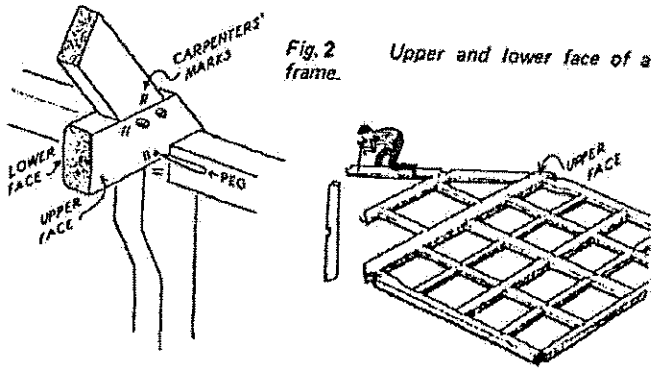


Fig. 2 Upper and lower face of a frame.

The timber conversion method used in early timber frames is known as hewing. This process was accomplished by use of a chalkline and ax to score or rough the log into a squared cant. Most often a broadax or hewing hatchet was used to finish or flatten the scored surface. Although this process could be done in a way that produced remarkably smooth timbers, in most cases the timbers were only hewn to a surface that was workable for the framer. The variation in size and shape was overcome in the scribing process. It therefore becomes the responsibility of the person surveying a frame to establish where the framer was taking measurements from or to. In the case of a bent (the main sections within a timber frame, see fig. 3) the width is measured from the outside of one exterior post to the outside of the opposite exterior post. Likewise the length of the frame can be established by measuring from the outside of one end bent corner post to the outside of the same post location in the bent on the opposite end. (See fig. 3).

Recording the correct locations for the interior bents or posts in a frame however requires understanding the concept and use of the upper or "layout" face. Since during the process of scribing the joinery the

framer blocked up his timbers to establish a flat and level plane, the layout face of a bent can be usually be found by determining which face of the bent the timbers are flush to. Braces are typically the easiest timbers to use in locating the layout face, since they are typically much smaller than the posts and connecting ties, so the offset is obvious. The side of the bent to which the timbers are flush then becomes the side to which field measurements are taken. Often "marriage marks" will indicate the upper face (see fig. 2). In many cases the orientation of these faces within a frame can be predicted. The English and German barn framers, for instance, almost always oriented the interior layout faces toward the threshing floor in the central "bay". The Dutch however would be more likely to orient all but the last bent towards one end of the frame.

