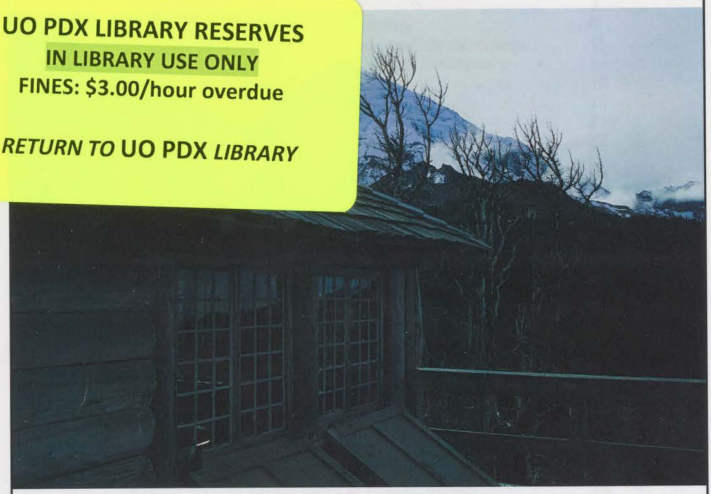
MOUNT HOOD NATIONAL FOREST
CLOUD CAP INN
HISTORIC STRUCTURE REPORT



ALLEN EDWARDS

TERMINAL PROJECT
HISTORIC PRESERVATION PROGRAM
SCHOOL OF ARCHITECTURE AND ALLIED ARTS
UNIVERSITY OF OREGON
2012

Contents

Introduction 1
Abbreviations, Acronyms, and Terms 2

Part I - Developmental History and Context 3
Chronology 3
Cloud Cap Inn Developmental History 6
Development in the Cloud Cap/Tilly Jane Area 11
Landscape and Environmental Conditions 14
Location and Access 16
Redevelopment Proposals 19
Contemporary Uses 21
Local Context 22

Part II - Physical Description and Analysis 23
Architectural Style 23
Architectural Influence 26
Site 27
Plan 27
Foundation 28
Fenestration 29
Log Walls 30
Roof 31
Chimney Configurations 32
Interior 33
Character Defining Features 36
Existing Maintenance Works Listed 37
Existing Maintenance Works During Crag Rat Occupancy 38
Existing Phased Restoration Plan 42
Restoration Zones 43
Major Financial Contributors to Phased Works 49
Fire Protection 50

Part III - Condition Assessment & Evaluation 51

Part IV - Recommendations 68

Conclusion 74

Bibliography 75

Appendices
A - National Register of Historic Places Nominations
B - East Wing Repair USFS Drawings
C - Preservation Briefs, No. 2, 9, 19, & 26
D - Supplemental Existing Photographs

Cover photo by Allen Edwards, Oct, 2011. View facing south

Introduction

The intent of this report is to assist the many interested parties who seek to preserve, interpret, utilize and enjoy the historic Cloud Cap Inn by informing decision making processes to further the preservation of this historic cultural resource. This historic structure report is written in partial fulfillment of the academic requirements for the degree of Master of Science in Historic Preservation at the University of Oregon under Program Director Professor Kingston Wm. Heath. This historic structure report will especially benefit the building's owner and tenant, the United States Forest Service and the Hood River Crag Rats Mountain Rescue Association respectively, who have judiciously maintained and preserved the building in tandem since 1954. The Crag Rats have conducted a majority of modern preservation work undertaken at the inn through a special use permit with the United States Forest Service. Their work on the Cloud Cap Inn has been in compliance with the Oregon State Historic Preservation Office since 1974 when the property was individually listed on the National Register of Historic Places.

The Cloud Cap Inn was established in 1889 by the notable Portland, Oregon developers William S. Ladd and C.E.S. Wood. These Renaissance men were involved in business, politics, and academia. They hired the experienced East Coast architect William M. Whidden, who had recently moved to the Pacific Northwest, to design the resort inn that would be called the Cloud Cap Inn. The inn has a unique and storied past that is historically significant for both its architectural influence and social importance. The inn stands as the cornerstone in the development of the Cascadian style of architecture that blossomed in the Pacific Northwest during the first half of the 20th Century. The building's design highlights the transference and adaptation of Adirondack and vernacular mountain-architecture to the climate and culture of the Pacific Northwest through the lens of early modernism. Key design elements seen on the Cloud Cap Inn have been subsequently assimilated into many lodges and buildings spanning from the early 1900s through the 1940s.

The Cloud Cap Inn has been individually listed on the National Register of Historic Places since 1974 and is included as a contributing building in the 1980 Cloud Cap/ Tilly Jane Recreation Area historic district nomination. As the structure has long been appreciated for its historical significance, it seemed overdue that a historic structure report be created for the structure to aid in the preservation and interpretation of the historically significant cultural resource.

Due to the inn's seasonal operation, and the overlap of the open season with academic internships, the author of this report would have preferred to devote a larger portion of time to on-site research during the preparation of this report. However, the author felt that the creation of such a report was paramount and despite limitations, it is a subject deserving the thorough consideration of a historic structure report to guide future preservation and maintenance efforts at the site.

Abbreviations, Acronyms, Prefixes, and Terms

CCC ..... Civilian Conservation Corps
CCI ..... Cloud Cap Inn
DFC ..... Desired Future Condition proposal
El. ..... Elevation
Fig. ..... Figure
HMS ..... Her Majesty's Ship, British Royal Navy
HSR ..... Historic Structure Report
N,S,E,W ... North, South, East, West
NHL ..... National Historic Landmark
NPS ..... National Park Service
NRHP ..... National Register of Historic Places
OHS ..... Oregon Historical Society
OR ..... Oregon State
SHPO ..... State Historic Preservation Office
USFS ..... United States Department of Agriculture Forest Service
USGS ..... United States Geological Survey
WPA ..... Works Progress Administration

Cloud Cap ..... Cloud Cap Inn site and proximity
Crag Rats ..... Hood River Crag Rats Search & Rescue Organization
Hood River ..... City of Hood River, Oregon
The inn ..... Cloud Cap Inn
National Register ..... National Register of Historic Places
Portland ..... City of Portland, Oregon
This report ..... Historic Structure Report of Cloud Cap Inn

PART I

DEVELOPMENTAL HISTORY AND CONTEXT

Fig. 1 Cloud Cap Inn with stagecoach.
Photo Univ. Oregon Special Collections PH037_0P96

CHRONOLOGY[1]

1792 – Mt Hood first sighted by Westerners by the crew of the H.M.S. Chatham, under command of Lieutenant William R. Broughton while exploring the Columbia River. Mt Hood was named after patron Rear Admiral Samuel Hood of the Royal British Navy.

1805 – Mt Hood sighted by Lewis and Clark.

1845 – Joel Palmer, a wagon trailblazer, partially climbed the mountain in search of settlement routes.

1849 – Government Camp was established by Lieutenant William Frost when forced to abandon his wagons on a military expedition.

1857 – Henry L. Pittock, Rev. T.A. Woods, Lyman Chattenden, and Wilbur Cornell, make first documented summit of the mountain.

1883/84 – First road from Hood River to the timberline was constructed.

1884 – First camp was established on Mt Hood's N side at Tilly Jane Creek by Mrs. Dave Cooper on Cooper Spur.

1889 – Cloud Cap Inn was erected at the timberline on the northeast shoulder of Mount Hood. Portland developers William M. Ladd and Charles Erskine Scott Wood hired architect William Whidden to design the inn. Chinese laborers were hired to improve the wagon road. Ladd and Wood opened operation on Aug. 6th as an upscale establishment but received sparse patronage and closed the following summer.

1 Joseph T. Hazard. Snow Sentinels of the Pacific Northwest. Seattle: Lowman & Hanford Co, 1932. 225-233. (Additional info compiled from USFS maintenance records)

1891 – Cloud Cap Inn began operation under Sarah Langille and family, with a more rustic appeal that achieved greater success and profitability.

1893 – The Cascade Forest Reserve was created by the Federal Government.

1894 – The Mazamas mountaineering club formed with charter members meeting at the top of the mountain. The inn received telephone service when Will Langille ran a wire down the mountain.

1897 – First death on Mount Hood: Frederic Kern a Portland grocer, climbing alone, was swept by an avalanche. Will Langille left guiding to his brother Doug in pursuit of gold in Alaska.

1900 – Doug Langille left guiding at the CCI for work with the USGS.
Sarah Langille hired European guides.

1907 – Operation of the Cloud Cap Inn taken over by Horace Mecklem, the Langille's nephew. 1st automobile reached Cloud Cap Inn. Automobiles replaced stagecoach for a majority of the commute. The steep final grade was still completed by stage coach.

c. 1912 – Horace Mecklem turned inn management over to Dorsey B. Smith.

1919 – Homer Rogers purchased the inn for $5,000 from William M. Ladd and sold it to Cascade Development Corp. A winter storm toppled the west wing chimney and destroyed the observation deck and stairs.

1925 – Redevelopment proposals for the Cloud Cap site are developed to accommodate increased vehicle traffic.

1926 – Plans for a tramway past the inn to the peak supplant prior redevelopment schemes. Tramway planning was mired in debate until the Great Depression squashed investment potential. Redevelopment was reconsidered, but again squelched by the opening of Timberline Lodge in 1938 and by US involvement in WWII.

The Hood River Crag Rats, a mountaineering club of Hood River, was organized. Members must be experienced climbers and have expert firsthand knowledge in rescue and lifesaving.

1927 – Noyes Tyrell managed the inn until he abandoned it in 1932.

1934 – Boyd French Sr. leased the inn, but it declined and was closed during WWII.

1938 – Timberline Lodge formally opened to the public, thus spelling the end of the Cloud Cap Inn as Mount Hood's most prominent resort inn.

1940 -- A brick exterior chimney was installed on the west wing for a wood stove.

1942 – The USFS purchased the inn for $2,000.

1946 – The USFS closed the inn, as it lacked a lessee/operator.

1950 – The USFS strongly considered tearing down the inn and erecting a plaque displaying its location.

1954 – Pending eminent destruction, the Crag Rats leased the building through a Special Use Permit and took on rehabilitation responsibilities in order to use it as a clubhouse and base for snow surveys, and mountain rescue operations.

1974 – Cloud Cap Inn listed on the National Register of Historic Places.

1991 - Desired future condition plan established to guide increasing restoration and maintenance requirements.

2003 – The Crag Rats renewed their Special Use Permit.

1999-Present - Phased preservation work completed upon the structure. See *Existing Maintenance Works During Crag Rat Occupancy* for details.

Cloud Cap Inn Developmental History

Mount Hood was first seen by Westerns in October 1792, by the crew of the survey brig HMS *Chatham* during the Vancouver Expedition, as they sailed up the Columbia River, hoping it would be the fabled Northwest Passage penetrating into the interior of the country. Their sighting occurred 14 years prior to the Lewis and Clark Expedition's first glimpse of the mountain in November 1805.[2]

> "Lieutenant Broughton sailed up the Columbia River to the vicinity of the Cascade Range and could see a 'noble mountain looming up before him. He named it Mount Hood after Lord Samuel Hood of the British Admiralty.'"[3]

The Vancouver Expedition traveled as far as the Columbia River Gorge, but left the area in disappointment, as the Columbia River did not fulfill their expectations of a far-reaching passage to the interior. It is likely they were unaware of the significance their brief encounter held in establishing the existence and name of what became one of the most admired and well know mountains in North America.

Euro-American pre-settlement in the vicinity of Mount Hood followed during the first half of the 19th century. "From 1806 until 1845 there is little recorded history of Mount Hood. Few of the nomads of pre-settlement days had time or inclination or literary ambition to halt and write something down."[4] However, settlement in the close proximity of Mount Hood, such as the City of Hood River, did not play an exclusive role in development interests and patterns that led to the creation of the Cloud Cap Inn. Due to the high visibility of Mount Hood from Portland, Oregon and the ease of train travel, the city approximately 100 miles west of Mount Hood provided much of the interest and investment in many developments on the mountain. As early as the 1840s, even before the City of Portland incorporated in 1851, the mountain to the east was drawing the attention of settlers in the area.

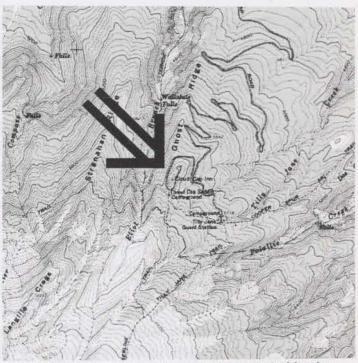


Fig. 2 Location of Cloud Cap Inn. Note switchbacks in the steep Cloud Cap Road and the proximity of the inn to the Eliot Glacier.
USGS *Mount Hood North, OR.*

"The pure mountain air and good food found here are wonderfully tonic, as I know from experience, and for a clean, healthful, unconventional, resting, outing spot I know none better than Cloud Cap Inn."[5]
Olin Dunbar Wheeler, 1903.

2 Joseph T. Hazard, *Snow Sentinels of the Pacific Northwest* (Seattle: Lowman & Hanford Co, 1932), 226.
3 Ibid, 225.
4 Ibid, 228.
5 Olin Dunbar Wheeler. *Wonderland [1895]-1906.* (Ann Arbor: Univ. MI Press. 1903), 107.

The Cloud Cap Inn is strongly associated with the development of mountaineering on Mount Hood. To fully understand the use and context of the building, a brief background on Mount Hood mountaineering is provided. The earliest known climbing on the mountain occurred in the mid-1800s, preceding the construction of the inn by nearly half a century. These early climbers were experienced alpinists, naturalists, or hardy individualists, and were at great risk of personal injury and climbed with minimal weather forecast knowledge, equipment, or outside support. The development of the Cloud Cap Inn brought a support system to Mount Hood that still exists to this day. Much like alpine lodges, the inn allowed for the transition from the nascent exploration of the mountain to blossom into the sport of mountaineering being viewed as an honorable family or individual pastime of the adventurous and wealthy, albeit under the close direction of a seasoned guide.

The earliest documented attempt of climbing on Mount Hood was undertaken in 1845 by Joel Palmer. His ascent was not sporting in nature and summiting the peak was not his ultimate goal. His climb was utilitarian in scope as he desired to achieve a vantage point from which he could perceive the most advantageous route west through the Cascade Mountain Range for settlement purposes.

> "Joel Palmer, on October 12, 1845, was scouting ahead of a cattle and wagon trail from The Dalles. He reached a spot near what is now Government Camp, the popular southern mountain headquarters. His decision to climb the mountain, made that day, was utilitarian as well as sporting. He wanted a birds-eye view of the passes and of the best routes west. Two men, who climbed with him, fell behind, and 'quit altogether' when Palmer began to cut ice steps in Zig Zag Glacier. He delayed not at all for his moccasins gave out and his feet were bare upon the icy glacier. Like a trustworthy pioneer he kept on until he did what he had started out to do. He made three-fourths of the distance to Illumination Rock on the upper fields, and caught the position of the pass between the Clackamas and the Big Sandy rivers."[6]

It would be another decade before a summit attempt would be made on the mountain. This occurred in 1854 when a party of three headed by Thomas Dryer, the founder of the *Weekly Oregonian*, attempted an ascent of the mountain. Their trip was initially perceived as a success, with the climbing party all claiming to have summited upon their return. In retrospect, it has been noted that their description of the summit did not match the factual topography of the peak. Their description of volcanic vents near the summit cast doubt on their claim, and it is surmised that they climbed to an area known as Crow's Nest and not to the highest peak of the mountain. The credibility of the Dryer climb has been further questioned as they calculated the height of the mountain with wild inaccuracy, and it has been noted that their personal accounts of the climb actually include the description of a peak of the mountain that was higher than the one they climbed.[7]

However, it would be missing the greater point to only consider the technical

6 Ibid, 229.

5 Jack Grauer [John Foerste], Mount Hood - A Complete History (Michigan: Grauer, 1975), 198-199.

success or failure of their attempt. The primary success of the climb was in pioneering and publicizing the sport of mountaineering on Mount Hood. This development provided the spark of awareness and interest in mountaineering on Mount Hood required for successful patronage to follow at the Cloud Cap Inn. A brief description of the climb was published including what is interpreted as a caveat for them not reaching the actual summit. This is seen in the brief *New York Times* article titled "Mount Hood, Oregon."

New York Times, October 18, 1854

> "A party consisting of the editor of the Oregonian and several gentlemen from this place and Portland, last week returned from an excursion for pleasure and exploration to Mount Hood. They ascended the highest range and to the top of the highest peak but one. They found cold weather, ice and snow, a plenty of volcanic rocks, and of course the 'goodliest prospect.' They started with instruments for measuring the height, but were obliged to leave them before mounting the highest peak. By some observations they made, however, and from some imperfect data, I am told they estimate the height to be about 16,000 feet."

Though there are several unsubstantiated claims of earlier climbs, and Native Americans could have previously climbed the mountain, the first documented ascent of the mountain was achieved in 1857. The remarkably scholarly climbing party included such notables as Henry L. Pittock - longtime publisher of the *Oregonian*, James G. Deardorff - principle of the Umpqua Academy, and Professor L. J. Powell.[8] Members of the climbing party independently published descriptions of this first ascent, James Deardorff in the *Democratic Standard* on August 13, 1857, and Henry L. Pittock in *The Oregonian* on August 2, 1864. These accounts contain the first accurate descriptions of the summit.[9]

During these early climbs, the height of the mountain was unknown and widely speculated. Colonel R. S. Williamson, an experienced preparer of field surveys, first measured the height of Mount Hood with reasonable accuracy in 1867. He established it as the highest point in the state of Oregon, at 11,225 feet above sea level.[10] In 1991, The United States National Geodetic Survey confirmed his measurement to be very close to the contemporary height of the mountain at 11,249 feet.[11]

When the Cloud Cap Inn opened in 1889, climbing on Mount Hood was a growing activity. Five years later, in 1894, the Mazamas mountaineering organization was chartered through an unusual proposal published in the paper.

Morning Oregonian, June 12, 1894

> "To Mountain Climbers and Lovers of Nature… It has been decided to meet on the summit of Mt. Hood on the 19th of next month…"

One hundred and ninety-three climbers summited Mount Hood and became the charter members of Mazama.[12]

Will Langille, the eldest son of Sarah and James, was active in the construction of the 1889 road improvement to Cloud

8 Ibid, 230.

9 Jack Grauer [John Foerste], Mount Hood - A Complete History (Michigan: Grauer, 1975), 199.

10 Hazard, 231.

11 National Geologial Survey Data Sheet, "Mount Hood Highest Point," www.ngs.noaa.gov/cgi-bin/ds_mark.prl?PidBox=RC2244 (accessed March 16, 2012).

12 Hazard, 233.

Cap and in the construction of the inn. He and his father begin climbing on the mountain during the inn's construction and Will continued exploring the north side of the mountain, as well as successfully summiting by way of the South Side Route. As early as 1891, when his mother Sarah overtook the management of the inn, Will begin working as a mountain guide. He is credited with being the first to guide trips from the north side of the mountain. Will retired from guiding in 1897 after leading at least fifty successful ascents from the Cloud Cap Inn with no casualties.[13]

Fig. 3 Doug Langille with a friend.
History Museum of Hood River County photo.

Harold Douglas Langille, known as Doug, was the third son of James and Sarah. Doug Langille also became an accomplished mountain guide and both brothers worked for the inn. They proved to be highly competent leaders, as well as served to perform many of the grueling tasks mountain-living required, such as skiing up to the inn during winter to check conditions, or stringing telephone lines down the mountain for the inn among other jobs.[14] Doug took over mountain guiding for the inn in 1897 when Will left for Alaskan mining prospects.[15]

Though Will, the eldest son, is referenced more frequently in descriptions of the Langille boys and their guiding activities, both provided the services that allowed the wealthy patrons of the inn a mountaineering experience and retreat. Will is credited with being the first person to circle the volcano, crossing all glaciers, and successfully guided over 100 summit climbs before leaving guiding to work for the United States Geological Survey. Doug notably led the Mazama's north-side charter climb of Mount Hood in 1894. Climbing the mountain was an anticipated pastime for the inn's guests and even after the Langille boys quit guiding, the inn maintained mountain guides on staff to lead trips to the summit.

Guests at the Inn who summited the mountain were permitted to write the word "Summit" beside their name in the guest book. They would then leave their business card stuck to the rafters with gum by placing a quarter on the other side and throwing it to stick on the rafters. These are visible in the photo of Sarah Langille in the main hall, see fig. 4.

Fig. 4 Oregon Historical Society photo

13 Grauer, 113-114

14 Sarah Baker Munro, *Timberline Lodge: The History Art, and Craft of an American Icon* (Portland: Timber Press, Inc. 2009), 25.

15 Munro, 25.

Fig. 5 Turn of the 20th century climbing party. Oregon Historical Society photo.

Onlookers back at the Inn could view the climbing parties through a telescope set up for that purpose or just enjoy the views on the observation deck.

Fig. 6 Newspaper hats and views from the observation deck. Photo OHS

In the late 1880s, Mount Hood was the most accessible of the large volcanic mountains in the west from the urban center of Portland, Oregon. The draw of the Cascade Range upon early American adventurers at the turn of the 20th century is described well by Joseph LeConte, the renowned professor, author, naturalist, and co-founder of the Sierra Club.

> "True Alpine climbing may be found in America only among the great Cordilleran Ranges of the West. Of these ranges none surpass the Cascades of Washington and Oregon and the Sierra Nevada of California. These magnificent mountains have been little frequented as compared with the Swiss Alps. Hence the difficulties of penetrating their wilder portions are still great, though the facilities for travel are increasing yearly."[16]

LeConte further extolled how the Cloud Cap Inn was Mount Hood's premier host for climbers before the 1930s when development on the south side of the mountain overtook what the inn could offer.

> "…the highest and by far the finest peak in Oregon is Mount Hood – 11,225 feet. It may be reached by automobile from Portland to Government Camp on the southwest side, or by rail to Hood River station and thence by stage to Cloud Cap Inn on the northeast side…. …The route by Cloud Cap Inn, over the Eliot Glacier, is shorter, but has a long stretch of very steep snow at the top. Mount Hood, more easily reached than any other volcanic cones of the Northwest, has

16 Joseph LeConte "Mountaineering on the Pacific Coast" *Nature and Science on the Pacific Coast* (San Francisco: Paul Elder and Co.), 246.

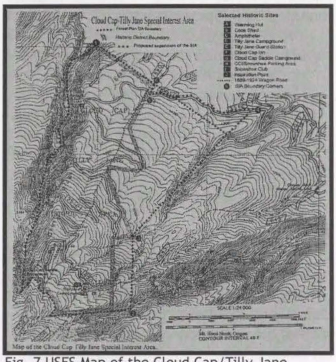
been ascended hundreds of times."[17]

Mountain climbing and leisure remained the primary pastimes at the inn throughout its service in guest accommodation, lasting intermittently until 1942, when the inn was sold to the USFS. The initial blow to the inn's social and architectural prominence on Mount Hood came with the opening of the Timberline Lodge in 1938. Again during World War II, the lack of leisure time, money, and interest further diminished the inn's use and maintenance throughout the 1940s. By the early 1950s, the fate of the Cloud Cap Inn was unknown as conditions deteriorated from neglect to a point where the USFS was strongly considering razing the building.

It came as a fitting, but eleventh hour decision, that the lease be taken over by the Hood River Crag Rats through a Special Use Permit with the USFS in 1954. The property has subsequently been preserved through a strong commitment to preservation and interpretation of the structure. Though the inn underwent a change in use offing guest accommodations to the Crag Rats' use of the building for search and rescue, snow survey programs, and as a clubhouse, the inn's historic association with mountaineering activities remains intact.[18]

17 Ibid, 247.
18 Munro, 27.

Development in the Cloud Cap/Tilly Jane Area



Map of the Cloud Cap-Tilly Jane Special Interest Area

Fig. 7 USFS Map of the Cloud Cap/Tilly Jane Special Interest Area and Historic District boundary. USFS

The north side of Mount Hood has received considerably less development than the more sun drenched south side. The mountain is located at a latitude of approximately 45° north, and thus receives considerably more solar exposure on the southern slopes than on the northern side. For many recreational activities, the sun is desirable. However, for mountaineering purposes, the southern exposure is often a hindrance and in the summer and fall is considered by climbers to be "out of condition" in the summer and fall. During that period, the snow on the south side is less stable in the direct sunlight, and there is increased danger of climbing accidents from snow melt and rocks falling from above and injuring climbers. For this reason, activities and development on the north side have primarily been focused on mountaineering and snowshoeing activities.

In 1980, the Cloud Cap/Tilly Jane Recreational Area was listed on the National Register of Historic Places as a Historic District. See fig. 7. The nomination includes developments from 1885-1930.

> "These include three roads up the northside of Mt. Hood into the area below Cooper Spur; Cooper's Tent Camp, Cloud Cap Inn, the Inn's stable, the Snowshoe Club's log building, two old cabin sites, a CCC camp, Tilly Jane Forest Camp with its amphitheater and the CCC built Ski Warming Hut."[19]

Further details about these developments can be viewed in the complete nominations provided in Appendix-A.

Development interest grew on the north side of the mountain in the 1850s when an influx of residents came to the City of Hood River. "Hood River people had long admired Mount Hood, and there was a great urge to make it accessible."[20] The fulfillment of this desire came five years before the development of the Cloud Cap Inn, with the clearing of a primitive road in 1884 and the subsequent addition of a tent camp.

> "In the summer of 1884, Captain Henry C. Coe, Oscar L. Stranahan, David Rose Cooper, and James Graham approached Mount Hood with development in mind."[21]

The course of the primitive road followed the path of a forest fire that preceded the clearing crew up the side of the mountain. While this uncommon road construction technique was a successful early method of penetrating the dense lower slopes of the mountain, the resultant road provided steep and challenging grades that required strong teams of horses to pull stage-coaches up the mountain. Completed in the summer of 1885, the road construction was concurrent with the development of the first guest accommodations provided on the north side of the mountain, Cooper's Tent Hotel.[22]

The outfit included many amenities such as cows for milk and cooking stoves, as well as and other hospitalities. Mrs. David Cooper and her family established the camp for tourists and mountaineers alike.

> "David Cooper and his wife operated a tent camp hotel on a flat area on the westernmost branch of Tilly Jane Creek, which is no longer flowing. The site is a place later known as Tilly Jane Meadows, located northeast of the present Cloud Cap/Tilly Jane Road junction."[23]

The success of the camp and access road wetted the appetite for further development speculation from Portland's wealthy in the nearby area, as the location was a reasonable commute from the metropolitan city and a promising escape from the commerce, offering unprecedented vistas for those with vacation time in the summers. "Members of prominent Portland families relaxed a week or more in one of the inn's eight guest rooms or adjacent cabins."[24]

Improved after only three years by Ladd and Wood, the primitive road remained a transportation challenge that presented a steep final section with a punishing 22%

19 National Register of Historic Places, Cloud Cap/Tilly Jane Recreational Area Historic District, Hood River County, Oregon. 1981.
20 Grauer, 83.
21 Ibid.
22 Ibid.
23 Cloud Cap/Tilly Jane, Historic District Nomintaion. Section 7.
24 Munro, 25.

grade. This grade would later prove too arduous for early automobiles to master, so a stagecoach remained in service to complete the final leg of the journey.

> "Great development was in the wind in the spring of 1889, when two Portland men, William M. Ladd, banker, and Colonel C.E.S. Wood, attorney, announced that they had bought the original road and organized the Mount Hood Stage Company, with plans for a hotel building and a much improved road."[25]

The 1889 road was built consecutively with the inn to provide access for materials to the Cloud Cap site and accommodate increased traffic. Laborers established a forest camp to occupy while cutting the Silver fir used in the inn's construction. A photo of the crew, fig. 8, depicts primarily Euro-American construction workers hewing timbers and joinery on the structure.

Fig. 8 Hand hewing heavy timbers for log construction 1888. Photo from Crags Rats' collection.

The laborious initial task of grading the road fell to other hands. "Chinese laborers were hired to dig and fill on the grades. 'China Fill', a problem and challenge to early motorist, was a 22-percent grade on a curve over a small ravine just below Cloud Cap Inn, the new hotel."[26]

James Turner from Portland was the initial foreman of the inn construction crew. William Ehrck from Hood River was the Masonry contractor. Old Country Chinese were the cooks and road labor crew. James Langille was the assistant foreman for the inn construction, and took over as foreman partway through the project. Fortune granted the construction effort an extra long warm season which allowed for the majority of construction on the inn to be completed that year.

> "By March the area was accessible by horse and wagon, the snowpack being unusually low in 1889. After the new road was sufficiently improved, a forest camp was installed, and men began to cut and hew a stockpile of Ambilis fir logs near the lodge site."[27]

After a remarkably efficient construction effort, due to a simple yet elegant design, the inn opened briefly for the end of a short season and received patronage before closing for the winter season. Winter conditions on Mount Hood were largely unknown at the time and there was anxiety about conditions at the Cloud Cap Inn and whether it could survive the heavy snow loads, severe storms, and freezing temperatures.

For the first of numerous occasions to follow, the Langille boys offered to accomplish the hearty and hellish tasks required of the high altitude building. "Doug Langille visited the building on homemade skis to check conditions… …The Langille boys found a little drifted snow inside, but the day was pleasant;

25 Grauer, 85.

26 Ibid

27 Ibid.

water dripped from the eaves."[28] Minds were eased with this report, and the inn proved that a building could survive the adverse winter conditions. By the turn of the 20th century, the inn had become a well loved establishment that even advertised in Portland newspapers.

> "Although the first inns on the south side of Mount Hood were built about the same time as Cloud Cap Inn, none enjoyed Cloud Cap's unique reputation as a destination resort. Inns on the south side clustered in Government Camp, a village near the summit of Barlow Pass along Highway 26. Built along the roadside, the lodges on the south side served more as overnight stops than as the destination retreats that Waugh later envisioned. Among these lodges were the Government Camp Hotel and Battle Axe Inn, rustic structures decorated with Indian and pioneer motifs similar to the décor later selected for Timberline Lodge."[29]

As it stands, the Cloud Cap Inn is the oldest remaining building on Mount Hood.[30] Other developments in the nearby vicinity include the Snowshoe Club Cabin built in 1910, and the Tilly Jane Campground built by the forest service in 1926. Further information on development in the vicinity can be found in the nomination forms provided in Appendix-A.

28 Ibid, 89.
29 Munro, 25.
30 Ibid, 27.

Landscape and Environmental Conditions

Fig. 9 Photo from Cloud Cap site facing south at the peak of Mount Hood.

The Cloud Cap Inn is an unconventional building, and is sited in a unique mountain environment. The inn possesses no address, but is located remotely at the termination of Cloud Cap Road, USFS Road #3512, on the northern side of Mount Hood in Hood River County. It would remain an understatement to say the landscape and climate surrounding the Cloud Cap Inn are imposing and dramatic. The environmental conditions that surround, and often envelop, the building are extreme for any extant historic structure. The inn is sited halfway up the side of an active volcanic center at 6,000 feet elevation with boulders, loose rock, and glaciers as neighbors. "Four of these glaciers are within striking distance, and one of them, the Eliot, is right underfoot. Its blackened lower levels are between the Inn and the mountain in a deep abyss."[31] The Inn has proved to be an enduring and challenging construction in the subalpine environment.

Current vehicle access from Cloud Cap Road is only open for the portion of the year when the inn is in seasonal use,

31 Hazard, 237-238.

typically from July to October. At other times, the road, see fig. 10, is gated to help prevent vandalism, which is a persistent issue as the inn stands nearly vacant for 8 months of the year.

Fig. 10 Sample portion of Cloud Cap Road, N side of Mt Hood. USFS photo

During the closed season, the inn is accessible by snowshoe, cross-country ski, or "Cat" and snowmobiles. It lies buried in snow, withstanding the pressure of snow loads, high winds, and storms.

Presently, the Crag Rats manage the inn at an operational level during the winter months and maintain a cache of rescue equipment and supplies for emergencies year-round. However, the inn is not open to the public during the winter. In the summers, the landscape becomes very dry and the inn has withstood multiple large wild fires. The inn only stands today through the diligent protection of the US Forest Service and wild land firefighters who install a custom made reflective fire protective wrapping during fires. Such events as the Gnarl Ridge Fire in 2008, would have seen the inn turned to ash without the measures of the US Forest Service.[32]

In light of these extreme conditions and pervasive severe weather, the design of the building was conceived in accordance with the mountain terrain that it inhabits. The design is inspired by the local landscape and incorporates many natural elements into the building's structural systems. The foundation was made of locally sourced dry laid stone rubble, and the massive log walls were felled and shaped on the mountain. Using local materials proximal to the construction site was advantageous to the construction of the inn, as transporting building materials from a city to the high elevation of the site would have posed a significant transportation dilemma, considering that the building was constructed in the pre-automotive era.

Similarly to how buildings in urban areas are part of a cityscape, which includes relationships with adjacent buildings, streets, and communities, the Cloud Cap Inn is part of the dramatic and unforgiving landscape. The historic environmental context was well described in 1940 by the Writers' Program (U.S.). Oregon.

> "The building is anchored to the basalt spur by cables to keep it in place during winter storms. The inn is situated directly below the snout of Eliot Glacier about three miles from the summit of Mount Hood. From this point ascents are made to the peak of the mountain."[33]

The building site occupies a rocky prominence just below the timberline where the trees are somewhat stunted in the subalpine environment. The local forested areas have been thinned significantly by two recent forest fires in the summers of 2008 and 2011. Sliver firs are a common species on the site, but grow to greater heights lower on the

32 Gnarl Ridge Fire Incident Report, 10/5/2008. http://www.inciweb.org/incident/1465/ (accessed Oct. 17, 2011)

33 Writers' Program Oregon, Mount Hood: A Guide. (Duell, Sloan and Pearce, 1940), 59.

mountain's slopes. The unfinished log exterior of the inn weathered quickly in the severe climate to a silver-grey hue, and many of the original logs have deteriorated significantly and been replaced. The overhanging eaves of the roof protect the highest two or three courses of logs, so that many original logs have remained at the top of the walls. Upon deterioration of the lower courses, the Silver fir logs are being replaced with Douglas fir logs, which convey a similar appearance after weathering, yet contain a higher degree of rot resistant resins that allow them to last longer unfinished and exposed in the environment.

The local environment is subalpine with sandy glacial soil and tree populations of mountain hemlock, subalpine fir, whitebark pine, and silver fir.[34] The neighboring Eliot Glacier is named after the Portland Unitarian minister, Thomas Lamb Eliot, who was an early explorer and naturalist on the north slopes of Mount Hood.[35] The site offers unprecedented views to the north, including the other Cascade Range volcanoes, Mount Adams, Mount Saint Helens, and Mount Rainier. Mount Hood itself is an andesitic volcano from the Quarternary age that was built through a series of lava-flow and lava-dome eruptions. It is considered midsize when compared against major Cascade volcanic centers, such as the ones listed previously.[36]

> "The most recent eruptive period at Mount Hood, the Old Maid eruptive period, occurred at about the time that U.S. and European parties were exploring the Pacific Northwest coast in the late 18th century."[37]

LOCATION AND ACCESS

Originally, the Cloud Cap Inn was intended to be attended primarily by wealthy Portlanders. The location was ideal for a high mountain lodge, as it would be able to capitalize upon both Portland's wealthy patrons, who could travel by train and stagecoach in a singe day, and the ability to receive supplies and equipment from the nearby city of Hood River. It helped matters significantly that Mount Hood is highly visible from Portland, and in essence, provided some of its own advertisement. In addition, the public's perception of vitality was associated with the mountain air during a period when Tuberculosis was a leading cause of death and the fresh mountain environment was seen as a healthful relief from the pollution and damp of the city. Travel to the inn at the turn of the 20th century relied upon rail and stagecoach. Currently, drivers from Portland can travel the 68 miles to the city of Hood River, and then another 25 miles to the inn.

Under the short-lived original management, the service was extravagant and transportation very quick. Jack Grauer describes it like this:

> "Hotel service was deluxe, including the ultimate in transportation from Hood River. When the Portland train arrived there each noon, the horse-drawn Cloud Cap Stage was waiting. A ten mile ride took the guests to a lunch stop at Joe Diver's ranch on the Little Luckamas. Then four fresh horses pulled the coach to Elk Beds, where Theodore Dallas waited with six strong, wild horses, straining at their bits to

34 Cloud Cap/Tilly Jane Nomination, section 7.
35 Grauer, 83.
36 W.E. Scott et al., Geological History of Mount Hood Volcano, Oregon, (U.S. Geological Survey, 1997), 1.
37 Ibid, 11.

terrify the passengers with a lurching, careening start... Guests stepped into Cloud Cap Inn just five-and-a-half hours from the railroad at Hood River."[38]

For the first two seasons, Lewis H. Adams and his wife operated the inn as an expensive, upscale establishment with an elaborate transportation system for guests from Portland. It received limited visitation during the first season, as it opened late in the season due to construction and then the onset of winter. The following year was little better with the inn receiving only 88 guests. The lack of patronage became a concern for the owners.

> "Owners Ladd and Wood had spent over $50,000; the mounting deficits prompted them to sell the livestock and close down. Sarah, wife of James Langille, agreed to take over Cloud Cap Inn in 1891. Service was simpler, and the transportation under Olinger and Bone was scaled down, bringing the Inn into an era of profitability."[39]

As the inn was the first permanent development in the Mount Hood recreation area, it was constructed when a majority of areas nearby remained wild.[40] Travel to the Cloud Cap Inn was thus initially a significant and exhilarating portion of the experience. Even at a scaled down capacity, transportation to the inn remained a scenic and grand portion of the experience of staying at the inn. The trip was described in the scaled down version as follows by a guest at the turn of the 20th century:

> "By train one is transported to Hood River Station, on the O. R. & N. Railway, thence by stage coaches to Cloud Cap Inn, a comfortable, rustic-like hotel, 7,000 feet [sic] above sea level. The Inn is a picturesque of silver fir-logs, securely built on the north edge of the mountain. Within a short walk of it is the Eliot Glacier. From the Inn, horses can be used to a distance, in the climb to the summit, more than 4,000 feet above the hotel. The climb is not a difficult one for most persons, and can be made in from five to six hours." (Wonderland '97, p.90 "Wonderland [1895]-1906"[41]

Pre-automotive transportation to the inn from Portland is documented in detail in Marion Russell's article "Our Trip to Mount Hood, 1893." The basis for the description is confirmed by the Sunday Oregonian July 9, 1893. The trip was taken in early July from the Portland Depot at 9 a.m. and continued to the city of Hood River, passing many scenic vistas in the Columbia River Gorge, such as Bridal Veil and Multnomah Falls, before arriving for a late lunch at the Langille House Inn.

The Mt. Hood Trail and Wagon Road Company operated the improved wagon road as a toll road and provided lunch to its passengers. The tolls became a point of contention in the nineteen-teens for early motorists attempting the steep road. Tolls remained until the Forest Service developed the Cloud Cap Road in 1926 and converted the wagon road into a ski trail.[42]

38 Grauer, 86.
39 Ibid.
40 W.E. Scott et al., 59.
41 Olin Dunbar Wheeler, Wonderland [1895]-1906 (Northern Pacific Railway, 1895), 90.
42 Cloud Cap/Tilly Jane Nomination.

Fig. 11 Stagecoach leaving the Cloud Cap Inn.
Univ. of OR. Lib- Special Collections PH037_0p96

Fig. 12 First stage stop, Hood River to Cloud Cap Inn.
OHS collection photo.

Redevelopment Proposals

Idyllically located high on one of the Pacific Northwest's most prominent and accessible mountains, the Cloud Cap Inn has long attracted redevelopment plans from architects and developers promoting additions, redesigns, or replacements of the inn. The inn has always been at a high risk for redevelopment, as it occupies a stunning site that "rests on a high shoulder, with the limited space for one hotel venture."[43]

Throughout the 1920s and early 1930s, some of Oregon's most prominent architects were involved in the push to renovate or replace the inn to accommodate increased automotive traffic. This sentiment followed a general trend in architecture away from large timber structures to more conventional types of construction. The redevelopment proposal that was most sympathetic to the original construction and the nature of the site was Pietro Belluschi's design for A.E. Doyle in 1927 seen in fig. 13.

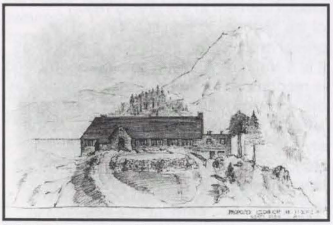


Fig. 13 Pietro Belluschi USFS copy of sketch. 1927. Scan USFS colllection

In 1929, Carl Linde designed a large and ornate castlesque "expansion" that was proposed by the Cascade Development Company, c. 1929 seen in fig. 14.

43 Hazard, 236.

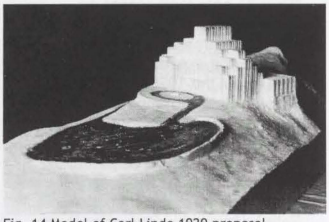


Fig. 14 Model of Carl Linde 1929 proposal. USFS photo

The most fully conceived idea was John Yeon's 1931 draft that reimagined the property completely. See fig. 15.

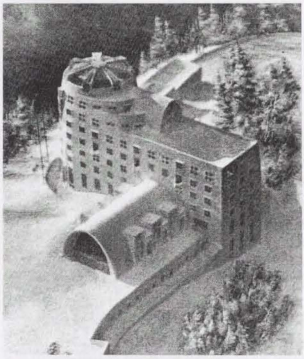


Fig. 15 John Yeon proposal 1931. OHS Research Library OrHi 39039.

The most aggressive redevelopment scheming came with the economic boom of the 1920s and the highly controversial proposal for a tramway that would lead past the Cloud Cap Inn and up to the summit of Mount Hood.

"Despite poor road access on Mount Hood's north side, private entrepreneurs applied for permits to operate and expand Cloud Cap Inn throughout the 1920s. The Cloud Cap Inn Resort Company submitted a design by architect Pietro Bellushci, then in A. E. Doyle's office in Portland, to the Forest Service as part of a permit application. The proposal resembled the rustic 1925 Multnomah Falls Lodge in the Columbia River Gorge, which Doyle had recently designed. The proposal for the Cloud Cap expansion was abandoned due to a lack of investors. Twenty-one-year-old Portland architect John Yeon also proposed a design for a grand hotel in the Cloud Cap area. In a 1983 interview with Marian Kolisch for the Smithsonian Institution, Yeon stated that he later 'came to hate' his designs as a 'youthful indiscretion.'" [44]

These proposals came during a period of burgeoning architectural speculation in the late 1920s and early 1930s that culminated in an elaborate and questionably feasible proposal of establishing a permanent tramway to the summit of Mount Hood. The proposed path is seen in fig. 16. The tramway became a very hotly debated topic with strong opinions filling the newspapers. The subject even divided advocates for wild areas such as the Mazamas. Fortunately, for the historic integrity of the already exquisite William Whidden design, none of these developments were undertaken.

44 Munro, 26

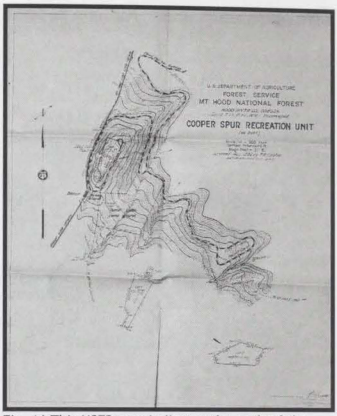


Fig. 16 This USFS map indicates the path of the proposed tramway through the Cloud Cap site. USFS collection.

Ultimately, the Great Depression squelched this and other redevelopment plans for the Cloud Cap site. In hindsight, the failure of these proposals was a crucial element in the preservation of the historically significant inn. The preservation of the inn is now a priority as it is a National Register listed property, and is recognized by architectural historians as the earliest known example of Cascadian style architecture. The inn's architectural style was later co-opted by the National Park Service into the NPS Rustic style, now ubiquitous across the American landscape.[45]

A myriad of reasons are attributed to the failure of these development proposals at the Cloud Cap site, however, aside from the effects of the Great Depression,

45 Rosalind Clark and Pamela Meidell, ***Architecture** Oregon Style* (Portland: Professional Book Center Inc. 1983), 187-189.

another major redevelopment hurtle, was the shift of public attention to the south side of the mountain accompanying the construction of the Timberline Lodge 1936-1938 that capitalized upon greatly increased activity on the mountain.