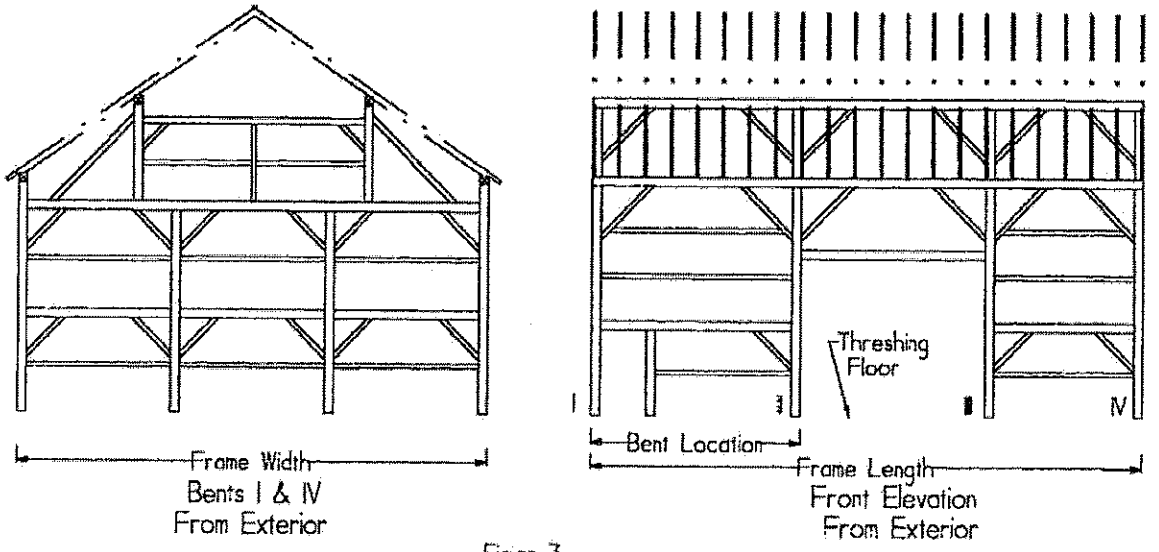


Figure 3

It is important to note that as simple as this concept is, the tendency to assume field measurements can be taken at convenient locations within the frame must be avoided. Typically a great deal of movement occurs during the life of a framed building. Since timber frames were constructed of green timber almost exclusively, the shrinkage, twisting and bowing that occurs during drying can cause significant deviation from the original layout. Since most early foundations tend to move over time, the locations of framing members may have also changed. These factors, combined with changes, repairs and additions, make it imperative for the surveyor to carefully investigate before taking measurements.

Often accurate measurements can be taken in areas of the frame least likely to have moved over time. Measuring a frame at or near floor level is the most likely to produce errors. The locations of bents can better be measured at the wall plates or roof purlins. Since the change in length of timber when it shrinks is minimal, the record taken at the plate can be very accurate. The width of the frame can be measured at the location of the principle tie beam in each bent. Care must be taken in this measurement since the failure at the joint of post and tie can be significant, and shrinkage in the cross section of the posts must be accounted for. The height of the frame, in most cases, is measured from the top of the sill plate to the top of the wall plate. One exception is when the posts rest directly on stone or masonry piers, which may have caused them to rot or "recede" from their original height.

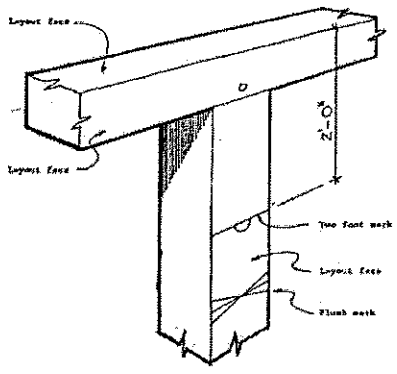


Figure 4

Fig. 4 shows the use of the "two foot mark" in laying out a scribe fitted frame. This mark was used by incorporating a framing square with a 24" leg during layout. The mark was placed two feet from the intended location of the reference face of the adjoining timber. Since this mark is at a known location, the intended location of the wall plate or sill may be extrapolated.

Square Rule Layout

Although the "scribe rule" layout system used on timbers being prepared for joining has remained relatively the same for centuries in Europe, another system of layout developed in the new world. This system of "square rule" layout carried the concept of the "air castle" to a new level. By imagining a perfectly square timber within each actual timber used to frame up a building, it became possible to layout and cut an entire frame without having to work at full scale. Each timber could be worked individually, and none needed to be pre-fitted before the frame was raised. This was accomplished with the use of "gains" and "housings" (see fig. 5) which are a great aid in measuring and documenting frames. Since the intention of the joiner was to create perfect timber at each joint location, the wood removed leaves a very accurate record of the mathematical model the joiner had created. The alignment of joinery to a layout face is still common in this newer system.

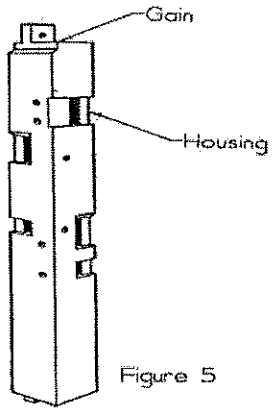


Figure 5

In many frames the record of the layout still exists in chalk. The framer would determine the working dimension of the piece to be cut and a working line would be "snapped" along the timber to locate the base of the housings (fig. 7). This transposed line was often a specific whole or half inch under the "nominal" timber size, or in some cases the true size, if the hewing was all done oversized. By measuring the length of the tie beam in a bent, from shoulder to shoulder, and adding the working dimension of the post on each end, the layout dimension can be determined. The existence of housings, along the plate for instance, also greatly simplifies the task of measuring bent locations. Since the housings are less likely to have disappeared than the scribed marks on a frame, accurate measurements are more easily taken.

The reductions made to tenoned timbers are also an assistance in surveying and recording. In fig. 6 we see a reference to "adzing down" a timber to a specific size. This adzed reduction, sometimes known as a gain, is typically done on the side of the timber opposite from the reference face. This can provide valuable information, particularly in the case of interior posts. In some cases however a gain may exist on both sides of a tenon. Then it may become necessary to look for other clues. Braces entering a post on opposite sides can often provide the information needed. The brace which is cut into the layout face will normally be unhoused (see fig. 7).