The construction of this significantly larger and more accessible lodge spelled an end to development schemes for the Cloud Cap vicinity. The Cloud Cap Inn was not efficiently located to accommodate the increasing number of guests the automotive era brought to Mount Hood. Development on all parts of the mountain slowed again in the 1940s when the United States entered into the Second World War. This action initiated a period of under-utilization and neglect at the inn. It was during this time that the ownership of the inn transferred to the USFS. If the inn was to remain standing, it became apparent that the need for an alternate use of the building was necessary, as the Timberline Lodge had effectively replaced the function of the inn in providing guest accommodations within striking distance of the peak. Under the early years of USFS ownership, the building suffered greatly from a lack of maintenance so that by the early 1950s the inn was slated to be razed. The Crag Rats overtook maintenance responsibilities for the building in 1954 as part of their lease and special use permit.

> "Developers in the 1920s focused first on expanding a small, existing private resort on the remote north side of Mount Hood. In 1889, prominent Portlanders William M. Ladd and Charles Erskine Scott Wood had built Cloud Cap Inn at 5837 feet, [sic] just below the Eliot Glacier and a ridge called Cooper Spur. The lodge which still stands, is a rustic, partly unpeeled log structure with stone fireplaces. Its shape, a half-hexagon facing the mountain, anticipated angles used in Timberline Lodge, although the two lodges are situated differently on the mountain."[46]

Contemporary Uses

From 1889 to 1942, the Cloud Cap Inn accommodated guests and fulfilled its original use as an inn providing guest accommodations, transportation assistance, and a mountain guiding service. During this period, the building was in use exclusively during the warmer months. It typically opened in early July, as soon as it was accessible, and closed in early October with the first major snowfall; the exact dates of service varying upon seasonal weather conditions.

Currently, the inn remains in use by the Crag Rats as a clubhouse and year-round at an operational level in the winter season in order to fulfill their functions in high altitude search and rescue, and as a base for their long-standing snow survey program. The inn is located proximal to mountaineering areas on Mount Hood and is optimally located for mountain rescue operations. The inn functions as a base camp for search and rescue personnel and as a location for stabilization of injured climbers. Thus, a complete descent off the mountain is not required before the administration of stabilization of injuries and medical attention.

46 Timberline Lodge, 24-25.

Beyond the scope of the Crag Rats' contemporary uses, a number of organizations also utilize the inn for a variety of functions:

- USFS - Education and wilderness Management
- Hood River School District Athletic Department - Education
- Mid Columbia Community College Education
- Boy Scouts of America Education, Training
- General Public Tours
- Hood River Sheriff Search & Rescue Training
- USFS 935th Aerospace Rescue Wing Training
- Mountain rescue organizations Training
- Nordic and Alpine clubs Training Outings

Local Context

The historic properties and cultural resources in the vicinity of the Cloud Cap Inn are well documented in the Cloud Cap/Tilly Jane Recreational Area historic district nomination. As the inn predates a majority of them, the development of the inn is most strongly historically associated with the 1889-1924 Wagon Road, the 1924 Cloud Cap Road, and the pioneering efforts of the 1884 Cooper Tent Camp. This report will not cover all the local properties individually. The Cloud Cap Inn's relative position with these local resources is well described by Hood River District, Forest Service Archeologist, Michael Dryden.

> "The Cloud Cap Inn is a primary contributing element within the Cloud Cap/Tilly Jane National Historic District that consists of 14 National Register of Historic Places properties. These properties include the Tilly Jane Guard Station (1931-1932), and American Legion constructed Cookhouse (1938), the Snowshoe Club Cabin (ca. 1910), the Cloud Cap Saddle Campground (1920s), the Cloud Cap Road (1924), Cooper's Camp (1885-1889), Cabin Sites (ca. 1906), the Cloud Cap Inn Stables (1889-1912), a Civilian Conservation Corps Camp (1939), 1885-1889 Wagon Road, the 1889-1924 Wagon Road, and Civilian Conservation Corps (CCC) constructed elements including: a campground (1930s), an amphitheater (1938) and a Ski Warming Hut (1939). The Cloud Cap Inn is the highest ranked individual contributing element with the historic district."[47]

47 Micheal Dryden, Cloud Cap Inn East Wing Rehabilitation Assessment of Effects, (USFS Report, 2006), 6.

Part II
Physical Description and Analysis

Architectural Style

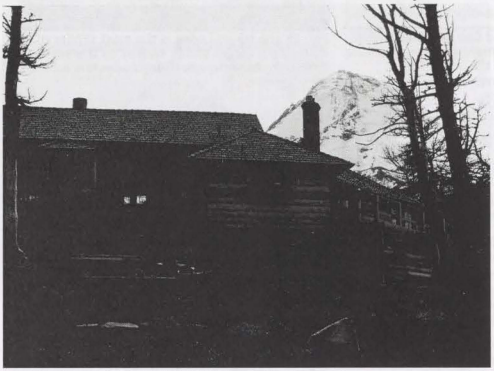


Fig. 17 Approach to Cloud Cap Inn. Facing south

Despite the inn's log and timber construction and unadorned appearance, the Cloud Cap Inn is not considered a vernacular building. It was one of the first commissions designed by the prominent architect William Whidden, and is canonized by architectural historians as a strong example of the Early-Modern style, an architecture style that incorporated old and new influences to achieve a new, yet familiar feel while emphasizing horizontality and materials over adornment.[48] The inn was built during a period of influential architectural development in America that included the Auditorium Building in Chicago, by Louis Sullivan and Dankmar Adler, a building created concurrently with the Cloud Cap Inn in 1889.

The inn's architectural style can be further defined as Cascadian style architecture, or what used to be known as Oregon Rustic style. "The Cloud Cap Inn opened in 1889 as the first alpine resort in the West."[49] This style originated with the Cloud Cap Inn and it remains the oldest known example. Whidden's inspiration for the design came from the combination of diverse vernacular styles and modern and historic construction techniques. Some vernacular influences seen at the inn include a sloping battered stone foundation similar to alpine huts and mountain hostels, and early American building techniques such as heavy timber framing and log construction.

The design of the Cloud Cap Inn does not attempt to compete in grandiose structural achievements with the verticality of the mountain. The building's design is also not an expansion of residential architecture vocabulary or a contraction of commercial styles. The inn's plan shape breaks from a rectangular tradition and showcases the architect's appreciation for systems of beauty that rely upon structure, form, and material, instead of ornamentation or ornate façades.

48 Rosalind Clark and Pamela Meidell, Architecture Oregon Style (Portland: Professional Book Center Inc. 1983), 188.

49 Peter Marbach and Janet Cook, Hood River Valley: Land of Plenty (Woodburn: Beautiful America Publishing Co. 2003), 22.

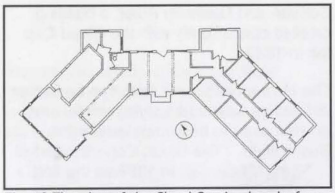


Fig. 18 The plan of the Cloud Cap Inn breaks from a rectangular tradition and highlights geometric angles to take advantage of the site's views. Image derived from USFS content.

Fig. 19 The Mingo Lodge is the most similar of all Adirondack lodges to CCI viewed by the author. Photo from tupperlake.net/MingoLodge.htm accessed 17/10/2011.

The design of the Cloud Cap Inn is strongly derivative of the local environment. While in written history the design of the inn is often said to be tied closely with Adirondack architecture, a specific example of an Adirondack structure with similar elements remains to be referenced.

Historic Adirondack lodges that predate the Cloud Cap Inn often emphasized verticality and relied upon the expansion of residential design paradigms. Thus, a majority of these lodges share the appearance of oversized residences. However, these elements, articulated verticality and an association with residential architecture, are absent in the Cloud Cap Inn design. Of the hundreds of images of historic Adirondack lodge architecture that the author viewed during research, fig. 19 is the most compelling example of a similar structure. Even so, the Mingo Lodge displays few commonalities other than a hipped roof and a horizontal emphasis. The similarity between these two forms of architecture lies primarily in their similarity of use, and not in similarities of design theory or architectural elements.

Beyond Adirondack architecture, William Whidden's inspiration also stemmed from his former employment in a large East Coast architectural firm which allowed for the inclusion of multiple American architectural styles, as well as aspects of European traditions. In the early 1880s, William Whidden was directly influenced by the Shingle style while working for the architectural firm of McKim, Mead and White and he would have been cognizant of the firm's construction of such Shingle style buildings as Cyrus McCormick's "Clayton Lodge" in Richfield Springs, New York in 1882. See fig. 20.

Fig. 20 Claton Lodge, note similarities in design such as low angle roof, with projecting eaves on all sides. Wisconson Historical Society accessed online comstockhouse.org/architectural/shingle.html 2/22/2012

Another historically significant and similar building that was contemporary with the Cloud Cap Inn is Frank Lloyd Wright's Home and Studio in Oak Park, Illinois. It

was constructed in the same year and both buildings highlight the transitional period to modernism as the horizontal axis became emphasized and geometric shapes and proportions became elemental to design theory. The inn and Wright's home and studio both contain traditional elements, yet are highly geometric and emphasize elemental geometric forms.

Fig. 21 Frank Lloyd Wright's Home and Studio. HABS ILL, 16-OAKPA,5-
Collection: Historic American Buildings Survey (Library of Congress) "Looking East," 1933.

The inn's appearance relates directly with the local natural environment of Mount Hood, such as the piles of course stones referenced in the foundation, or the angular horizontality of a broken fallen tree trunk seen in the plan shape. "This is a land of dramatic landscapes and climate and diverse cultural influences. These elements are frequently celebrated through a regional architecture style called Cascadian."[50] The successful unification of the building to the site came through understanding the natural features and environmental conditions of the site.
It is unknown if William Whidden was influenced by Native American coastal plank house construction during his work on this project. However, the traditional plank houses of the Pacific Northwest coast share many commonalities with the inn's construction. Such similarities include low-pitched gable roofs, the use of native and minimally altered materials, massive planar wooden elements, a voluminous single-story interior, and a direct and integral connection with the site and surrounding environmental context.[51]

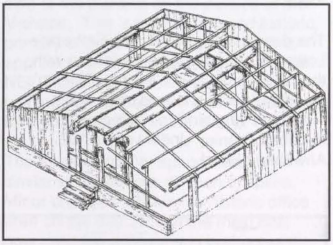


Fig. 22 Kwakiutl house framing diagram. Illustration from *Native American Architecture*, Peter Nabokov Oxford Univ. Press, 1989. p. 250

Though the Cloud Cap Inn has been occasionally referred to as a Whidden and Lewis design, it is was designed specifically by the former, William Whidden, in 1888-1889. This occurred prior to Ion Lewis' arrival in Portland and the beginning of their fruitful 20-year partnership. Their work included the construction of many prominent buildings in Portland, such as the Failing Office Building, one of many listed on the National Register.

50 United States Forest Service, Built Environment Image Guide for the Forests and Grasslands. (United States Forest Service, 2001), 181.

51 Peter Nabokov and Robert Easton, Native American Architecture (New York: Oxford University Press, 1989), 250.

Architectural Influence

The timeless qualities of William Whidden's singular design are affirmed by the inclusion of many of the inn's design elements into Cascadian architecture and subsequently into the ubiquitous National Park Service rustic style. The following admired buildings have all received National Historic Landmark status and feature compelling design commonalities with the Cloud Cap Inn which predated them.

The design of the roof of the Timberline Lodge displays strong correlations with the hip roofed Cloud Cap Inn. The inn's modified-V plan shape is seen again replicated very similarly at a grander scale in Gilbert Stanley Underwood's 1927 Ahwahnee Hotel.

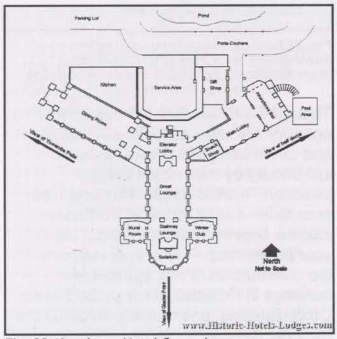


Fig. 23 Ahwahnee Hotel floor plan. www.historic-hotels-lodges.com/California/ahwahnee-hotel/tour/photos/ahwahnee-floorplan.gif accessed 2/21/2012.

In addition, the Sierra Club's 1915 Parsons Memorial Lodge features such similarities as a single story building with a battered masonry foundation, low-pitched roof, and exposed log rafters.

Examples of the Cascadian style that followed include: The Snoqualmie Falls Lodge 1919, Oregon Caves Chateau 1934, Timberline Lodge, Multnomah Falls Lodge 1936-1938, and the Silver Falls Lodge 1937.

It could be argued that many of these design commonalities are attributed to the organic outcome of architectural construction embracing harsh environmental conditions while being removed from urban centers and access to prefabricated materials. However, the fact that the Cloud Cap Inn first proved these design elements at a large scale, and in a remote and harsh environment in the American west, provides a compelling argument for the inn's influence upon these later constructions.

> "From about 1890 to 1940, architects and designers created a Northwestern variation on the rustic design called Cascadian. An early example is the Cloud Cap Inn, a hiker's lodge on Mt. Hood, perhaps inspired by rustic buildings then being constructed in the Adirondacks. The CCC of the 1930's incorporated rustic design and a high level of craft into public works."[52]

52 United States Forest Service, Built Environment Guide, 183.

SITE

The Cloud Cap site consists of a shallow domed volcanic cone that slopes increasing south to north. Cloud Cap Road passes by the site on the SE side and terminates in a non-historic parking area between the Snow Shoe Club hut and the inn. Reference *Landscape and Environmental Conditions p.14,* for further detail on the terrain and flora of the site. The site featured cabins and stables that were lost before the end of the period of significance in 1954, these are non-extant and should not be considered for reconstruction. See fig. 54 for site map. The location of historic privies is unknown.

Due to the relative inaccessibility of the site, many building elements were hand crafted from local materials using early American construction traditions seen in the dry-laid stone foundation, hand hewn log timbers, traditional joinery, and massive stone fireplace.[53]

PLAN

Though the plan shape of the inn has been previously described as "C-shaped" by some authors, it will be referred to as a modified V-Shape in this report as this definition better communicates the angular and open nature of the plan. See fig. 24. The dynamic footprint of the building creates eight principal elevations, with the main entrance centrally located on the NE side of the building on the outside of the V-shape. This is the current, and historic, primary entrance to the building and is approached from the parking area to the NE. The entrance features a historic hand painted "Cloud Cap Inn" sign surrounded by a portico added in the 1920s.

The existing interior spaces are very similar to the historic division of space. Minor changes include the historic office area on the east side of the main hall, now used for storage, and bedrooms on the south wall of the east wing were reconfigured from four to three rooms.

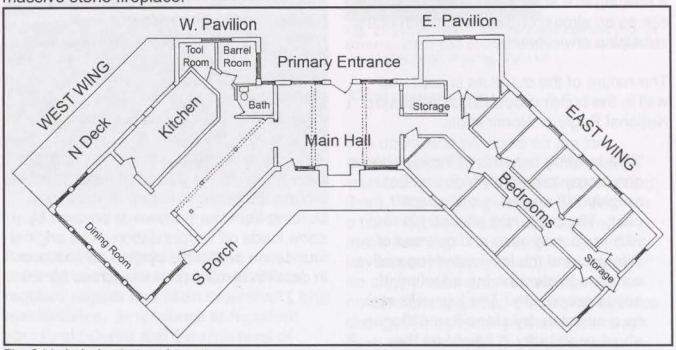


Fig. 24 Labeled existing plan. *Illustration created using USFS measured drawings.*

53 C. Kenith Wilbur, *Home Building and Woodworking in Colonial America,* (Guilford: The Globe Pequot Press, 1992), 1-37.

In many photographs, the SW side of the building is depicted as the most photogenic side and it can be interpreted as the primary elevation, though it does not contain the entrance sign or the larger doorway and portico.

Fig. 25 The south elevation of the west wing View facing north.
OHS collection photo

The south side features a central courtyard area and the south porch within a semi-enclosed exterior space created by the projecting wings. Whidden's sympathetic design to site and landscape resulted in a building that stands seamless upon the site as an almost organic outgrowth of the subalpine environment.

The nature of the structure is captured well in the building description within the National Register Nomination.

> "The building consists of three sections one storey in height which meet at roughly 30° angles in a C-shaped plan. The moderate-pitched hip roof with projecting eves and courses of shingles and the lap-jointed log wall combine to give the Inn a feeling of easy horizontality. The log walls rest on a massive dry-stone foundation about one storey in height on the downhill west side of the Inn. The logs are bolted together, and the whole is anchored to the solid rock below with metal cables. There is no applied ornament, rather, ornamentation is through subtle changes in the use of materials and the use of numerous small-paned windows. Logs are placed vertically at one end of the structure rather than horizontally as in the rest, and one wall on the east side is shingled. The broad sweep of the shingle roof is punctuated by two large chimneys, one stone, the other brick."[54]

The cover photo of this report highlights how the inn's design mirrors the local mountain environment by using a similar 30 degree roof pitch as the slope of the mountain to blend within the landscape. The building stands as an unobtrusive element within the landscape similar to the boulders and stunted trees.

FOUNDATION

The original battered foundation and massive fireplaces were created using native stones. "Rock blasted from nearby cliffs was used to build two great fireplaces."[55] Winter conditions on the mountain were not fully understood in the late 1800s, and it was speculated whether the inn could remain standing through its first winters, so the foundation was bolstered in anchoring the building to the earth by lashing braided steel cables around the entire structure to keep the building from being blown or pressed by snow loads off its foundation. The original foundation and cable system can be seen in detail in historic photos such as fig. 26 and 27.

54 Paul Hartwig, Cloud Cap Inn National Register Nomination (Salem: Oregon SHPO, 1974), Sec-7.

55 Peter Marbach and Janet Cook, Mount Hood, 26.

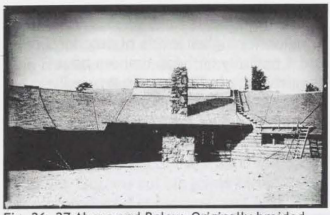


Fig. 26, 27 Above and Below. Originally braided steel cables anchored the inn to the site. Photos from USFS collection

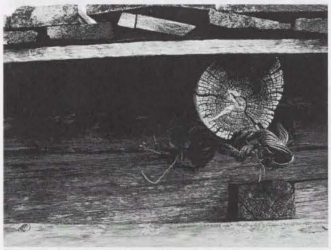


Fig. 28 Current remains of the cable system.

It came as no surprise that the unreinforced dry-laid stone foundation required regular and often extensive maintenance. In response to recurrent structural failures and the high level of maintenance required to insure proper support, the foundation has been reinforced internally using a variety of methods throughout the years and is the most extensively altered portion of the building. Foundation work remains a central issue for the building with the primary difficulty being obtaining a longer lasting foundation that retains the historic appearance of dry stacked stone. The existing foundation features a combination of mortar and stone foundation with concrete pillars and steel reinforced poured concrete. This is then clad in local stones to achieve the historic appearance of the dry stacked stone.

Fig. 29 Stone rubble and Portland cement mortar cover a reinforced poured concrete foundation on the N elevation W wing. View NE

FENESTRATION

The doors and windows on the inn experience a high level of deterioration seasonally, even with shutters protecting them. The existing wooden shutters are a non-historic type that are covered in metal flashing. The windows and doors have been replaced multiple times with no original elements remaining. For a notated photo-guided discussion of these changes in type and placement through time, see Appendix D - Supplemental Photographs as well as Sections III Condition Assessment and Section IV Recommendations.

Log Walls

"Giant firs felled miles below were hauled up to the building site."[56] Felled lower on the mountain and hewn with hand tools on-site, the inn's timbers were shaped of the coniferous evergreen tree Abies amabillis. This species grows exclusively in the Pacific Northwest, and is also known as Pacific silver fir, white fir, Amablis fir, or commonly the silver fir. Silver fir was chosen for a construction material as a matter of convenience, utilizing a local timber from the most accessible vicinity to the building site, thus alleviating the need to haul heavy logs by wagon up the steep road to the inn farther than necessary.

Though the structural qualities of silver fir in log construction are not ideal, the wood is manageable for log construction. Silver fir is not known for its strength or longevity in construction. As a construction-wood, it is relatively soft and weak compared to other common softwoods. However, because the engineering of the inn was based in the technique of overbuilding beyond potential bearing loads, the relative weakness of silver fir was not initially a structural issue.

Over time, it has become apparent that silver fir is ill fit in the original design as an unprotected exterior wood. The lack of cladding and finish on the building increases moisture penetration and trapping. Silver fir's diminished resin content makes it a maintenance burden as logs rot and deteriorate. The protection from sun and moisture provided by the eaves and overhangs has aided the preservation of many of the logs on the top three courses of the walls, and they have experienced the least deterioration, with many original logs retained.

56 Ibid.

The lower courses have experience significantly higher levels of deterioration and a majority of these timbers have been replaced. The logs in proximity to the ground that receive frequent snow contact, moisture from splash-back, and duff buildup have an accelerated rate of deterioration.

Fig. 30 Note unweathered replacement logs under eaves and patina of original logs protected by eaves. Stones replicating the historic dry-stacked foundation cover a contemporary concrete foundation. E Pavilion, view facing west.

To remedy the deterioration problem, a restoration technique has been employed by substituting deteriorated silver fir logs with more resilient Pseudotsuga, or Douglas fir logs. Chosen for its similar appearance to silver fir upon weathering, Douglas fir is structurally superior and contains increased resin content to resist moisture and last longer in the severe weather conditions. Upon initial replacement, the Douglas fir logs contrast the historic logs with a yellower appearance than the silver fir. However, with the passing of subsequent seasons, the new wood develops a patina similar in appearance to the grey hue of the historic logs. Replacement logs are crafted to the same dimension as the historic logs, 8" wide by 10" tall with the exterior left round, but are milled with contemporary tools. As of yet, replacement logs have

not been visible on the buildings interior due to placement or interior treatments. This change in material has received "no adverse effect" signatures from the Oregon SHPO prior to installation.

The historic joinery and logs are seen on the top two courses of the East Pavilion in fig. 30. Square cut lap joints have been reproduced in replacement logs. At the foundation, stones replicating the historic dry-stacked foundation cover a contemporary concrete foundation or are reinforced with mortar joints. Recent replacement logs are easily visible with a pronounced yellow hue that has yet to fade and develop the silver patina that will follow after subsequent seasons. The outside face of the logs originally was left round with the bark remaining. However, bark began peeling immediately and is seen partially peeled even in photos from 1889. Over time the bark has almost entirely been lost, and replacement logs are installed without the bark to match the existing original logs that are bare.

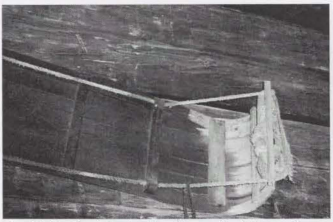


Fig. 31 On the interior E gable wall of the main hall broad axe, adz and slick marks remain from the original carpentry.
View facing E

ROOF

Fig. 32 Crag Rats assess roof conditions for winterization at the end of the 2011 season.
View facing NE

A moderately pitched 30 degree pitched gable roof features hipped roof projecting wings and open eaves. The roof is currently clad in both historically accurate cedar shingles, and retains some cedar shakes from a previous replacement. The cedar shingles are better suited to surviving high winds and severe weather at the site.

Fig. 33 Note split cedar shakes. These will be replaced with cedar shingles upon deterioration. Crag Rats constructing bunk frames 2011. Facing W

Originally, there was an observation deck on the roof and a wood ladder system to reach it. Exposure to winter storms required that the system be stringently repaired seasonally. It was destroyed entirely during the winter storm in 1919 that toppled the west wing chimney and was never rebuilt fully and is not seen in photos after 1940.

Fig. 34 The original observation deck and stairs were reconfigured many times as they were rebuilt seasonally before being lost entirely in 1919. USFS collection photo.

Chimney Configurations

Located in a subalpine environment, the inn has always relied heavily upon internal heating sources to remain habitable. Originally, the inn utilized two stone fireplaces to maintain heat, one at the end of the west wing, and the other on the south wall of the main hall. As the building was historically occupied exclusively during the summer months, the east wing bedrooms were not heated. Currently, in winter conditions when occupation is minimal, the main hall is also used for a sleeping area by the fireplace.

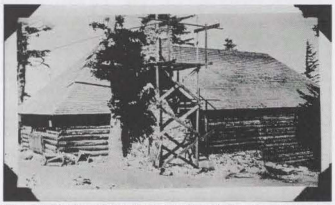


Fig. 35 Photo of the nearby Cloud Cap Snowshoe Club Building c. 1920. This building is sometimes confused with the CCI. Note the roof is hipped on both ends of one ridge span and not the CCI. USFS collection photo.

The original exterior stone chimney on the west wing was destroyed in a winter storm in 1919 and was not rebuilt. Period photos thought to be documenting a c. 1920 reconstruction are actually of chimney work on a deceivingly similar nearby building. See fig. 35.

During the 1920s the west wing was without a stone or brick chimney, with only the flue for the cooking stove remaining. See fig. 36. During this period the building received the beautiful casement window configuration seen currently on the dinning room.

Fig. 36 Note lack of stone or brick chimney on west wing between 1920 and 1940. Photo from collection of Michael Dryden.

A brick chimney was built circa 1940 near the ridge line of the west wing. This brick chimney vents a wood stove in the dining room. It was toppled in a storm and rebuilt in 1990. This is the chimney that remains today. As this change came during the historic period of use, the alterations have obtained historical significance.

Fig. 37 Existing brick chimney constructed in 1940 and rebuilt in 1990. See fig. 33 for location of brick chimney on west wing. View facing east

INTERIOR

The interior of the Cloud Cap Inn has seen numerous minor alterations throughout its history. However, the overall plan and use of rooms has remained relatively consistent for a building of its age.

Various terms have been used to describe the inn's rooms over the years. For the purposes of this report, the names used in the Labeled Plan fig. 24 are used by the author as they are the most descriptive of the spaces defined. (In historic documents however, terms such as Living Room or Lobby are found instead of Main Hall)

Fig. 38 Above. Dining room 1889-1919 era with fireplace.
OHS photo.

Fig. 39 Below. Guests relax by the main hall hearth 1893. OHS photo

Like the roof, many alterations from the historic period are considered historic alterations to be preserved in the interior. The design of the inn's interior evolved throughout the historic period, depending upon economic or functional considerations. However, one aspect that remained constant in the interior was an inviting combination

of rustic yet classy accommodations that allowed guests to enjoy the rugged mountain environment in a great deal of comfort. The interior provides a sense of hospitality, and functions as a cultural hearth in the often hostile mountain environment. The spatial emphasis on fireside gathering and the open flowing connectivity of the interior spaces promote social engagement. "It was a thoroughly homelike and hospitable place, a veritable olden time inn."[57]

The general openness of the design and emphasis on communal spaces contrasted the compartmentalization and interior separation prevalent during the Victorian era and foreshadowed the flowing interior spaces of the Prairie School of architecture. The inn could host a maximum of 30 guests and the interior design utilized communal dinning and relaxation areas.

In addition to mountaineering, the design equally intended to allow guests the opportunity of engaging with the mountain environment from within the idyllic mountain lodge above the clouds, and emphasized outdoor pursuits and leisure activities. Plentiful windows and outside areas such as the N porch, S deck, and observation deck offered excellent views and light to appreciate the environment without leaving the grounds.

In 1928, the south wing was extended out to 44'-10" from the original length of 28' to accommodate increased use from automobile traffic. Though this alteration compromised the architect's intended geometric symmetry of the building plan, it is considered historic and is retained.

Fig. 40 Relaxing in the central hall. OHS Photo

57 Munro, 51.

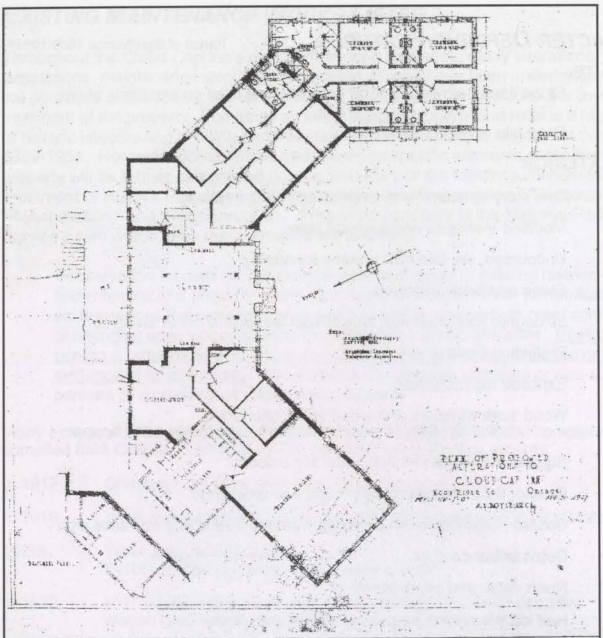


Figure 2. August 31, 1927 plan drawings by A.E. Doyle. Existing walls shown as solid lines, proposed changes shown as cross-hatched drawings. Note that south bedrooms in east wing are shown as same size, shape and configuration as the north bedrooms.

On the NE wall bedrooms of the east wing, the original four-room layout is retained, with the additional storage area off the end from the extension in 1928. However, on the west wall of that wing, the original four-room layout was converted to three larger rooms and the added storage area in 1928. As William Whidden's original blueprints have never been located, the most accurate interpretation of the original

Fig. 41 The earliest known interior plan of CCI. USFS collection image.

room layout comes from A.E. Doyle drawings for an expansion to the inn. This drawing is not a definitive description of the original layout, but is the only known drawings displaying that configuration.

Character Defining Features

Period of Significance 1889-1954[58]

Site

Stone lined pathway to north entrance and road on west side of site

Rock pile at end of west wing

Exterior

One story structure with emphasized horizontal axis

Modified V-shaped architectural plan

Uncoursed, dry-laid native stone foundation

Stone and brick chimneys

30 degree roof pitch with hipped roof wings and cedar shingles

Projecting Eaves

Exposed log rafter tails

Wood sash windows with wood storm shutters
Including: Casement, double-hung, and single pane hopper

Square cut lap-jointed horizontal log exterior

Exterior face of wall logs left round and unfinished

Gabled portico on north entrance from the 1920s and entrance sign

Dutch entrance door

North deck, and south porch

Half log covered storage area under north deck

Interior

Massive stone fireplace with ashlar stonework hearth

Tongue and groove fir floors, ceilings, and walls in east wing

Open-beam ceilings in dining room, kitchen, and main hall

Historic pencil graffiti on bedroom walls

Vertical and horizontal board walls in dining room and main hall

Adz and broad axe marks on interior wall logs in main hall

Decorative corbels in door frames

58 Period of Significance was not established in 1974 CCI National Register nomination.

Existing Maintenance Works Listed

Throughout the Cloud Cap Inn's over century-long existence, many alterations, adaptations, maintenance work, and restoration actions have been undertaken. For the purposes of this report, the umbrella term "Restoration" is applied to the overall treatment of the property. The inn is an intact historic property that retains a high level of historic integrity and is being restored as a whole to depict the restoration period of 1889-1954. However, individualized treatments on specific elements of the historic property will be further categorized per the Secretary of the Interior's Standards for the Treatment of Historic Properties. These are listed as: "Preservation," "Restoration," "Rehabilitation," and "Reconstruction." Presented concisely in the National Park Service's own words, they are defined as the following.

> "Preservation focuses on the maintenance and repair of existing historic materials and retention of a property's form as it has evolved over time. 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."[59]

Many early maintenance efforts went undocumented. This is the most complete list compiled from Oregon SHPO, Crag Rat, and US Forest Service records.

c. 1913	Chimneys repaired, new porch added to south side
c. 1919	West wing, chimney, and observation deck destroyed in windstorm
1920s	West wing reconstructed Portico added covering north entrance door
c. 1928	8'-6" addition to east wing to accommodate increased use after wagon road was replaced with automobile road in 1926
c. 1931	Lower seven courses of logs replaced
c. 1940	Exterior brick chimney and wood stoves added (Chimney later toppled in 1990 and was reconstructed) Civilian Conservation Corps Era Added vertical paneling to dining room and main hall Widened Interior doorways and added corbelling
1950s	Tongue and groove fir ceilings in kitchen replaced with plywood
1952-53	Entrance door replaced with raised panel and Dutch door

59 National Park Service, Four Approaches to the Treatment of Historic Properties (U.S. Department of the Interior) www.nps.gov/tps/standards/four-treatments.htm (accessed Sept. 27 2011)

Existing Maintenance Works During Crag Rat Occupancy

The Crag Rats have been responsible for the maintenance of the Cloud Cap Inn since 12 years prior to the establishment of the National Register of Historic Places in 1966 and are thus some of the pioneers of preservation in America. The Cloud Cap Inn was first nominated individually to the National Register of Historic Places in 1974. Later, it was also listed as a contributing building to the Cloud Cap/Tilly Jane Recreational Area historic district in 1980. After the inn became a National Register listed property, the Crag Rats began working closely in compliance with the Oregon SHPO on all preservation and maintenance work. "An existing Memorandum of Agreement (MOU 606-94-156) between the Forest Service and the State Historic Preservation Officer as submitted to the Advisory Council on Historic Preservation allows for the Crag Rats to perform routine maintenance and major repairs to the Cloud Cap Inn."[60]

The Cultural Resource Management Plan that was submitted to the Oregon SHPO in 2000 was not approved as submitted. However, all Crag Rat projects have received pre-approval from the State Historic Preservation Officer.

1950s	Porch added to south side of kitchen
1956	2 pit toilets relocated
1957	North foundation repair Year round cold water plumbing added Main door repair 8 shutters repaired or replaced
1959	South wall on east wing Built 3' foundation Rebuilt south vertical cedar siding Replaced studs and bracing Removed logs and covered with hardboard
1960	Kitchen floor leveled, new counters and cabinets Spring cover replaced USFS allowed the Crag Rats to block the road and driveway and take steps to reduce vandalism during the winter
1961	Partial repair NW corner foundation
1962	NW foundation repair
1963	Constructed NW rock wall
1964	East wing shakes covering hardboard Front porch removed from N side of W wing

60 Michael Dryden, "Cloud Cap Inn East Wing Rehabilitional Assessment of Effects (paper submitted to the Oregon SHPO regarding rehabilition efforts, August 17, 2006), 6.

1965	East wing roof repair Kitchen equipment added Shutter repair
1967	Repair of porch, foundation, and logs
1968	Main hall jacked up for repair of floor joists SE corner jacked up for repair of logs and rock wall
1969	Floor joists under kitchen replaced Creosote footing installed Rock wall rebuilt
1972	Replacement of rotten sills
1974	Replacement of porch boards and NW corner post Repair snow damage on east wing Kitchen beam replaced East wing door reinforced
1975	Kitchen floor brought to level Replacement lower wall logs cut, transported, and hewn
1978	Deteriorated logs at NW corner replaced Failing rock foundation rebuilt Water system re-plumbed with steel piping
1979	Living room fireplace re-bricked Rock wall above fireplace removed and insulated with visqueen New toilet installed in bathroom, interior remodeled 3rd room on west side of east wing insulated
1980	9 new logs installed
1981	Logs replaced on south side of west wing All logs replaced from kitchen door to living room door Stabilized foundation at SE corner of east wing with additional braces
1982	East wall repair from front door to wing Deteriorating logs replaced with footing and rock wall to elevate logs off ground
1983	Foundation replaced under front door Waterline under foundation and porch replaced Rock and mortar foundation under front door replaced Three 10' logs replaced to left of front door New window sills New porch added to front of building set on pyramid blocks
1984	Spring enlarged, added reservoir tank, re-landscaped
1985	1985-1992 specific information missing from record Re-roofed, tongue and groove fir purchased

1993 Spring cover replaced with cedar to resist deterioration
Front porch replaced

1994 Vandalism on north wall near kitchen repaired
Trees felled and hauled to Winans Mill for east wing restoration
Architecture students complete measured drawings
Desired Future Condition (DFC) developed for Cloud Cap informed by USFS
Partial replacement of shakes on roof

1995 DFC submitted to USFS

1996 DFC completed development plan not yet approved
Research done at Oregon Historical Society
Casement windows installed with shutters
Historic door given to Hood River County Historical Museum
Documentation of door completed for reconstruction

1997 Fabrication and installation of new window casements and shutters for NE windows in living room

New wood storage proposed under kitchen in order to complete restoration of east wing as evidenced in 1912 photo

Reconstruction and installation of main entry Dutch door
Fireplace chimney re-pointed
Inn re-plumbed with copper pipes
Front and rear door sills replaced

1999 Porch added on north side of dining room, based upon historic photos
Reconstruction of firewood storage area beneath north side porch
Trap door installed in kitchen floor with steps to wood storage area

2000 Kitchen Rehabilitation
- Windows manufactured and installed of vertical grain Douglas fir
- Historic molding shape by Kreig Millwork
- Relocation of kitchen to original placement on west wing
- Exterior logs near kitchen replaced
- Floor and floor structure replaced in kitchen
- Vaulted ceiling restored and opened in kitchen
- Doorway between kitchen and living area widened to 5"
- New kitchen counter tops and cabinets
- New gas lines installed

Main lobby fireplace chimney flue lined
Header beam replaced
Replacement of exterior logs on south elevation on west wing
Repair of west wing foundation
Plywood wall paneling replaced with 1"x12" tongue and groove

2001 Deteriorated plywood and T&G ceilings replaced on west wing
- Also on south rooms of east wing
- Temporary plywood floors installed

Replacement of sub-flooring in south rooms on east wing with 6"x6"

pressure treated beams
Concrete footings replaced
1 window replaced in-kind on south wall of west wing

2002 Flooring, joists, and beams replaced in west wing dining room

Addition of south deck to main hall and west wing
CCC era cedar paneling removed to view original hewn logs and registration window on east wall of central hall

Registration window framed in salvaged materials
West wing tool room windows replaced
Exterior wall logs replaced in west wing tool room
Concrete footings of west wing faced with masonry
Exterior north wall logs replaced in central hall restoration

2003 Crag Rats renew special use permit with the USFS
Windows replaced in tool room
Exterior wall logs replaced in west wing tool room
Concrete footings on west wing faced with masonry

2004 "Phase V rehabilitation work at Cloud Cap Inn began under terms of an existing Memorandum of Understanding [sic] with the Crag Rats regarding operations, maintenance, and preservation activities. A 'No Adverse Effect' determination was made in 2003 for the proposed work, which included foundation, floor and ceiling repairs, interior and exterior wall repairs, and window replacements. Approximately 30% of the planned work was completed by October 2004. The Deputy SHPO participated in the field inspection of 2004 work."[61]

2004-2006 Phase IV - East Wing Repair
KPFF Consulting Engineers, Portland OR.
Interior partition demolition
Foundation demolition
Ceiling demolition
Roof framing demolition
Wall demolition
Historic Graffiti on interior walls from guests to be retained.

The original door is being conserved by the History Museum of Hood River County. A reproduction door was created by Lewis L. McArthur.

61 *Pacific Northwest Region Monitoring and Evaluation*, Ch 2. p.31.

Existing Phased Restoration Plan

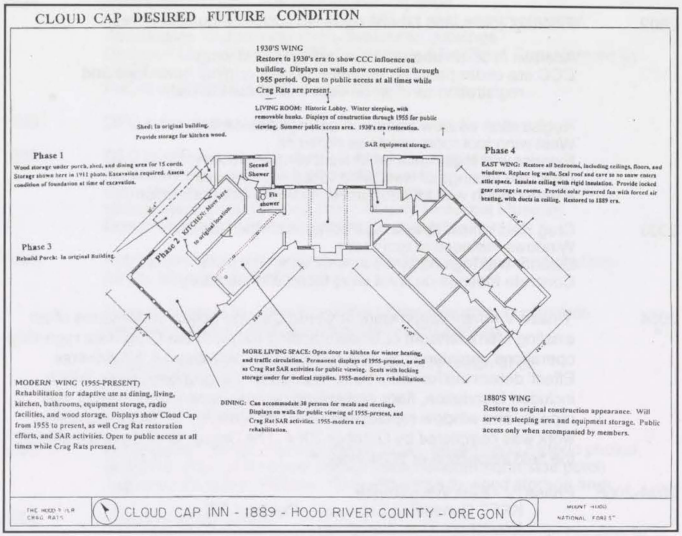


Fig. 42 Created by USFS and Crag Rats as submitted to OR SHPO in 1995.
Image Crag Rats Collection

Preservation Zones

In September of 1995, the Crag Rats in conjunction with the Hood River Ranger District of the US National Forest Service, prepared a report titled "Cloud Cap Desired Future Condition."

This report established the objectives for the inn as: 1. The Base for Crag Rat Search and Rescue operations, training exercises, and outings. 2. The preservation of the Inn as "a Heritage resource to be appreciated by the public, Crag Rats, and future generations." This document has not been accepted as submitted to the Oregon SHPO. However the idea of unique restoration zones was retained in phased works.

The Cloud Cap Inn has three distinct periods of historic use that are currently interpreted in different areas of the inn.

East Wing - 1880s Original Service

The east wing of the building is being restored to interpret the appearance of the original construction. It functions as a sleeping area, equipment storage, and wood storage area. Public access is only permitted when accompanied by Crag Rat members. The rooms feature non-historic contemporary bunk beds and there are no known historic furnishings in the rooms. Historic pencil graffiti in the east wing bedrooms is preserved.

Main Hall - 1930's Civilian Conservation Corps.

This area is the main hall. I t is an area open to the public. During the late 1930s the CCC was active in the Tilly Jane area and used the Cloud Cap Inn while building ski trails and the Tilly Jane Ski Cabin. During their time at the inn, the CCC widened interior doorways to make the space more communal and informal and added large corbels in doorways. They also crafted an ashlar stone hearth for the fireplace in the main hall.

West Wing - 1954 - Modern Era Crag Rats

The West Wing is a utilitarian space that incorporates the changes of the early modern era in 1954 when the Crag Rats occupancy changed use from guest accommodation to organizational use. The kitchen was relocated back to its original position. The open hallway area adjacent to the kitchen is a mixed-use storage and bunk area.

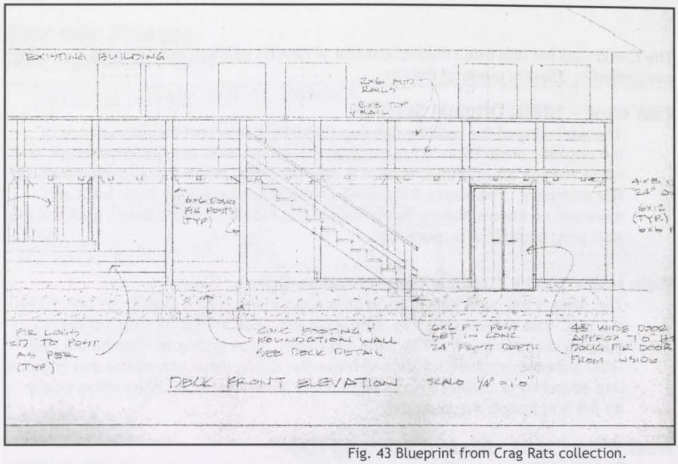


Fig. 43 Blueprint from Crag Rats collection.

Phase I

The north deck was reconstructed by Wells Construction Inc. in 1999. The deck flanks the west wing on the north side. It is primarily constructed of dimensional Douglas fir with horizontal fir half log cladding over a reinforced concrete foundation with a door. A wood storage location was created under the porch and dining area with combined space for 15 cords of wood. (One cord = 128 cubic feet, or a space 4'x4'x8') To complete the wood storage area, some excavation was required and the condition of the foundation was assessed at the time of the excavation.