The Joiners' Language

A further understanding of how the framer saw the frame comes from learning the "language" the framer utilized in laying out the joinery. Many historians believe the framing square and mortice and tenon layout developed hand in hand. In most cases, the location and size of mortices and tenons are a direct reflection of the widths of the legs of the framing square i.e. 1 ½" and 2". The most common language would appear to be 2" to 2". This refers to offsetting a 2" wide mortice or tenon 2" from the layout face (see fig. 6). In some cases, particularly with smaller scantlings, a 1 ½" to 1 ½" layout may be used, and massive principle tie beams will often utilize a 2" to 3" layout.

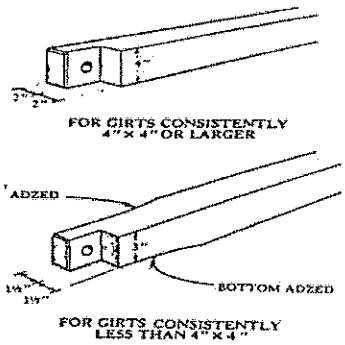


Figure 6

Understanding this language provides another tool in documentation, since it serves to confirm which face of a

timber was used for reference. It also is an important aspect in developing working drawings for restoration and repair work. Particularly in the case of square ruled frames, the recording of the layout language assists in fabrication replacement timbers, which in many cases are interchangeable throughout the frame.

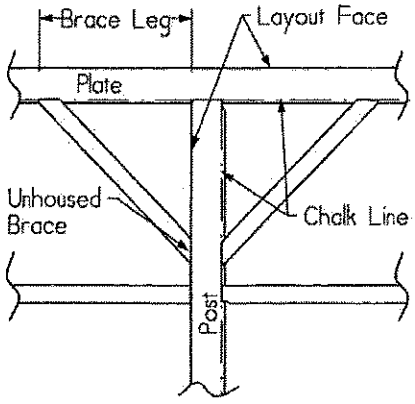


Figure 7

Another facet of the joiners standard language is found in the use of many standardized measurements. This may be in part due to the lack of good paper documentation. It's unlikely most frame carpenters had a set of drawings to throw on their dashboard until well into the nineteenth or twentieth century. Instead certain dimensions were standard for working out a frame. Braces for instance seem to have become standard shortly after the introduction of the square rule layout system. In barns throughout the Midwest, braces are laid out at 36" nearly everywhere in the frame. In some cases they are pushed to 48". This layout refers to the distance measured from the housing along the connecting tie or plate, or down the post, measured from the housing.

The size of timber used in framing is also usually standardized. In English and Germanic framing the use of even numbered square sections seems common, although far from absolute. In larger barns, 4"x4" scantlings are used for braces and siding girts, while scaffold ties, purlin posts, purlins and intermediate posts may be 8"x8" and principle tie beams and main bent posts are commonly 10" x 10" nominally. Dutch barns provide an exception to this rule and often use rectangular timber. Although this standardization is more frequent in post industrial and square rule framing, it can serve to help establish the logic of the frame itself.

The width of the hay mows and threshing floors seem to most often be measured out in even feet, rather than some feet and some inches. This would seem logical in that the process of remembering, rather than ciphering, would greatly aid in being able to cut a frame in an expedient and efficient manner. Even the distance from the sill plate to the top of the wall plate is most often in even feet. Of some interest is the fact that the dimension of 14' seems to come up quite often. The reason for this is likely moot, but one of the author's favorite stories has to do with the height a man trimming trees for wickets or waddle can reach with a single section of ladder carried into the wood. This might explain the availability of good logs about 14' long. Then again, maybe not.

A Systematic Approach

1. In summation we can begin to establish a simple regimen for recording timber frame structures:
2. Determine the type of layout system used in framing up the building.
3. Determine the layout faces of the respective components.
4. Determine which parts of the frame have been added or modified.
5. Determine the working dimensions of the timbers.
6. Determine the language of the joinery.
7. Measure the frame where the information is intact.
8. Record the information as the framer would have done.

As was stated at the outset, this document is not intended to serve as a text or reference. It is strictly information based on the authors experience and research. The intention is to stimulate those who have chosen to study early carpentry methods to continue to strive toward better documentation and better understanding.