Contractor

Wells Construction Inc.
Hood River, Oregon
503.386.6698

Consultant Engineers

Gorge Engineering Inc.
White Salmon, Washington
509.493.4151

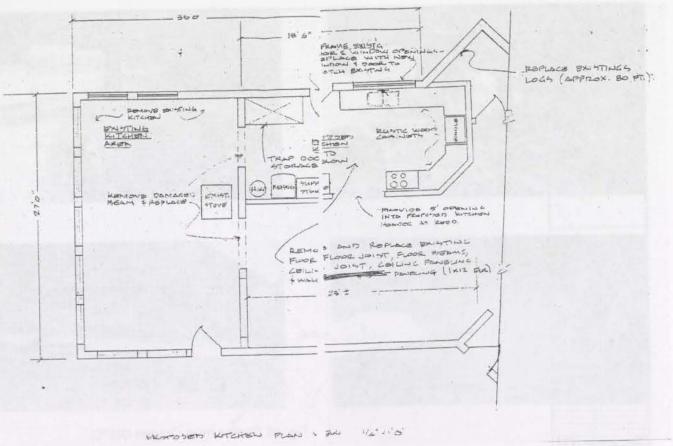


Fig. 44 Kitchen relocation and remodel draft. Image from Crag Rats Collection

Phase II

This phase was the Kitchen relocation and remodel in 2000. The original location of the kitchen was along the north wall of the west wing, next to the north deck. At some unknown point it had been moved to the dining room. This alteration was reversed and the kitchen was moved back to the original location. The kitchen door and window were replaced in kind and new cabinets and amenities were added to the kitchen. A trap door was installed leading down to the large wood storage area in the basement. The flooring, joists and ceiling panels were all replaced in kind, and a damaged beam by the wood stove in the dining room was replaced.

Contractor

Wells Construction Inc.
Hood River, Oregon
503.386.6698

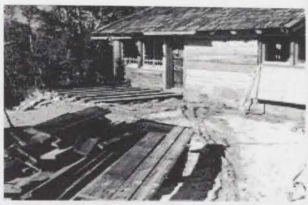
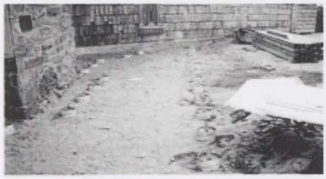





Fig. 45 Photos from Oregon SHPO.

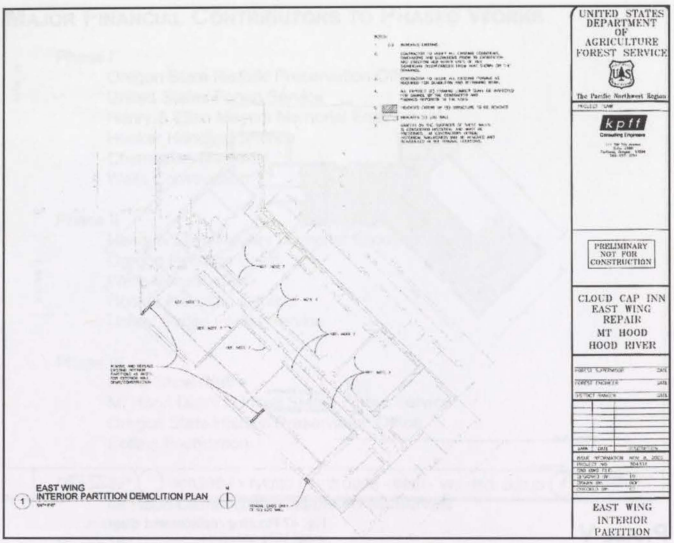
Phase III

In 2001-2002 the dining room door was reconstructed and windows along the south wall of the west wing were replaced. Windows were manufactured by Kreig Millwork that had previously done window repair and possessed the correct historic molding shapers. Deteriorated flooring, floor joists, and hall ceiling were replaced. Deteriorated logs on the north wall were replaced. Three windows and shutters on the south hall wall were installed that match the existing kitchen windows. The shutters consisted of plywood clad in sheet metal and painted brown. Exterior walls were foam insulated between the top wall log and the roof. The south porch was rebuilt in 2002.

Contractors

Krieg Millwork & Building Supply
Hood River, Oregon
541.386.2929

Wells Construction Inc.
Hood River, Oregon
503.386.6698



Phase IV - East Wing Repair

This phase was an extensive repair of the east wing which is intended to interpret the 1889 era. Due to the larger scale of the repair, this phase extended from 2004-2006. Interior partitions were repaired. Concrete footings were replaced and portions of the existing rock foundation were removed and replaced with a concrete stem wall under the logs. Logs were replaced and structural adjustments were made on the north elevation. "Log Hog" screws were used in place of spikes in the new logs. Tongue and groove walls in the bedrooms with historic pencil graffiti was retained.

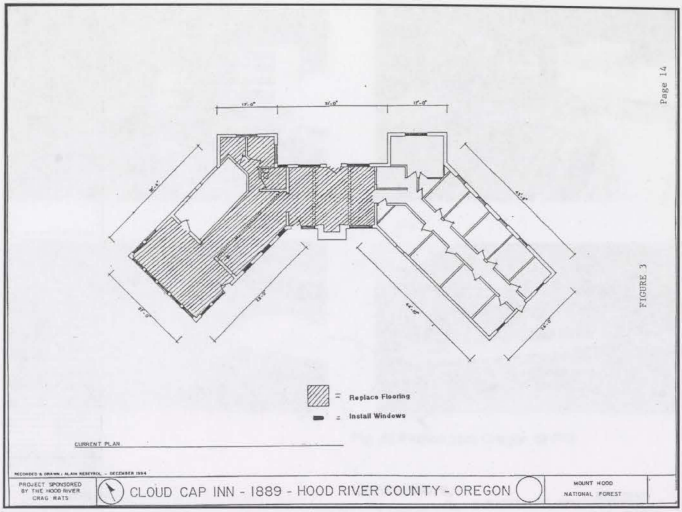
Fig. 46 East wing demolition plan. Reference Appendix-B oversized *East Wing Repair* drawings for further details.
Image OR SHPO collection

Consulting Engineers

KPFF Consulting Engineers
Portland, Oregon
503.227.3251

Contractor

Wells Construction Inc.
Hood River, Oregon
503.386.6698



Phase V

Phase V was carried out in 2003 and focused upon the main hall and west wings of the inn. Tongue and groove flooring was replaced in the main hall and west wing. Widows on the north elevation of the main hall were replaced in kind. North and south wall logs were replaced. The fireplace hearth was repaired. Previously installed ceilings were stained. Subflooring and flooring were replaced with salvaged flooring from previous demolition in the west pavilion. The fireplace hearth was repaired using existing stones.

Fig. 47 Flooring replacement diagram. Image USFS collection.

Work

Crag Rats
Hood River, Oregon
541.399.3732

Major Financial Contributors to Phased Works

Phase I
- Oregon State Historic Preservation Office
- United States Forest Service
- Henry & Ellen Meyers Memorial Endowment
- Hooker Handling Service
- Chemectan Memorial
- Wells Construction

Phase II
- Henry & Ellen Meyers Memorial Endowment
- Oregon Heritage Grant
- Wells Construction
- Hooker Handling Service
- United States Forest Service

Phase III
- Snow Shoe Club
- Mt Hood District United States Forest Service
- Oregon State Historic Preservation Office
- Collins Foundation

Phase IV*
- Mt Hood District United States Forest Service

Phase V*
- Mt Hood District United States Forest Service

*Complete funding documentation for phases IV and V was missing during research.

Fire Protection

During the warm and dry Northwest summers, the inn is often threatened by forest fires in the region. It is remarkable that the building was not destroyed prior to large scale wildland fire fighting practices that began in the area during the CCC era of the 1930s when Mount Hood received increased recreational development. There have been two notable fire incidents in recent history that have threatened the very existence of the Cloud Cap Inn. In these extreme situations, measures beyond spraying with water have been required of the USFS to insure the protection the historic resource. These include spraying the roof with fire retardant foam, and creating and applying a heat reflective wrapping for the exterior. Fortunately, these efforts have been successful, and the inn remains unscathed. Presently, the proximity of these fires is strikingly apparent when viewed out the east wing doorway, fig. 49.

2008 - The Gnarl Ridge Fire

Fire crews doused the inn's roof with orange fire retardant foam and applied the foil wrapping. The fire caused minimal damage and the retardant was scrubbed off. The cedar roof was stained by the retardant, but it has subsequently faded back to the historic appearance. The fire came within 60 feet of the structure, yet the structure was not damaged. The Oregon State Historic Preservation Office presented Forest Service archeologist Mike Dryden with a Heritage Steward Recognition Award for his tireless leadership in this effort.[62]

62 Stewart Tomlinson, "Forest Service Archeologist Wins State Preservation Award," *The Oregonian*, Oct. 13, 2008.

2011 – Dollar Lake Complex Fire

The building was wrapped in fire resistant foil and doused with sprinklers on the roof. A fire crew and pumper were stationed on site. There was no fire damage.[63]

Fig. 48 Fire retardant wrapping used during the Gnarl Ridge Fire 2008. Photo from *The Oregonian www.oregonlive.com/outdoors/index.ssf/2008/10 forest_service_archaeologist_w.html* Accessed 3/12/2011

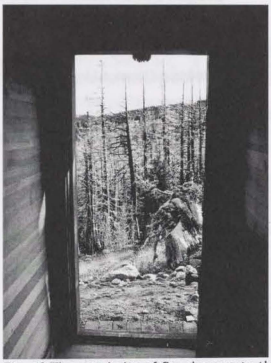


Fig. 49 The proximity of fire damage to the inn is currently highly visible. View SE out the west wing doorway.

63 Staff, "Crews Work to Protect Historic Mt Hood Buildings from Wildfire," *Northwest Cable News, Aug 31, 2011. www.nwcn.com/home/128856038.com (accessed March 13, 2012.)*

PART III - CONDITION ASSESSMENT

Fig. 50 The Cloud Cap Inn view looking south.

In this condition assessment, the standard rating system of Good, Fair, and Poor is combined with photographs and supporting technical information to describe existing conditions of the building's components for evaluation. The urgency of required attention and the relative significance will be covered if pertinent. All existing materials are considered in this report.

This condition assessment describes the existing conditions of the physical components that make up the Cloud Cap Inn. Evaluation is based upon field observations conducted during three trips to Mount Hood in the fall of 2011. The inn was only seasonally open during the first visit prior to closing for the season.

The Cloud Cap Inn is a single-story mountain lodge with a modified V-plan shape that consists of a gabled central unit with hip roofed wings that project out from the gable sides. There are two pavilions protruding from the north elevation, one deck off the north west side of the west wing, and one porch flanking the south side of the west wing and main hall.

Fig. 51 Cloud Cap site looking south west.

Fig. 52 Cloud Cap site at entrance. Note vehicle induced erosion and deterioration of stone barriers along road and path. Facing S

Fig. 53 South side facing north. This location was historically barren.

Existing Conditions

The immediate Cloud Cap site is located on the northern slopes of Mount Hood at approximately 6,000 feet. The topography is a shallow domed cone that slopes gently to the north on what once was a pre-Fraser lava vent. The well-drained volcanic soil is partially barren with mixed terrain and subalpine forest at the foot of the Eliot Glacier.

Evaluation - Fair

The north entrance of the site is deteriorated from vehicle induced erosion. Stone rubble barriers lining vehicle traffic areas have deteriorated. Driving on non-graveled areas has increased erosion.

Regrading is not required. Reline roadway, paths, and parking areas with stone rubble barriers to prevent unmitigated vehicle induced erosion. Stone barriers should be assessed and maintained annually to mitigate these problems.

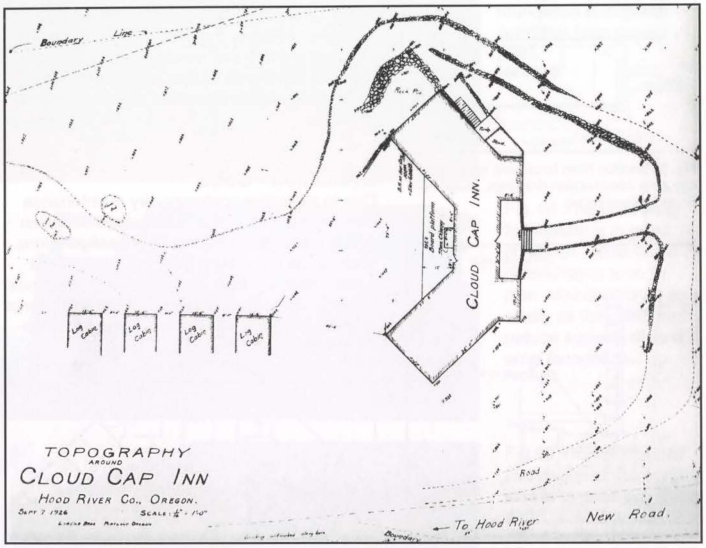


Fig. 54 Historic 1926 Lorene Bros. Portland, Oregon topography map depicting placement of stone rubble barriers at the Cloud Cap Site. Image from Crag Rats collection.

Stone demarcation barriers should be restored based upon this historic topography map from 1926. Note unbroken stone barriers along both sides of the entrance road near the west wing of the building. Smaller stone path demarcations to the south of the site and cabins were lost before the ending of the period of historic significance in 1954 and do not need to be restored. Historic plantings were short-lived in the harsh environment and did not obtain historical significance and should not be restored.

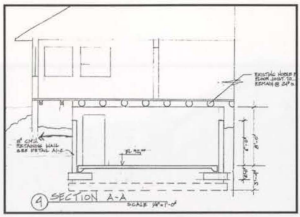


Fig. 55 Section from basement wood storage area construction drawings. Image from Gorge Engineering Inc.

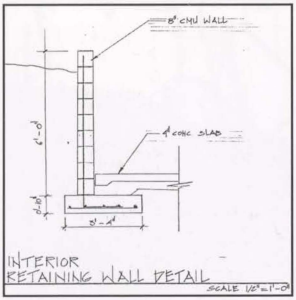


Fig. 56 North retaining wall from basement. Image from George Engineering Inc.

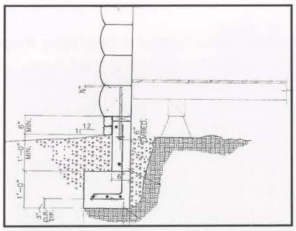


Fig. 57 Concrete footing section from east wing repairs 2006. Image from kpff Consulting Engineers, See Appendix-B S-501.

FOUNDATION

The original dry stacked rubble stone foundation experienced many failures historically and is the most heavily modified aspect of the building. Under NPS treatment standard, *Restoration,* the foundation has received many alterations using modern concrete construction clad in stone.

Evaluation - Good

Due to extensive contemporary maintenance work on the foundation, it is in good condition and is more stable than in prior configurations. Monitor the foundation from the exterior and crawl space annually. Maintain west wing rock pile annually. Apply stone rubble to the exterior of the contemporary concrete basement foundation where missing.

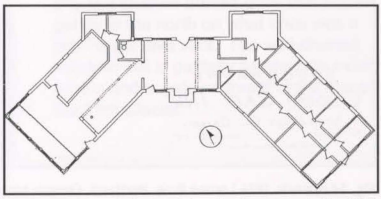


Fig.58 Portions of plan and foundation extended in 1928 highlighted in red. Image derived from USFS drawings

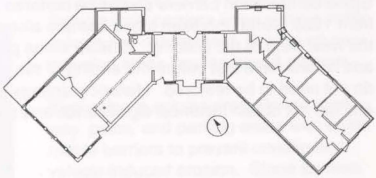


Fig. 59 Areas with concrete stemwall and piers highlighted in blue.
Image derived from USFS drawings

FOUNDATION - EXISTING CONDITION

Fig. 60 The east wing foundation is in good condition from repairs in 2006.
Facing NE

Fig. 61 The west wing foundation is in good condition. Note some deterioration to rock pile. Maintain rocks annually as they shift and reduce support of west wing foundation.
Facing E

Fig.62 The central hall foundation of the north side is in good condition.
Facing E

Fig.63 The foundation on the north side of the west wing is in good condition. Rocks applied to the outside of the modern concrete foundation should be reapplied around the basement doorway.
Facing SW

Fig. 64 Douglas fir lower logs replaced in 2006 have not yet weathered and are currently easily discernible from historic silver fir logs. The original upper two rows of logs are retained as they have been shielded from the elements by the open eaves. The exposed gable ends of the central hall are clad in cedar shingles in good condition. Facing SW

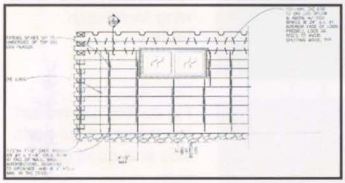


Fig. 65 Modern log wall spiking diagram. Image from kpff Consulting Engineers. See appendix-B, S-302.

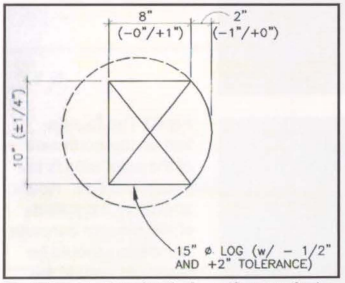


Fig.66 Section view detail of specifications for log selection and shaping. Image from kpff Consulting Engineers. See appendix-B, S-002.

WALLS

Existing Conditions

Load-bearing log walls consist of timbers 8" thick x 10" tall cut from 15" diameter logs with the exterior surface remaining round. These are laid horizontally and are joined with ½" Ø by 1'-8" galvanized spikes. Corners are joined with half-lap joints and spiked. Logs continue from foundation to roof height in 10 courses. Upper course logs are incised to inset log rafters. Log rafters are bolted directly to the upper log. Deteriorated hewn silver fir logs have been replaced with milled Douglas fir logs as a preventative maintenance practice.

Evaluation - Good

East Wing - The elevations on the east wing are in good condition. Logs were replaced on this wing as well as the pavilions in 2006. There is no current deterioration from splash back or moisture trapping on these walls. The upper two rows of logs remain on the east pavilion.

Central Hall - The central hall is in good condition at both the north and south elevations. Logs on the north wall were replaced in 2002. The small portions of exposed gable end on the east and west elevation wall are clad in cedar shingles.

West Wing - The logs on the south elevation of the west wing were replaced in 2000 and are in good condition. Logs from on the north side of the west wing are replacements that have weathered to the iconic silver color of the lodge and remain in good condition.

FLOOR FRAMING

Fig. 67 Log floor joists seen in basement wood storage area looking south. Note timber girder and notches in floor joists to receive girder. Facing S

Fig. 68 2002 photo by Nancy Niedernhofer, from Oregon SHPO collection. Notice timber floor joists at chimney footing. Facing E

Fig. 69 2002 photo by Nancy Niedernhofer, from Oregon SHPO collection. Floor joists in west wing. Facing W

Existing Conditions

Floor framing consists of 9" diameter noble fir log and timber floor joists spiked to 2" x 6" ledgers at 24" on center. Undersides of log floor joists are notched to receive two central girders laid parallel 4' apart. In 1996 sagging floor joists were bolstered by cedar posts. Floor joists under the kitchen area were replaced by 6" x 6" pressure treated beams in 2006. Floor joists were replaced in the dining room area in 2002. The east wing utilizes three floor joist configurations. Primarily, log floor joists remain. 6" x 6" pressure treated beams are used under the bedrooms on the south wall. In the east wing storage area, 2" x 6" floor joists are laid perpendicular to the wing. As floor framing has received ample attention since the 1990s, all are currently in good condition.

Evaluation - Good

Floor joists, sub-flooring, ledgers, and girders are in good condition due to recent monitoring and repairs. Cedar piers supporting floor joists are at risk of deterioration without concrete footings.

PORCH AND DECK

Fig. 70 South porch is in good condition. Existing boards are laid parallel with elevations, historically they were laid perpendicular. View facing north

Fig. 71 North deck in good condition. View facing east.

Existing Conditions - The existing north deck and south porch are both in good condition due to their recent reconstruction and are not in need of immediate attention. Moisture damage is minimal.

Evaluation - Good The inn features one porch and one deck, both reconstructed and in good condition. The south porch boards are laid in a non-historic configuration parallel to adjacent west wing elevation.

CHIMNEYS

Fig. 72 Note deterioration on lower mortar joints. View facing NE

Fig.73 Stone chimney is in good condition. Flue was relined in 2000. View facing N

Fig. 74 Stone chimney hearth in central hall. In good condition. View facing NE

Existing Conditions - The Cloud Cap Inn features two chimneys and one hearth fireplace. The brick exterior chimney on the west wing vents a wood stove and is in poor condition though rebuilt in 1990. Deterioration of lower mortar joints is readily apparent. The central hall chimney was repointed in 1997 and the hearth features ashlar stone work from the CCC that was repointed in 2003.

Evaluation - Poor
Mortar joints on the lower 8 courses of the brick chimney are deteriorating. Repoint joints, replace broken and spalling bricks in kind. Stone chimney mortar joints, foundation, and hearth are in good condition. The metal high wind chimney cap on stone chimney is not historically compatible.

Fig. 75 Note heavy timber queen post trusses, log rafters, board sheathing and purlins.
View facing E

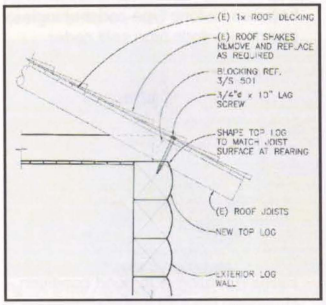


Fig. 76 Roof and wall connection diagram by KPFF Consulting Engineers, see appendix-B S-501.

Fig. 77 Exposed rafter tails experience highest deterioration of roof framing.
View facing W

ROOF FRAMING

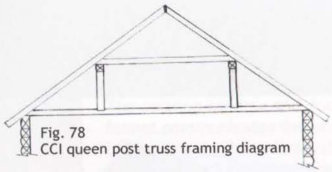


Fig. 78
CCI queen post truss framing diagram

Existing Conditions

Roof framing consists of heavy timber, queen post trusses with 6" diameter log rafters spaced at 2'-6" on center and secured with 2" x 6" collar ties. Log rafters are attached to wall logs with ¾" x 10" LAG screws. The roof to wall connection is covered on the exterior by 5" diameter log blocking that is toe-nailed in place. The top exterior wall logs are incised to receive the log rafters and many original logs remain on the top two courses as they are protected by the eaves. The hipped roof portions of the wings have 6" diameter log ridge beams, while the peak roof ridges use 1" x 6" ridge beams. The roof features 1" x 6" board sheathing.

Evaluation – Good

Roof framing components are in good condition as roofing materials have been well maintained since the 1950s. The most significant deterioration is found in the protruding log rafter tails where they are exposed on the exterior to the elements. The exposed end grain absorbs moisture readily and drys faster than other portions of the log creating checking and should be monitored annually for structural failure.

ROOF CLADDING

Fig. 79 The east wing and east pavilion roofs are clad in cedar shingles. They are in excellent condition and expected to last for at least 15 years.
View facing W

Fig. 80 On the east wing and east pavilion with shingles the roof ridge lines are trimmed in 1" thick boards.
NE corner of east pavilion. View facing SW

Fig. 81 Copper flashing on gable wall and east wing connection, flashing trough in roof connection. View facing SE

Fig. 82 Split cedar shakes cover the main hall and west wing. View facing NW

Existing Conditions

The existing roof cladding is mixed between historic type cedar shingles, and non-historic type split cedar shakes. Both are laid on top of tar paper and nailed to the 1" x 6" sheathing boards. The east wing and east pavilion are clad in shingles while the main hall, west wing, west pavilion, and entrance portico are clad in shakes.

Evaluation - Good

Existing roofing is in good condition. However, the split cedar shakes found covering the west wing, central hall, and west pavilion are a historically inaccurate roofing material and should be replaced upon deterioration with cedar shingles and wood ridge line trim boards as seen on the east elevation. Roofing should be inspected from inside and out of the building annually. Flashing is in good condition at roof face connections and the surrounding chimneys. Roof cladding is the first layer of protection against the elements and should be evaluated and maintained annually.

Fig. 83 18-lite wood casement windows on west wing. View facing NE

Fig. 84 8-lite casement windows on central hall. Note evidence of moisture trapping at sill level from shutter. View facing N

Fig. 85 Single-lite hopper windows on east wing. View Facing W

FENESTRATION: WINDOWS

Existing Conditions

The existing window and door format communicates the end of the period of historic significance and includes modifications until 1954. No original doors or windows remain. Due to recent restoration efforts, the inn's windows are in good condition and have been replaced in kind or with historically compatible variants using accurate molding shapes from Krieg Construction Inc.

Window Types

- West wing, 18-lite casement
- Kitchen, 20-lite casement
- Central Hall, 8-lite casement
- East wing, Single-lite hopper

Evaluation - Good

Windows are in good condition as they have been targeted in recent preservation efforts. The primary concern is moisture trapping at the sill level when shutters are closed during the winter, and deterioration of window glazing. Glazing has been appropriately applied. Weep holes or divots on the bottom of storm shutters are not present to reduce moisture trapping during the wet winter months.

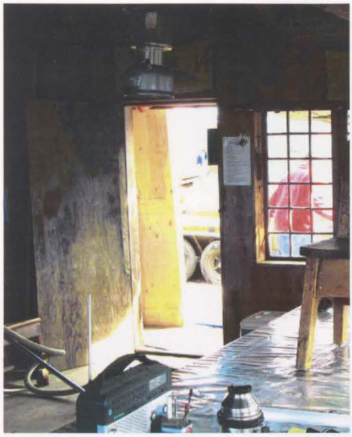


Fig. 86 The west wing exterior door is the only door experiencing deterioration and is a temporary plywood door. View facing E

FENESTRATION: DOORS

Existing Conditions

The existing window and door format communicates the end of the period of historic significance and includes modifications that were represented at the end of that period in 1954. No doors or windows original to the 1889 construction remain. Due to recent preservation efforts, a majority of doors are in good condition and have been replaced in kind or with historically compatible variants. Due to heavy on site activity during field research, and the closing of the inn for the season, detailed door photography was not prepared for this report. However, doors are visible in many photos and were visually inspected. Supplemental door photos may be attached to Appendix-d when available.

Door Types

- North entrance, 9-lite Dutch door
  Reconstructed in 1997, in good condition
- East wing, 9-lite exterior door
  Reconstructed in 2006, in good condition
- East wing, wood panel bedroom doors
  Reconstructed in 2006, in good condition
- West wing dining room exterior door
  Plywood unknown construction date, non-historic door type, fair condition
- Central hall south wall, wood batten door
  Good condition
- Kitchen, 9-lite cross braced wood panel door
  Reconstructed in 2000, in good condition
- Bathroom wood panel door, in good condition
- Basement, metal door
  Constructed in 1999, in good condition
  Non-historic door type

Evaluation - Good

Doors are currently in good condition with the exception of the west wing exterior door that is a temporary plywood door. Door sills are in good condition, but require monitoring annually as they are a high wear area with high moisture. The metal basement door and plywood temporary door are historically inaccurate. Wood batten doors, like the one seen in fig. 43 Phase I drawings, would be acceptable replacements.

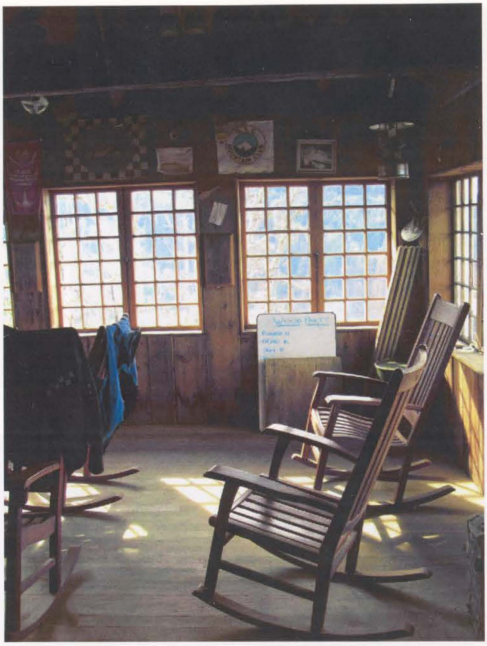


Fig. 87 The unadorned interior of the Cloud Cap Inn is remarkably hospitable. Fir floors, 18-lite casement windows, and heavy timber framing in the west wing dining room create a rustic space bathed in natural light. Note moisture damage at floor level on wall boards. View facing SW

Existing Conditions

Like the exterior of the building, the interior lacks ornamentation and finish. The interior features open ceilings in communal areas, but is framed with 1" x 4" tongue and groove Douglas fir boards in the east wing and the west wing hallway. As the kitchen and east wing were recently repaired, they are in good shape. The central hall is in good condition with original logs remaining on the interior, which display the markings of traditional tools such as the broadaxe and the adz. For further detail on the 2006 east wing repair, refer to drawings in Appendix-B.

INTERIOR: CENTRAL HALL

Fig. 88 Hearth and south wall in central hall.
View facing NE

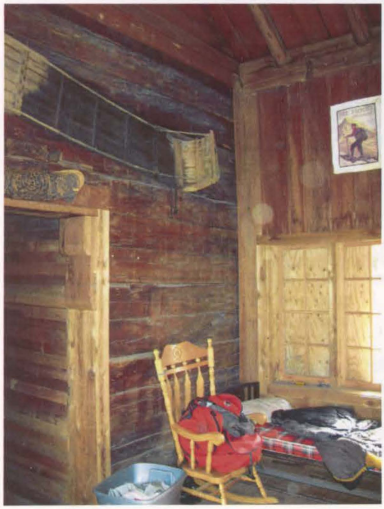


Fig. 89 Interior walls in the central hall feature original wall logs that contain historic craft tooling marks from the broadaxe and adz. Note wood trim on doorway to east wing and vertical wall boards on the south wall. View facing SE

INTERIOR: WEST WING

Fig. 90 Framed interior wall between west wing hallway and dining room. Vertical wall boards and large doorway chamfers are CCC era additions from the late 1930s.
View from dining room facing E

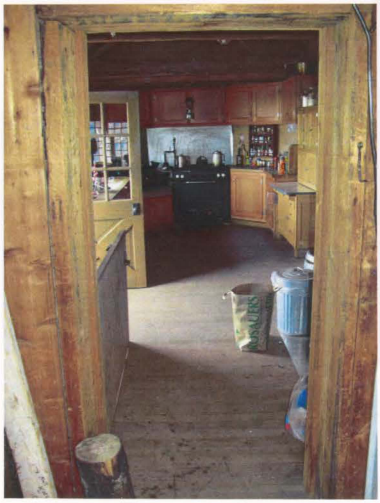


Fig. 91 Kitchen recently restored to original location with open ceiling. View through dining room doorway.
View facing NE

Interior: East Wing

Fig. 92 View of third bedroom on north side of east hallway. Other bedrooms are all in similar good condition from 2006 repair. View facing N

Fig. 93 Douglas fir tongue and groove on floors, walls, and ceilings in the east wing. This wing is in excellent condition as it was repaired in 2006. Note lack of light fixtures. View down east wing hallway. View facing E

Interior Evaluation - Good

The interior elements of the inn are in good condition. The primary preservation challenge is preventing moisture trapping in the exterior walls from moisture penetration, as the solid log walls are permeable. This form of deterioration is currently seen at a low level in the dining room west wall, see fig. 87. Moisture damage should be inspected and monitored annually particularly at sill level and at the connection between the roof and the wall.

Building Systems

Fig. 94 USFS custom heat reflective foil placed on building during 2008 Gnarl Ridge fire. Photo from *The Oregonian* www.oregonlive.com/outdoors/index.ssf/2008/10/forest_service_archaeologist_w.html (accessed 2/20/2012)

Fig. 95 2002 photo by Nancy Niedernhofer of plumbing system installed in 1997. Plumbing should be monitored annually for leaks due to severe weather to prevent moisture damage in foundation and subflooring. View facing E

Existing Conditions

The Cloud Cap Inn has a minimum of building systems and relies upon a wood stove and a hearth for heating and windows for cooling. The building has one sink in the kitchen, and only one bathroom with a toilet and a sink. Water is sourced from an off-site spring. The building is not wired for electric lighting. In 1997 the inn was re-plumbed with copper pipes. A forced air heating system for the bedrooms is being considered. The largest building system is an attachable heat resistant foil covering for the exterior walls of the building that was created in 2008 by the USFS. It has been used successfully during fires in 2008 and 2011.

Evaluation - Good

Due to the minimal use of building systems and recent maintenance work, the inn's systems are in good condition. The fire retardant foil is retained by the USFS when not in use.

PART IV

RECOMMENDATIONS

The following recommendations strive to uphold the United States Secretary of the Interior's Standards for the Treatment of Historic Properties. Of the four defined treatment standards, *Restoration* is selected as the most appropriate treatment for the property. During the property's primary period of historical significance, from 1889 to 1942, the Cloud Cap Inn was privately owned and operated as a series of commercial hotel ventures. The inn has been adapted for compatible use since 1954 as both a base for search and rescue operations, and a clubhouse by the Crag Rats. Existing works at the inn, approved by the Oregon State Historic Preservation Office, have divided the inn into three distinct restoration zones. Each with a different restoration period. The National Park Service defines *restoration* as follows.

> "**Restoration** is defined as the act or process of accurately depicting the form, features, and character of a property as it appeared at a particular period of time by means of the removal of features from other periods in its history and reconstruction of missing features from the restoration period. The limited and sensitive upgrading of mechanical, electrical, and plumbing systems and other code-required work to make properties functional is appropriate within a restoration project."[64]

64 National Park Service, "Standards for Restoration and Guidelines for Restoring Historic Properties: Restoring." www.nps.gov/hps/tps/standguide/restore/restore-index.htm (accessed March 13, 2012).

The following recommendations are guided by applicable National Park Service *Preservation Briefs*, included in Appendix-C. As the inn is a highly unique resource, many of the preservation challenges it faces are not directly covered in this literature. In such circumstances, recommendations are based upon the Secretary of Interior's Standards, contemporary academic preservation theory, and from guidance provided by the Oregon State Historic Preservation Office.

The US Forest Service and the Crag Rats have been deeply invested in the restoration of the building continuously since 1942 and 1954 respectively, both predating the National Historic Preservation Act of 1966. Neither organization is new to the field of preservation and both are beyond reproach in their steadfast commitment to the appropriate treatment of the inn. These organizations have performed in compliance with the Secretary of the Interior, National Park Service, and Oregon State Historic Preservation Office, as each have developed stronger preservation programs and offered increasing technical data and assistance. The US Forest Service has worked closely with the Oregon SHPO in all proposed work, and won a Heritage Steward Recognition Award from that office in 2008.

While buildings receiving the attention of a Historic Structure Report have often seen minimal prior preservation work or study, the Cloud Cap Inn has enjoyed sustained investment and attention since the 1950s. All existing materials, including original building fabric and replaced and added elements, have been included in the evaluation of existing materials and receive recommendations.

Site

The north entrance of the site is deteriorated from vehicle induced erosion. Stone rubble barriers lining vehicle traffic areas have deteriorated. Driving on non-graveled areas has increased erosion.

Regrading is not required. Reline roadway, paths, and parking areas with stone rubble barriers to prevent unmitigated vehicle induced erosion. Stone barriers should be assessed and maintained annually to mitigate these problems. Use the historic 1926 Lorene Bros. Portland, OR topography map that depicts the historic placement of stone rubble barriers at the Cloud Cap site to guide work.

All public vehicle access should be accommodated in the parking area to the north in between the Snow Shoe Club Hut and the Cloud Cap Inn. Only service related vehicles should be permitted to access the south side of the site. Even temporary or service vehicle parking should not be permitted on the east side of the entrance road by the foot path to the north entrance. This is the primary location of vehicle induced erosion on the site. Proper construction of the dry laid stone barriers will aid in preventing further deterioration. "No Parking" signs should not be used as they would detract from the pre-automotive nature of the inn.

Foundation

As the existing foundation is in good condition, monitoring the foundation from the exterior and crawl space annually is the primary recommendation. Maintain the west wing rock pile annually as it strengthens the west wing foundation. Re-apply stone rubble with mortar to the exterior of the contemporary concrete basement foundation where it is missing and the concrete foundation is showing. Rake away duff buildup on the exterior perimeter of the foundation at the opening and closing of the annual season to insure proper drainage and resist moisture trapping and related problems. Assess the condition of the foundation stringently at the opening and closing of the season near the north deck and south porch for moisture related issues.

Half log siding covering the reconstructed wood storage area below the north porch is deteriorating. The drainage of the deck should be monitored throughout the open season to insure the half log siding is not trapping moisture. As the half logs are not structural, the primary recommendation is to replace in kind before they deteriorate enough to retain increased percentages of moisture content.

Walls

The existing walls are in good condition from extensive recent repair work and there are no known deterioration or structural problems. Monitor wall condition from the interior and exterior annually, and from the interior during the winter season. Search for signs of moisture, particularly at sill and roof connection levels and at door and window openings. During all winter excursions to the inn, insure that interior air is ventilated and heated to aid in drying the walls. Though repairs are not expected in the winter, log any observed damages or issues and notify the US Forest Service and Crag Rats for planning purposes.

Existing log replacements since the 1990s have incorporated milled Douglas fir logs

in place of deteriorated hand hewn silver fir logs. This change in material has been determined by the Oregon SHPO as having no adverse effect. Though log replacement has been extensive, no replaced logs are prominently visible on the interior due to board paneling and tongue and groove wall boards.

In portions of the interior, such as the main hall gable ends, original logs remain visible and depict the markings of the traditional hewn log tools and craft. In the future when logs visible from the interior need to be replaced, it is recommended that the interior surface be hand hewn so that the traditional craft and tooling marks are visible. Contemporary milling techniques would be acceptable on those logs for the top and bottom faces as they are not visible and the smoothness of planed or sawn surfaces decreases the chance for irregularities in the joint that allow moisture to penetrate.

Floor Framing

Floor joists, sub-flooring boards, ledgers, and girders are in good condition due to extensive recent repair work. These elements should be monitored annually from the crawl space for deterioration. Though these elements are not visually significant elements of the inn's construction, they should be replaced in kind unless the advantages of modern techniques can be shown to far out weight replacement in kind. Historic noble fir floor trusses should be retained if possible as problems arise. Sagging floor joists should receive post supports similar to those placed in 1996 with the addition of cast concrete pyramids to resist decay and submersion of the posts. Log floor joists and timber girders visible from the basement wood storage area display the historic construction technique to visitors and should be retained and replaced in kind upon deterioration. During future repair work, any salvageable materials retaining structural integrity should be retained by the US Forest Service for use in further maintenance actions.

Porch and Deck

The inn features one porch and one deck, both reconstructed and in good condition. Maintain both porch and deck free of debris, leaf, and moss buildup weekly during open season to prevent moisture trapping and accelerated deterioration to these elements and the foundation. Both the south porch and north deck feature boards oriented running parallel to the adjoining building elevations. This is not the historically accurate configuration, as the boards originally were laid perpendicular. As these exterior elements deteriorate and become in need of replacement, reconfigure boards in the historic configuration running perpendicular to the building's elevations. The historic configuration allowed water to be channeled away from the foundation as opposed to the existing configuration which can trap water and accelerate foundation deterioration. The use of conventional pressure treated materials should be avoided in all visible elements of the inn including decking.

Chimneys

The west wing brick chimney is in poor condition and requires immediate attention. Mortar joints on the lower eight courses show accelerated deterioration. The grey color of the mortar in the upper courses indicates the use of Portland cement. When the brick chimney was

constructed c. 1940 the use of Portland cement was common and since the chimney was reconstructed in 1990 it is not confirmed what the original mortar was. As the brick chimney is only visible from a distance, on the exterior roof peak, the nature of the historic mortar is not a primary concern. Due to the severe environmental conditions imposed upon these joints, a full reconstruction of the chimney is recommended.

As the mortar joints on the upper portion of the chimney are more intact than the lower, the chimney is at risk of toppling with large portions of the top remaining intact and possibly breaking through the roof or tumbling off the roof in severe winter storms. This safety hazard would be mitigated through the reconstruction of the entire chimney. Reconstruction will also create a uniform appearance.

Many bricks are seen in the early stages of spalling and cracking due to weather extremes and the lack of plasticity in Portland cement. Retain existing bricks that are in good condition and replace in kind deteriorated bricks. Bricks displaying minimal exterior deterioration can be placed facing inward in reconstruction. Refer to Appendix-C Preservation Brief 2: *Repointing Mortar Joints in Historic Masonry Buildings*.

The exterior stone chimney on the south side of the main hall is in good condition due to recent work. Evaluate mortar joints and the condition of the flue lining at the opening and closing of each season for deterioration.

The existing high wind chimney cap on the stone chimney is not historically compatible and should be replaced with a more discrete chimney cap made of stone or ceramic. Metal chimney caps with the composition of the existing metal one were developed during the mid-twentieth century and are incongruous with the property's historic period. Consider the feasibility of a projecting angled ceramic flue liner similar to the one seen on the brick chimney. If this is determined to not be feasible, contact the Oregon SHPO for recommendations for a custom solution that is historically compatible.

Roof Framing

Roof framing components are in good condition as roofing materials have been well maintained since the 1950s. The most significant deterioration is found in the protruding log rafter tails exposed to exterior elements. The exposed end grain absorbs moisture readily and drys faster than inner portions of the log rafter. This creates checking in the wood, which is normal and not inherently a problem. However, exterior rafter tails should be monitored annually for structural failure and deterioration. Individual assessment of log rafters was not within the scope of the creation of this report. In light of the extensive material replacement already undertaken at the inn, any existing original log rafters should be retained and receive new spliced ends upon deterioration. The depth of the deterioration determines the appropriate treatment. View the "Wood Splicing" section of Appendix-C Preservation Brief: 26 for further information.

Splicing repairs should be avoided on non-original log rafters and roof framing materials as these are integral parts of a load bearing system that withstands weather extremes and significant force during storms and under excessive snow loads.

When replaced logs reach the end of their structural, lifespan they should be individually replaced in kind.

Roof Cladding

Split cedar shakes on the west wing, central hall, and west pavilion should be replaced as soon as necessary, with cedar shingles matching existing shingles on the east elevation. Replaced areas should also receive similar wood ridge line trim boards as on the east elevation. This should happen in the next 10 years. Roofing should be inspected from inside and outside of the building annually. Flashing should be inspected and maintained annually at seams and surrounding chimneys. Roof cladding is the first layer of protection against the elements and should be evaluated and maintained stringently.

Windows and Shutters

The primary concerns are moisture trapping at the sill level when shutters are closed during the winter and deterioration of window glazing. Glazing should be evaluated annually. Weep holes or drainage divots should be created along the bottoms of shutters to prevent moisture trapping and to reduce deterioration in sill area. As these problems arise seasonally, check conditions and mitigate problems at an individual level.

Existing shutters on the inn are in good condition, but are not historically compatible with the building's period of significance. If shutters were removed entirely from the building during the open season and never seen by the public, as is seen in historic photos, non-historic shutters would be acceptable. However, because existing shutters are hinged and remain on the building year-round, the existing sheet metal clad shutters are historically inaccurate. The entire removal of shutters during the open season would be ideal, however, considering persistent modern vandalism, hinged shutters may be the only prudent configuration. If that is the case, replace existing metal clad shutters with wood batten shutters. This action will increase ventilation and prevent moisture trapping and related damages at the sill level.

Doors

A majority of the doors are in good condition. Door sills should also be monitored annually as they are a high wear area with high moisture levels. The exterior plywood door on the west wing dining room and the metal basement door should be replaced with wooden batten doors, as both are historically incompatible designs for the inn. Door shutters should receive similar treatment as discussed in the window shutter recommendations.

Interior

The primary preservation challenge is preventing moisture trapping in the exterior walls, as they are permeable solid log walls. This form of deterioration is currently seen at a nonthreatening level in the dining room west wall. Moisture damage should be inspected and monitored annually, particularly at all openings, at sill level, and at the connection between the roof and the wall.

The highest level of care should be taken to insure that any original interior elements be preserved or restored. Of note are the original log gable walls of the main hall and the historic pencil "graffiti" in the east wing bedrooms. Maintaining proper func-

tion of the building envelope, foundation, walls, roof, windows and doors is the best way to protect these significant elements.

Building Systems

Due to the minimal use of building systems and recent maintenance work, the inn's systems are in good condition. Plumbing in the crawl space should be monitored annually for successful operation and to prevent moisture related damage.

The fire resistant foil should be properly stored and monitored in a climate controlled environment to insure that it remains ready for immediate use.