Illustrations Credits

The illustrations listed here are from previous publications. They are and will remain the property of the original owners. All other illustrations are by the author.

Figure 1	Cecil A. Hewett	*English Historic Carpentry*	1980
Figure 2	Richard Harris	*Discovering Timber-Framed Buildings*	1986
Figure 4 & 5	Jack Sobon	*Traditional Timber Frame Layout Sytems*	1987
Figure 6	Jack Sobon	*Timber Frame Construction*	1984

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Treatment Cost Summary: Haselton Barn

Treatment Type: Preservation

Priority	Feature Name	Treatment Description	Quantity	Unit Cost	Total Cost
High	Main Barn First Floor Framing and Deck	Fungus and pest control	1 LS	$1,000.00	$1,000.00
High	Main Barn: Bent Three	Bolstering the tension connections in bents 2 - 5.	8 Ea	$300.00	$2,400.00
High	Foundation: Main Barn	Catalog, remove and rebuild with original stone.	900 SF	$45.00	$40,500.00
High	Main Barn: Added Bent Seven	Realign bent seven.	1 LS	$2,000.00	$2,000.00
High	Main Barn: Bent Six	Realign bent six	1 LS	$2,000.00	$2,000.00
High	Main Barn: Bent Five	Realign and repair bent five	1 LS	$2,000.00	$2,000.00
High	Foundation of Attached Silo Ell	Reconstruct stone foundation on new footing.	336 SF	$45.00	$15,120.00
High	Main Barn: Bent Four	Post repair and realign bent	1 LS	$3,000.00	$3,000.00
High	Main Barn: Bent Two	Bent two: control for repairs	0 LS	$0.00	$0.00
High	South Eave Wall: Bays 1-8 At Second Floor L	Repair flying purlin in bent one	1 LS	$1,000.00	$1,000.00
High	Main Barn: Bent Three	Realign and secure bent three.	1 LS	$2,000.00	$2,000.00
		Total High Priority Preservation Treatment Costs:			**$71,020.00**
Medium	Main Barn: Bent One - East Gable End	Repair existing clapboard	1,000 LF	$1.95	$1,950.00
Medium	Main Barn: Bent One - East Gable End	Pocket door: repair and make operational	1 LS	$2,000.00	$2,000.00
Medium	South Eave Wall: Bays 1-8 At Second Floor L	Replace low drive girts	2 LS	$1,000.00	$2,000.00
		Total Medium Priority Preservation Treatment Costs:			**$5,950.00**

Total Preservation Treatment Cost: **$76,970.00**

Treatment Cost Summary: Haselton Barn

Treatment Type: Rehabilitation

Priority	Feature Name	Treatment Description	Quantity	Unit Cost	Total Cost
High	North Roof	Remove old roof covering and install sheathing.	22 SQ	$400.00	$8,800.00
High	Main Barn: Added Bent Eight	New supports for hip roof	1	$3,800.00	$3,800.00
High	Main Barn: South Eave Wall Exterior	Regrade and drain south eave wall	130 LF	$25.00	$3,250.00
High	South Roof	Alt B: Standing seam roof alternative	22 SQ	$400.00	$8,800.00
High	North Roof	Flashing the cupola	1 LS	$700.00	$700.00
High	North Roof	Alt. B: Standing seam roof alternative	22 SQ	$400.00	$8,800.00
High	The Cupola	New timber supports for cupola	1 LS	$2,000.00	$2,000.00
High	Silo Roof	Alt B: Install standing seam roof	6 SQ	$400.00	$2,400.00
High	South Roof	Flashing the silo and cupola	1 LS	$1,500.00	$1,500.00
High	South Roof	Alt A: New 50 year architectural asphalt shingles	22 SQ	$100.00	$2,200.00
High	South Roof	Remove old roof covering and install sheathing	22 SQ	$400.00	$8,800.00
High	Silo Roof	Alt A: Install 50 year architectural shingles.	6 SQ	$100.00	$600.00
High	North Roof	Alt. A: New 50 year architectural asphalt shingles	22 SQ	$100.00	$2,200.00
High	Silo Roof	Remove old roof covering and install sheathing.	6 SQ	$400.00	$2,400.00
High	Main Barn: Added Bent Nine	Create new windows and install in gable end	6 Ea	$800.00	$4,800.00
		Total High Priority Rehabilitation Treatment Costs:			**$61,050.00**
Low	Main Barn Cellar Framing	Create finished space in cellar	1,296 SF	$100.00	$129,600.00