A key element of the building's systems are the lack of modern systems such as wired lighting and multiple bathrooms. The reliance upon wood for heating communal areas and lamps for lighting should be retained as experiential aspects of inn usage.

Procedural Recommendations

- Continue searching for the original William Whidden blueprints for the building.

- As a component of the historic interpretive element of the main hall and west wing, provide local data collected on glacier and snow surveys by the Crag Rats. The Cloud Cap Inn is in a unique position to interpret how climate change is affecting historic buildings in the area.

- Complete and resubmit a refined version of the Desired Future Condition proposal to the Oregon SHPO for approval.

- Contact the Oregon SHPO about updating the 1974 National Register nomination to the most current form type and include missing information such as Period(s) of Significance and other pertinent information lacking from the older form. Having established Period(s) of Significance and Significant Dates will help guide future preservation efforts immensely.

For this report, the Period of Significance is 1889-1954, spanning the original use of the property as an inn to 1954 with the change of use when the Crag Rats took over occupation and the modern use and management of the inn.

The establishment of current Area(s) and Level(s) of Significance will also be very important for interpreting and preserving the inn appropriately.

The importance of completing this is paramount to the appropriate treatment and understanding of the inn and will affect the direction of all future restoration actions.

- Further develop historic interpretive components to the building and increase public awareness of access during open seasons and consider Crag Rats hosting climbing activities that utilize the Cloud Cap Inn as it was historically.

Conclusion

The Cloud Cap Inn is a rare and unique historic cultural resource. The sheer existence of the inn is remarkable in light of the lack of large-scale fire suppression methods in the area until the 1930s. The mountainous location of the inn plays a major role in defining the character of the building. It is located by visitors by being sited at the termination of a steep gravel US Forest Service road. For the high level of use the building receives, it is remarkable that it retains a strong sense of historic individuality. This goes beyond the simple retention of historic fabric or restoration of building elements, and is appreciated by visitors as the building continues to remain without an address and expected modern systems such as wired lighting. As the building revealed its history and composition slowly through study, the author found it to be a rewarding study for its high level of craft, influential design, and association with outdoor pursuits. From astonishing panoramic views at the site and the geometric precision of design, to the high level of traditional craft in American heavy timber and log construction, the Cloud Cap Inn is a Northwest gem that is remarkable when observed from the smallest detail to the macro level. This is the building that stands as the cornerstone of the Cascadian style of architecture seen in numerous western lodges to follow. Despite the extreme weather, seasonal inaccessibility, and remote location, the Cloud Cap Inn has been faithfully maintained for over a century and deserves to remain standing for the ages as a valued historic resource for all to appreciate.

Bibliography of Cited and Useful Sources

Albrecht, Robert. "Mountain Lodge Roof Design in the Arctic-Alpine Zone." Northern Engineer, Vol. 14, No. 3: 11-13.

Cereghini, Mario. *Building in the Mountains: Architecture and History*. Edizioni Del Milione Milano. Translated from Italian by Lucia Krasnik. 1957.

Clark, Rosalind L. *Architecture, Oregon Style*. Portland: Professional Book Center, 1983.

Corning, Howard M. (1989) Dictionary of Oregon History. Binfords & Mort Publishing. 1989.

Deering, Thomas P Jr. "Mountain Architecture: An Alternative Design Proposal for the Wy'East Day Lodge, Mount Hood Oregon." M. Arch - University of Washington,1986

Douglas, William O. *Of Men and Mountains*. Seattle: Seattle Book Co. 1981.

Grauer, Jack [John Foreste]. *Mount Hood: A Complete History*. Michigan: Grauer, 1975.

Greely, William. "What Shall We Do With Our Mountains." Sunset, Vol. 59, No. 6, (Dec. 1927): 15.

Hartman, James. "Architectural Design in Heavy Snow Country." Master's Thesis (Architecture). University of Washington, 1976

Hartwig, Paul. Cloud Cap Inn National Register Nomination (Salem: Oregon SHPO, 1974), Sec-7.

Hazard, Joseph T. *Snow Sentinels of the Pacific Northwest*. Seattle: Lowman & Hanford Co, 1932.

Kennish, Katharine. *The Mountain House*. Midland, Mich.: Northwood Institute Press, 1981.

LeConte, Joseph "Mountaineering on the Pacific Coast" *Nature and Science on the Pacific Coast*. San Francisco: Paul Elder and Co. 1915

Lockley, Fred. "History of the Columbia River Valley, From the Dalles to the Sea." Vol.3 S. J. Clarke Publishing Co., 1928. p 591

Lowe, Don and Roberta. *Mt. Hood: A Portrait of a Magnificent Mountain*. Caldwell, Idaho: The Claxton Printers, Ltd., 1975.

Mackinlay, Ian and Willis, W. E. *Snow Country Design.* Oakland, Ca.: Mackinlay Winnacker McNeil, AIA & Architects, 1965.

Marlitt, Richard. *Matters of Proportion: The Portland Residential Architecture of Whidden & Lewis.* Portland: Oregon Historical Society Press, 1989.

McNeil, Fred. Wy'east, *"THE Mountain": A Chronicle of Mount Hood. Portland, Ore.*: The Metropolitan Press, 1937.

Munro, Sarah Baker. *Timberline Lodge: The History Art, and Craft of an American Icon.* Timber Press, Inc. Portland, Oregon. 2009

Putnam, William Lowell. *The Great Glacier and Her House.* New York: The American Alpine Club, 1982.

"The Neglected Hazards of Snow and Cold." AIA Journal, Vol. 72, No. 2, (Feb. 1973): 52-59.

Theakston, Franklin H. "Snow Loads on Low-rise Buildings." Canadian Architect, Vol. 19, No. 9, (Sep. 1974): 42-47.

Tomlinson, Stewart. "Forest Service Archeologist Wins State Preservation Award," The Oregonian, Oct. 13, 2008.

USFS. The Built Environment Image Guide for the North Pacific Province, Internal USFS document. 2001.

Vaughan, Thomas and Farriday, Virginia, eds. "Space Style and Structure, Building in Northwest America," 2 Vols. Portland, Ore.: Oregon Historical Society, 1974.

W.E. Scott et al., *Geological History of Mount Hood Volcano.* U.S. Geological Survey, 1997.

Wheeler, Olin Dunbar. *Wonderland [1895]-1906.* Northern Pacific Railway Co., 1895.

Wilbur, Keith C., Home Building and Woodworking in Colonial America, (Guilford: The Globe Pequot Press, 1992), 1-37.

Workers of the Writers' Program of the Work Projects. American Guide Series: Mount Hood A Guide. CompDuell, Sloan and Pearce. New York: J. J. Little & Ives Company, 1940.

Form 10-300 (Rev. 6-72)

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES INVENTORY – NOMINATION FORM

(Type all entries – complete applicable sections)

STATE: Oregon
COUNTY: Hood River
FOR NPS USE ONLY
ENTRY DATE: OCT 18 1974

SEE INSTRUCTIONS

1. NAME

COMMON: Cloud Cap Inn

AND/OR HISTORIC:

2. LOCATION

STREET AND NUMBER: NE flank of Mt. Hood in Mt Hood National Forest

CONGRESSIONAL DISTRICT: Representative Al Ullman, Oregon Second Congressional District

CITY OR TOWN: Mt. Hood ~~National Forest~~

STATE	CODE	COUNTY	CODE
Oregon	41	Hood River	027

3. CLASSIFICATION

CATEGORY (Check One)	OWNERSHIP		STATUS	ACCESSIBLE TO THE PUBLIC
☐ District ☒ Building	☒ Public	Public Acquisition:	☒ Occupied	Yes:
☐ Site ☐ Structure	☐ Private	☐ In Process	☐ Unoccupied	☐ Restricted
☐ Object	☐ Both	☐ Being Considered	☐ Preservation work in progress	☐ Unrestricted
				☒ No

PRESENT USE (Check One or More as Appropriate)

☐ Agricultural	☐ Government	☒ Park	☐ Transportation	☐ Comments
☐ Commercial	☐ Industrial	☐ Private Residence	☐ Other (Specify)	Base camp for snow survey and rescue operations
☐ Educational	☐ Military	☐ Religious		
☐ Entertainment	☐ Museum	☐ Scientific		

4. OWNER OF PROPERTY

OWNER'S NAME: United States Forest Service

STREET AND NUMBER: 340 NE 122nd Avenue

CITY OR TOWN: Portland 97216

STATE: Oregon CODE: 41

5. LOCATION OF LEGAL DESCRIPTION

COURTHOUSE, REGISTRY OF DEEDS, ETC: Hood River County Courthouse

STREET AND NUMBER:

CITY OR TOWN: Hood River 97031

STATE: Oregon CODE: 41

RECEIVED AUG 8 1974 NATIONAL REGISTER

6. REPRESENTATION IN EXISTING SURVEYS

TITLE OF SURVEY: Statewide Inventory of Historic Sites and Buildings

DATE OF SURVEY: 1970 ☐ Federal ☒ State ☐ County ☐ Local

DEPOSITORY FOR SURVEY RECORDS: Parks and Recreation Section

STREET AND NUMBER: Oregon State Highway Building

CITY OR TOWN: Salem 97310

STATE: Oregon CODE: 41

FOR NPS USE ONLY
STATE: Oregon
COUNTY: Hood River
ENTRY NUMBER: OCT 18 1974
DATE

7. DESCRIPTION

CONDITION	(Check One)						
	☐ Excellent	☒ Good	☐ Fair	☐ Deteriorated	☐ Ruins	☐ Unexposed	
	(Check One)			(Check One)			
	☐ Altered	☒ Unaltered		☐ Moved	☒ Original Site		

DESCRIBE THE PRESENT AND ORIGINAL *(if known)* PHYSICAL APPEARANCE

The Cloud Cap Inn sits on a rocky point with a commanding view 6,000 feet above sea level on the north-east slope of Mount Hood. It was erected in the summer of 1889 and was the first resort facility on the mountain. Designed by William H. Whidden, later with Ion Lewis to design Portland's noted city hall, it shows strong influence of the American Shingle style at that time being developed by prominent Eastern architects, notably McKim, Mead and White for whom Whidden had previously worked.

The building consists of three sections one storey in height which meet at roughly 30° angles in a C-shaped plan. The moderate-pitched hip roof with projecting eves and courses of shingles and the lap-jointed log walls combine to give the Inn a feeling of easy horizontality. The log walls rest on a massive dry-stone foundation about one storey in height on the downhill west side of the Inn. The logs are bolted together, and the whole is anchored to the solid rock below with metal cables. There is no applied ornament, rather, ornamentation is through subtle changes in the use of materials and the use of numerous small-paned windows. Logs are placed vertically at one end of the structure rather than horizontally as in the rest, and one wall on the east side is shingled. The broad sweep of the shingle roof is punctuated by two large chimneys, one stone, the other brick.

Capacity of the Inn was thirty guests. Running water was piped from a nearby stream. Furnishings and cuisine were the finest. Because of difficulty of access, the Cloud Cap Inn was not a financial success, and the level of service and accommodation slowly declined.

The United States Forest Service has owned the building since 1940. It is now used by Special Youth Permit by the Crag Rats, a mountain rescue club from Hood River, Oregon. In return for the use of the building, the club is required to maintain it and it exists today in good and substantially original condition. Their current permit is good until 1982, at which time it may be renewed.

SEE INSTRUCTIONS

8. SIGNIFICANCE

PERIOD *(Check One or More as Appropriate)*

☐ Pre-Columbian	☐ 16th Century	☐ 18th Century	☐ 20th Century
☐ 15th Century	☐ 17th Century	☒ 19th Century	

SPECIFIC DATE(S) *(If Applicable and Known)* 1889

AREAS OF SIGNIFICANCE *(Check One or More as Appropriate)*

Aboriginal	☐ Education	☐ Political	☐ Urban Planning
☐ Prehistoric	☐ Engineering	☐ Religion/Phi-	☒ Other *(Specify)*
☐ Historic	☐ Industry	losophy	Travel and enter-
☐ Agriculture	☐ Invention	☐ Science	tainment
☒ Architecture	☐ Landscape	☐ Sculpture	
☐ Art	Architecture	☐ Social/Human-	
☐ Commerce	☐ Literature	itarian	
☐ Communications	☐ Military	☐ Theater	
☐ Conservation	☐ Music	☐ Transportation	

STATEMENT OF SIGNIFICANCE

Cloud Cap is situated on the north face of Mt. Hood in such a manner as to afford a good view of the mountain and its glaciers. Designed by the prominent Northwest architect, W. H. Widden, and constructed at 5,985 feet elevation in 1889, the Inn was the first recreational resort in Mt. Hood.

In the early 1880s Mt. Hood was an essentially unexplored region with no access roads. 1884 saw a road constructed to the snow line by the Mt. Hood Trail and Wagon Company. The company operated a daily stage between Hood River and the upper Hood River to the base of Mt. Hood. A summer tent camp at the terminus awaited the passengers who journeyed to Mt. Hood for exploration and climbing.

William M. Ladd and C. E. S. Wood, prominent businessmen of Portland, purchased the company in 1888 and commissioned the building of Cloud Cap Inn. They hired Portland architect, W. H. Whidden to design the building. William H. Whidden arrived in Portland about 1883 to supervise the erection of the Portland Hotel for the firm of McKim, Mead, and White. With an indefinite delay in the construction of the hotel, Whidden left and then returned about 1887 and decided to remain in Portland and establish a practice. In 1890 he joined with Ion Lewis, formerly a member of the Peabody and Stearns office in Boston, and established the trend for Northwest architecture. The Whidden and Lewis office produced many fine buildings, some reminiscent of the best work of McKim, Mead, and White, including their advancement of the "Colonial Revival" in residential work and the intoduction of the Italian Rennaisance style to public and business structures. The firm also fostered several young architects who carried on distinguished careers of their own.

Foremen for the various crews were brought in from Portland. A Mr. Brown, of Portland, assisted by James L. Langille, Hood River, was in charge of construction of the Inn itself, Brown leaving prior to the Inn's completion. Nearly all the work crews were Hood River men. Chinese laborers did most of the road grading and bridge construction. The work camp was established at Elk Creek Springs, 3 miles from the proposed Inn.

Work continued throughout the summer and Cloud Cap Inn was officially opened in August 1889. The few guests who visited the Inn (continued)

SEE INSTRUCTIONS

9. MAJOR BIBLIOGRAPHICAL REFERENCES

Langille, W. A. "Recollection of Old Cloud Cap Inn," 1927, Typescript, 7 pages. Copy in possession of Parks and Recreation Section, Oregon State Highway Division

10. GEOGRAPHICAL DATA

LATITUDE AND LONGITUDE COORDINATES DEFINING A RECTANGLE LOCATING THE PROPERTY

CORNER	LATITUDE Degrees	Minutes	Seconds	LONGITUDE Degrees	Minutes	Seconds
NW	°	'	"	°	'	"
NE	°	'	"	°	'	"
SE	°	'	"	°	'	"
SW	°	'	"	°	'	"

OR

LATITUDE AND LONGITUDE COORDINATES DEFINING THE CENTER POINT OF A PROPERTY OF LESS THAN TEN ACRES

LATITUDE Degrees	Minutes	Seconds	LONGITUDE Degrees	Minutes	Seconds
N45°	24'	13"	W121°	39'	13"

APPROXIMATE ACREAGE OF NOMINATED PROPERTY: 1

LIST ALL STATES AND COUNTIES FOR PROPERTIES OVERLAPPING STATE OR COUNTY BOUNDARIES

STATE:	CODE	COUNTY	CODE
STATE:	CODE	COUNTY:	CODE
STATE:	CODE	COUNTY:	CODE
STATE:	CODE	COUNTY:	CODE

RECEIVED AUG 8 NATIONAL REGISTER

11. FORM PREPARED BY

NAME AND TITLE: Paul Hartwig, Park Historian

ORGANIZATION: Oregon State Highway Division

DATE: July 26, 1974

STREET AND NUMBER: State Highway Building

CITY OR TOWN: Salem 97310

STATE: Oregon

CODE: 41

12. STATE LIAISON OFFICER CERTIFICATION

As the designated State Liaison Officer for the National Historic Preservation Act of 1966 (Public Law 89-665), I hereby nominate this property for inclusion in the National Register and certify that it has been evaluated according to the criteria and procedures set forth by the National Park Service. The recommended level of significance of this nomination is:

National ☐ State ☒ Local ☐

Name: David B. Talbot

Title: State Parks Superintendent

Date: August 2, 1974

NATIONAL REGISTER VERIFICATION

I hereby certify that this property is included in the National Register.

A. Bruce Denison

Director, Office of Archeology and Historic Preservation

Date: 10/8/74

ATTEST:

Harold D. Tinkey

Keeper of The National Register

Date: 10/17/74

☆ U.S. GOVERNMENT PRINTING OFFICE : 1973—729-147/1442 3-1

SEE INSTRUCTIONS

Form 10-300a
(July 1969)

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES
INVENTORY - NOMINATION FORM

(Continuation Sheet)

STATE	
Oregon	
COUNTY	
Hood River	
FOR NPS USE ONLY	
ENTRY NUMBER	DATE
	OCT 18 1974

(Number all entries)

CLOUD CAP INN (CONTINUED)

2. Location

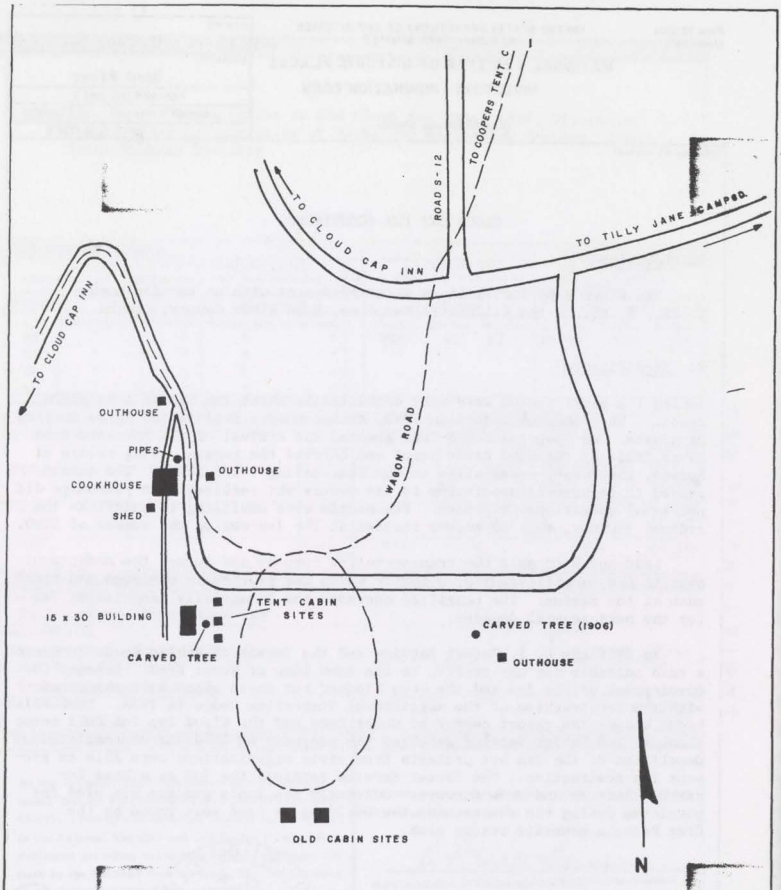
The Cloud Capp Inn is in an unsurveyed area with no section number, T. 2S., R. 9E, on the Willamette Meridian, Hood River County, Oregon.

8. Significance

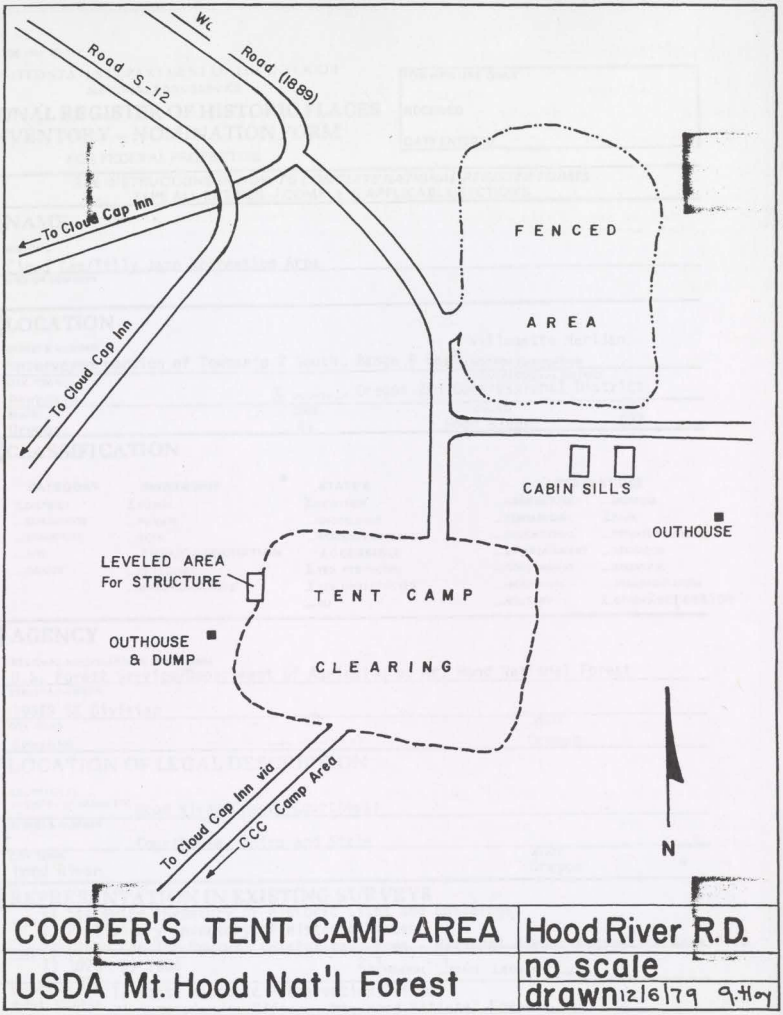
during the short season were very enthusiastic about the Inn as a vacation resort. When the Inn opened in 1890, the promoters anticipated large numbers of guests. An open-coach-and-four greeted the arrival of the Portland-Hood River train at the Hood River depot and carried the guests, using relays of horses, the twenty-seven miles to the Inn, taking 7 1/2 hours. The season proved to be very disappointing to the owners who realized that patronage did not equal operational expenses. Few people were unwilling to undertake the arduous journey; only 88 guests resided at the Inn during the summer of 1890.