Treatment Cost Summary: Haselton Barn

Treatment Type: Rehabilitation

Priority	Feature Name	Treatment Description	Quantity	Unit Cost	Total Cost
Low	Main Barn First Floor Framing and Deck	Center drive deck removal and enhace framing.	1 LS	$14,000.00	$14,000.00
Low	Main Barn First Floor Framing and Deck	North side bay deck removal and joist enhancement	1 LS	$10,000.00	$10,000.00
Low	Main Barn First Floor Framing and Deck	Add bolsters to joist system to reduce spans	1 LS	$7,000.00	$7,000.00
Low	Main Barn: Second floor framing and Deck	Bolsters for north drive girts	8 LS	$250.00	$2,000.00
Low	Silo Interior	Create usable floor in silo	784 SF	$27.00	$21,168.00
Low	Main Barn: Second floor framing and Deck	Remove added partition barriers	1 LS	$1,500.00	$1,500.00
		Total Low Priority Rehabilitation Treatment Costs:			**$185,268.00**
Medium	South Eave Wall: Bays 1-8 At Second Floor L	Floor from bay one to silo	1 LS	$1,000.00	$1,000.00
Medium	Main Barn: Added Bent Nine	Staging for the back gable end	1 LS	$3,000.00	$3,000.00
Medium	Main Barn: North Eave Wall Exterior	North wall brick infill foundation	200 SF	$45.00	$9,000.00
Medium	Main Barn: Bent One - East Gable End	Replacement of gable end window	1 LS	$800.00	$800.00
Medium	Main Barn: Second floor framing and Deck	Add joists to bays six, seven and eight	1 LS	$1,500.00	$1,500.00
Medium	Main Barn: Second floor framing and Deck	New stairs in bay three	1 LS	$3,500.00	$3,500.00
Medium	Main Barn: Second floor framing and Deck	Elevator	1 LS	$30,000.00	$30,000.00
Medium	Center Drive Upper Loft	Build cat walk with rails to cupola	1 LS	$2,000.00	$2,000.00
Medium	South Eave Wall: Bays 1-8 At Second Floor L	Reinforce stairway to loft in bay one.	1 LS	$1,000.00	$1,000.00
Medium	Main Barn: Second floor framing and Deck	Raise deck in south side bays	1 LS	$5,500.00	$5,500.00

Treatment Cost Summary: Haselton Barn

Treatment Type: Rehabilitation

Priority	Feature Name	Treatment Description	Quantity	Unit Cost	Total Cost
		Total Medium Priority Rehabilitation Treatment Costs:			$57,300.00

Total Rehabilitation Treatment Cost: $303,618.00

Treatment Type: Restoration

Priority	Feature Name	Treatment Description	Quantity	Unit Cost	Total Cost
High	Main Barn: Bent Three	Free tenon repair to tie beams	2 LS	$400.00	$800.00
High	Main Barn: North Eave Wall Exterior	Repair of window openings	10 Ea	$800.00	$8,000.00
High	Sills: Silo Ell	In-kind replacement of sills, stud and post repair	84 LF	$175.00	$14,700.00
High	Main Barn: Added Bent Nine	Realign bent nine	1 LS	$2,000.00	$2,000.00
High	Main Barn: Added Bent Nine	Sheathing replacement (approximately 50%)	500 SF	$2.00	$1,000.00
High	Sills: Main Barn	In-kind repair and/or of exisitng sills	162 LF	$175.00	$28,350.00
High	Main Barn: Added Bent Nine	Install new replacement clapboard siding	3,744 LF	$1.95	$7,300.80
High	West Gable End	Repair fan window frame and replace sash	1 Ea	$1,500.00	$1,500.00
High	Main Barn: Second floor framing and Deck	Girt end repair in bay one	6 Ea	$700.00	$4,200.00
High	Main Barn: North Eave Wall Exterior	Sheathing repair	1,600 SF	$1.50	$2,400.00
High	North Roof	Principle purlin replacement; bay three north.	1 LS	$2,000.00	$2,000.00
High	North Roof	Common rafter repair, bay three	5 Ea	$250.00	$1,250.00
High	Silo Exterior	Sheathing repair and replacement	800 SF	$1.50	$1,200.00

Treatment Cost Summary: Haselton Barn

Treatment Type: Restoration

Priority	Feature Name	Treatment Description	Quantity	Unit Cost	Total Cost
High	The Cupola	Remove cupola and repair/replace in-kind	1 LS	$27,000.00	$27,000.00
High	Main Barn: South Eave Wall Exterior	Sheathing replacement and repair	576 SF	$1.50	$864.00
High	Main Barn: South Eave Wall Exterior	New cow door and hardware	1 Ea	$1,000.00	$1,000.00
High	Main Barn: South Eave Wall Exterior	Window repair and replacement	10 Ea	$800.00	$8,000.00
		Total High Priority Restoration Treatment Costs:			**$111,564.80**
Low	Main Barn: South Eave Wall Exterior	Scraping and painting south eave wall	7,001 SF	$1.22	$20,741.22
Low	Main Barn: Bent One - East Gable End	Exterior paint scraping and coating	1,644 SF	$1.22	$2,005.68
Low	Center Drive Upper Loft	Remove plywood and bat guano	1 LS	$1,500.00	$1,500.00
Low	Silo Exterior	Scraping and painting exterior of silo	1,600 SF	$1.22	$1,952.00
Low	Main Barn: North Eave Wall Exterior	Painting the north wall	8,000 SF	$1.22	$9,760.00
Low	North Eave Wall Bays 1-8 At Second Floor Le	Remove added office space.	1 LS	$700.00	$700.00
Low	West Gable End	Scraping and painting west gable end	1,008 SF	$1.22	$1,229.76
Low	Main Barn: Bent Six	Install new girts and tie to original locations.	1 LS	$6,000.00	$6,000.00
		Total Low Priority Restoration Treatment Costs:			**$43,888.66**
Medium	Main Barn: Bent One - East Gable End	Repair reproduce transom light over door	1 LS	$1,000.00	$1,000.00
Medium	Main Barn: Second floor framing and Deck	Rebuild stairs from second floor to first floor	1 LS	$1,000.00	$1,000.00
Medium	Main Barn First Floor Framing and Deck	Install new floor to match original; south wall.	1,200 SF	$5.00	$6,000.00

Treatment Cost Summary: Haselton Barn

Treatment Type: Restoration

Priority	Feature Name	Treatment Description	Quantity	Unit Cost	Total Cost
Medium	Main Barn First Floor Framing and Deck	Remove deck boards to provide access to joists.	1 LS	$6,000.00	$6,000.00
Medium	Main Barn Cellar Framing	Restore orginal vertical supports in later barn	1 LS	$8,000.00	$8,000.00
Medium	Silo Exterior	Repair and reproduction of trim elements	120 LF	$25.00	$3,000.00
Medium	Silo Exterior	Clapboard repair and replacement	3,200 LF	$1.95	$6,240.00
Medium	North Eave Wall Bays 1-8 At Second Floor Le	Re-create and install low drive girts	5 Ea	$500.00	$2,500.00
Medium	Main Barn: South Eave Wall Exterior	Repair of clapboards and trim	4,000 LF	$1.95	$7,800.00
Medium	Main Barn: North Eave Wall Exterior	Clapboard and trim repair and replacement	7,200 LF	$1.95	$14,040.00
Medium	Main Barn First Floor Framing and Deck	Re-create damaged joists, add new joists to code.	1 LS	$6,000.00	$6,000.00
			Total Medium Priority Restoration Treatment Costs:		**$61,580.00**

Total Restoration Treatment Cost: **$217,033.46**

Treatment Type: Stabilization

Priority	Feature Name	Treatment Description	Quantity	Unit Cost	Total Cost
Critical	Building Envelope	Structure clean-up and debris removal	1 LS	$8,000.00	$8,000.00
Critical	Building Envelope	Secure window and door openings	1 LS	$6,000.00	$6,000.00
Critical	Building Envelope	Stabilize cupola	1 LS	$6,000.00	$6,000.00
Critical	Building Envelope	Weatherization of structure	1 LS	$1,500.00	$1,500.00
Critical	Building Envelope	Site work and grading	1 LS	$5,000.00	$5,000.00

Treatment Cost Summary: Haselton Barn

Treatment Type: Stabilization

Priority	Feature Name	Treatment Description	Quantity	Unit Cost	Total Cost
		Total Critical Priority Stabilization Treatment Costs:			$26,500.00

Total Stabilization Treatment Cost: $26,500.00

Total Cost by Structure: $624,121.46