Ladd and Wood sold the transportation company and turned the management over to the Langille family; a family which had previously explored and named much of the region. The Langilles operated the financially languishing Inn for the next several decades.

In 1926 the U. S. Forest Service and the Bureau of Public Roads completed a road suitable for car traffic to the snow line of Mount Hood. Schemes for development of the Inn and the area bloomed but these plans were abandoned with the construction of the magnificent Timberline Lodge in 1938. Timberline Lodge became the resort center of Mount Hood and the Cloud Cap Inn fell into disuse. The Forest Service acquired the property in 1940 and contemplated demolition of the Inn but protests from civic organizations were able to prevent its destruction. The Forest Service retained the Inn as a base for rescue missions and snow surveys. Currently the Inn's grounds are used for picnicing during the summer, and the building is used year round by the Crag Rats, a mountain rescue club.

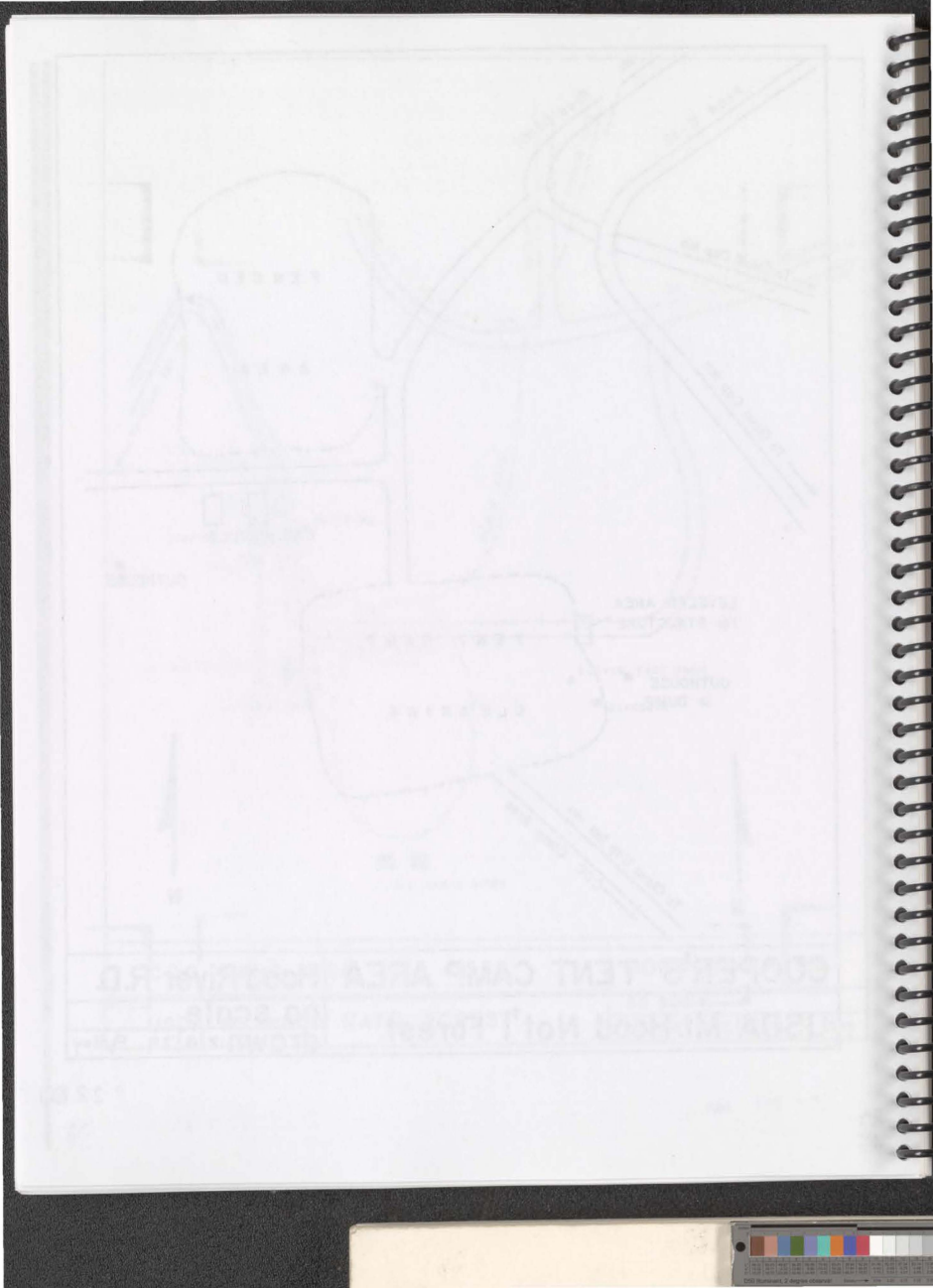


CCC CAMP AREA	HOOD RIVER R.D.
USDA MT. HOOD NAT'L FOREST	no scale
	drawn 12/6/79 9. Hay



COOPER'S TENT CAMP AREA	Hood River R.D.
USDA Mt. Hood Nat'l Forest	no scale
	drawn 12/6/79 9. Hoy

22 1981



Form No. 10-306 (Rev. 10-74)

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

FOR FEDERAL PROPERTIES

FOR NPS USE ONLY
RECEIVED
DATE ENTERED

SEE INSTRUCTIONS IN *HOW TO COMPLETE NATIONAL REGISTER FORMS*
TYPE ALL ENTRIES -- COMPLETE APPLICABLE SECTIONS

1 NAME

HISTORIC
Cloud Cap/Tilly Jane Recreation Area
AND/OR COMMON

2 LOCATION

STREET & NUMBER
Unsurveyed portion of Township 2 South, Range 9 East, Willamette Meridian. NOT FOR PUBLICATION
CITY, TOWN
Parkdale X VICINITY OF
CONGRESSIONAL DISTRICT
Oregon 2nd Congressional District

STATE	CODE	COUNTY	CODE
Oregon	41	Hood River	027

3 CLASSIFICATION

CATEGORY	OWNERSHIP	STATUS	PRESENT USE	
X DISTRICT	X PUBLIC	X OCCUPIED	__AGRICULTURE	__MUSEUM
__BUILDING(S)	__PRIVATE	__UNOCCUPIED	__COMMERCIAL	X PARK
__STRUCTURE	__BOTH	__WORK IN PROGRESS	__EDUCATIONAL	__PRIVATE RESIDENCE
__SITE	PUBLIC ACQUISITION	ACCESSIBLE	__ENTERTAINMENT	__RELIGIOUS
__OBJECT	__IN PROCESS	X YES: RESTRICTED	__GOVERNMENT	__SCIENTIFIC
	__BEING CONSIDERED	X YES: UNRESTRICTED	__INDUSTRIAL	__TRANSPORTATION
		__NO	__MILITARY	X OTHER Recreation

4 AGENCY

REGIONAL HEADQUARTERS. *(If applicable)*
U.S. Forest Service/Department of Agriculture, Mt. Hood National Forest
STREET & NUMBER
19559 SE Division
CITY, TOWN
Gresham, VICINITY OF
STATE
Oregon

5 LOCATION OF LEGAL DESCRIPTION

COURTHOUSE
REGISTRY OF DEEDS, ETC. Hood River County Courthouse
STREET & NUMBER
Courthouse, Third and State
CITY, TOWN
Hood River
STATE
Oregon

6 REPRESENTATION IN EXISTING SURVEYS

TITLE 1) Statewide Inventory of Historic Sites and Buildings
2) Preliminary Inventory of Historic Places
3) ~~Cloud Cap Inn Unusual (Historical) Area - National Forest Recreation Area~~ Plan
DATE 1) 1976 3) 1964
~~2) 1972~~ 2,3 X FEDERAL 1 STATE __COUNTY __LOCAL
DEPOSITORY FOR SURVEY RECORDS 1) State Historic Preservation Office
2) Supervisor's Office - Mt. Hood National Forest
CITY, TOWN 3) Supervisor's Office - Mt. Hood National Forest STATE Oregon
~~1) Salem 2,3) Gresham~~

DESCRIPTION

CONDITION		CHECK ONE	CHECK ONE
X EXCELLENT	X DETERIORATED	X UNALTERED	X ORIGINAL SITE
X GOOD	X RUINS	__ ALTERED	__ MOVED DATE_____
X FAIR	__ UNEXPOSED		

DESCRIBE THE PRESENT AND ORIGINAL (IF KNOWN) PHYSICAL APPEARANCE

The Cloud Cap/Tilly Jane Area has a variety of unique features left from the period of its greatest use between 1885 and the late 1930s. These include three roads up the north side of Mt. Hood into the area below Cooper Spur; Cooper's Tent Camp, Cloud Cap Inn (a National Register property), the Inn's stable, the Snowshoe Club's log building, two old cabin sites, a CCC Camp, Tilly Jane Forest Camp with its amphitheater and the CCC built Ski Warming Hut.

The Cloud Cap/Tilly Jane Area is located on the north slope of Mt. Hood just below Cooper Spur and Eliot Glacier between Eliot Branch and Tilly Jane Creek. The area is within a high elevation, subalpine zone with sandy glacial soil. It is in an unsurveyed portion of T. 2 S., R. 9 E. in what would be parts of Sections 10, 14 and 15. The area is heavily timbered with little understory and has open hillsides and ridgetops. Tree cover is mountain hemlock, subalpine fir, and white-bark pine.

Cloud Cap Road (Forest Service Road S12), built in 1926, winds its way up ten miles from its start at the Cooper Spur Inn to where it forks at one of the branches of Tilly Jane Creek. One-half mile east is Tilly Jane Forest Camp and to the west, about three-quarters of a mile at the 6000 foot level, is the Cloud Cap Area. The road is graveled on its lower end and is plain dirt above. Its conditon, generally good, varies with the amount of traffic and weather conditions. The present road is now under contract to upgrade its condition. This road replaced the old road built in 1889 by the Mt. Hood Stage Company owned by William M. Ladd and C.E.S. Wood who were the builders of Cloud Cap Inn. This road was quite steep and can be seen at various points cutting across the new road.

In the 1930s, the 1889 road was brushed out by the CCC for use as a ski trail. Today, the roadcut is still very obvious and easily followed, though overgrown in some places. The road constructed by Ladd and Wood replaced an even earlier one. In 1886, David Cooper, Henry Coe, and Oscar Stranahan cut a trail along the crest of Ghost Ridge parallel to Evans Creek as far as Eliot Glacier. The next year, they widened the road for use by wagons as far as Cloud Cap Saddle and obtained a permit to operate it as a toll road under the name of Mt. Hood Trail and Wagon Road Company. Faint traces of this old wagon road are still visible in a few places along the ridge, which it follows on a straight, steep course.

David Cooper and his wife operated a tent camp hotel on a flat area on the westernmost branch of Tilly Jane Creek, which is no longer flowing. The site is at a place later known as Tilly Jane Meadows, located northeast of the present Cloud Cap/Tilly Jane Road junction (map attached). Portions of the 1889 wagon road are still visible from the present road in this area.

(see continuation sheet)

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

FOR NPS USE ONLY
RECEIVED
DATE ENTERED

Cooper's Tent Camp was operated from 1885 to 1889 by Mrs. Cooper as a base camp for tourists and for climbing expeditions led by her husband David. Little remains of the tent camp today. The spur road into it, still very visible, enters a large flat clearing from the north. A great deal of ash mixed in the soil is evidence of many campfires on the spot. On the west side of the opening is a squared and leveled area about 15 by 20 feet. These may have been the foundations for two large tents but also appear to have been used later for what may have been a woodcutting operation in the area soon after the turn of the century. Southeast of these sites is another outhouse hole with several boards scattered around.

The two cows kept at the camp, and whatever other stock was necessary for use in excursions up the mountain, were kept in a large fenced area about 25 yards north of the large clearing, east of the road. Wire was wrapped around poles and trees, enclosing a large forested area. A gate may have been located on the west side of the fenced area, adjacent to the road. A great deal of wire remains imbedded in the trees today.

Along the raod, south of the camp on the right side, a faint carving in the blaze of a tree reads: V. C. / E. E. / A. uo./ 1887. The road continues southward, parallel to a branch of Tilly Jane Creek, and crosses the present road at the junction to Tilly Jane Campground. At a point about 250 feet from the junction, the road made a loop and then switched back up into the present Cloud Cap Saddle Campground, then up to Cloud Cap Inn.

At the south side of the small loop, about 100 feet from the creek, two leveled spots are cut out of the hillside next to each other. These are both 12 by 15 feet and were most likely cabin sites for either sheepherders or workers at Cloud Cap Inn. Their age (late 19th Century) is testified by several square nails pounded into some trees immediately in front of the leveled areas.

North of the cabin sites, on the east side of the creek, is a blazed tree with names carved on it. Of the four names inscribed, only the names of Dekum and Tomlinson are legible as is the partial date, July 3?, 1906.

In the 1930s, the area bound by the present road, Tilly Jane Creek, the cabin sites and the hillside to the west were used as a CCC Camp. This was probably

occupied while work was being done at Tilly Jane Campground. Access into the camp was by a road which cut into the hillside at the junction of Cloud Cap Road with the road to Tilly Jane Campground. This road ran slightly southwest for about 100 feet, then turned west across the creek for about 75 feet, where it then turned north and joined the old wagon road. No structures remain from the camp, but there are several outlines. Three temporary tent structures on wooden bases, each 15 by 18 feet, lay in a row, running southward from the last turn before the road merges with the wagon road. Parallel to these a few feet to the west, stood a rather substantial building, 15 by 30 feet. Between this building foundation and the tent structure outlines is a blazed tree with the initials S. [K]. and G. L. [T]. North of these sites, on the west side of the road, is where another building stood. This was about 25 feet square and was equipped with plumbing. It is possible this was a bathhouse but most likely, it was a cookhouse. At the southwest corner of the building was another small structure which may have been a woodshed.

Cloud Cap Inn, built in 1889, is already a National Register property, having been entered in 1974. It sits on the south end of a rocky prominence with an unsurpassed view of Mt. Hood. Running south from the Inn, on the east edge of the point, were four small log cabins in a row which were rented to guests. These all opened to the west and were held down by steel cables, anchored between each cabin and securely looped over their roofs on both ends. The cabins have long since disappeared, leaving only parts of the cables and a large pile of stones over the water supply pipe as the only evidence of their existence.

Across the large open parking area, north of Cloud Cap Inn, is the Snowshoe Club's building. A 99 year lease was obtained from the Forest Service for the site in 1910. In that year, Mark Weygandt, helped by both David Cooper, Sr. and Jr., Bert Sandman and Russel Gobin, built the large log clubhouse. The building is rectangular in shape, about 25 by 70 feet, and lies on a north-south axis.

It is one story on the south becoming two stories as it follows the slope of the hillside north. Where the building is one story high, there are five courses of logs above the stone and cement foundation. On the north end, where the building becomes two stories, there are many more courses of logs. These unpeeled logs are square notched on the ends and partially hewn so as to fit very closely. Chinking was done with burlap sacks and some sort of fiberous matting material. The hip roof is covered with cedar shakes over smaller cedar shingles. Square, teardrop embossed, sheet metal shingles cover the ridges of the roof.

The main entrance into the clubhouse is on the south end of the east side. Cement steps lead up to the opening which is covered by a plywood storm door held on by large iron strap hinges. Another entrance is on the bottom floor in the center of the north elevation. It is a heavy metal storm door which is a recent addition.

A large chimney is just to the left of the main entrance. On the other side of the door is a small cinderblock chimney. There is some evidence that this may have replaced a small stone fireplace. Another chimney added to the original building projects through the roof just off center on the west side of the north elevation and is made of brick.

One interesting feature of the building is the relatively small number of windows. There is only one window on the east side, this on the north end; one on the south side, and three, evenly spaced, on the west elevation. All of these are covered by metal shutters on large strap hinges. On the north elevation, above the door, are three, horizontal fixed four panel windows all in one opening.

The architecture is very fitting for the area. The building is constructed of natural materials, stone and wood, its floor plan follows the contour of the land, and it is built much in the same style as Cloud Cap Inn.

The wagon road built by Ladd and Wood ran behind the Snowshoe Club building and then straight downhill. Immediately after crossing the present road, on the east side, are the remains of the stable used to house horses which drew the stagecoach up to Cloup Cap Inn. The stable was a log cabin style building, built of timber cut from the immediate area. The building has collapsed into itself and is very rotten. Three layers of saddle-notched logs, however, are still in place, revealing the structure's 12 by 15 foot dimensions and doorway in the center of the west elevation.

Tilly Jane Campground was built in 1926 by the Forest Service. It was placed along the north side of Tilly Jane Creek, across from the American Legion Camp which had been set up a few years before. At that time, the stone stoves were built and toilet facilities installed. The cookstoves built by Tilly Jane were crafted with native mountain, grey rock. The rock was crudely hewn into rectangular shapes and fitted together with mortar into a low, three sided informal stove. The campground was improved upon about 1934 when the one-story guard station and garage were erected by the CCC on the west end of the facility.

The Tilly Jane Guard residence is made up of several adjoining wings. The main portion of the structure faces east into the campground. It is connected on its west elevation by a short hallway leading into a rectangular room with another small rectangular wing adjoining its east end. The overall layout is that of an irregular T, approximately 22 by 36 feet. The wood frame structure rests on a cement foundation and is covered by a shake, hip-on-gable roof, pierced just south of center through its peak by a stone chimney covered by a hood. The exterior walls are covered by clapboard siding to just below window level, followed by vertical board and batten up to the roof. The only exception to this is the small, westernmost wing which is covered with shingles. The main entrance is in the center of the east elevation with windows on each side. It is covered by a small gable projecting from the roof and has stone steps leading up to it. With one exception, the fenestration of the building is regular. This is on the south elevation of the main wing where there is a horizontal window. Also, on the south elevation, are board steps nailed to the outside wall leading up to a winter attic entrance. Another entrance is through a board and batten door on the south side of the hallway wing.

Inside, the building is finished with dressed lumber in a very rustic manner. The main structure is broken into two parts. A kitchen area is located on the south half and the living area, with its hardwood floor and stone fireplace, occupies the rest. A set of steep stairs lead up to a loft in the attic from just next to the front door.

Several feet south of the guard residence is a garage built in the same exterior style, 16 by 18 feet. It is a single room structure with a sliding, double door on the north. A south-facing window has been boarded over so as to blend with the rest of the exterior. Virtually no changes have occured to these buildings through the years besides general maintenance. They have been recently painted a khaki green which is compatible with both the buildings' style and their surroundings.

The American Legion Camp complex, south of Tilly Jane Campground across the creek, includes an old cookhouse and amphitheater. The amphitheater is a large clear area where campfires were built with two sets of elevated bleachers on the south and west. These bleachers were made of large, halved log planks, held onto anchored, cut stumps by wooden pegs. These were placed on stone terraces into the natural hillsides, up to nine rows high, and made accessible by several flights of stone steps at the ends of the rows.

East of the amphitheater is the cookhouse. This was originally an open-air structure, but now has removable board and batten walls. It is a single story, rectangular one-room building, 20 by 30 feet, with a dirt floor. It sits on a north-south axis with the open doorway on the north. The shaked gable roof is unusual in that the east slope is at less of a pitch and, therefore, longer than that of the west. The building's framework is made from very large logs, some of which need replacement.

In the center of the building, a huge cookstove, 15 feet long, runs lengthwise. This stove is made of cement with a thick iron sheet top. Rough wood counters for food preparation have been built into the wall on the west side. Evidence, in and around the building, shows that at one time, it was equipped with electricity.

The final building on the south side of Tilly Jane Creek, about 200 feet from the cookhouse, is the Ski Warming Hut built by the CCC in 1939. The Warming Hut is a one and one-half story, rectangular log, A-frame building, constructed on a cement foundation. It sits on a north-south axis and is roughly 18 by 56 feet. The log beams, on which the shaked gable roof is built, extend down to the ground where they are anchored to give the building added strength. The roof, however, only reaches the ground on the front 15 feet of the structure over the vestibule on the north. The exterior walls are all covered with shakes, with the exception of the areas on either side of the vestibule which are filled with half-log siding vertical logs. The fenestration of the building is regular being four panel, fixed wood sash windows. The only exception to this is the nine panel, fixed wood sash window looking out from the upstairs loft above the rear entrance.

The vestibule leading to the main entrance on the north elevation is 15 feet deep, has a dirt floor and houses drop toilet outhouses on either side. A set of steep stairs, on the west side, lead up inside to the loft and out through a molded rail door, with three flush panels and a large window, onto a balcony with a pole railing over the entrance.

Both the front and rear doors into the main living room are molded rail doors with five flush panels. This room has a cement slab floor and is finished with vertical board walls. Just off center in the room is a large, circular fireplace. It has a round brick base with an aluminum sheet back which opens into the main part of the room. The whole works is covered by a sheetmetal shroud leading to a stovepipe which runs straight up through the roof. A large iron woodstove, picnic table, metal-covered box for wood and halved-log benches in the northwest corner round out the furnishings.

The upstairs loft area has nearly as much floor space as the room below. The floors are made of large planks and the ceiling is open-log beamed. There are two openings in the floor down to the main downstairs room which are protected by pole guardrails.

The entire area, which includes Cloud Cap Inn, the Snowshoe Club's building, Tilly Jane Campground, Tilly Jane Guard Station, the American Legion Camp, the Ski Warming Hut, the CCC Camp, Cooper's Tent Campsite, the present road and two previous ones, all form a unique yet cohesive group. The full history of growth on the north side of Mt. Hood is told in these buildings and sites without a missing component. It is quite an unusual thing to have such an array in such a compact area. Each building or site, on its own merits, could be considered eligible for National Register status as Cloud Cap Inn already has been. As a group, their importance and interrelationships form a bond which cannot be denied.

Buildings and Sites Contributing to the Character of the Cloud Cap - Tilly Jane Recreation Area Historic District:
(Numbers Correspond to Locations on Accompanying Site Map)

1. Traces of 1886-1899 Wagon Road: Ascending Ghost Ridge parallel to Eliot Branch of the Middle Fork Hood River to the foot of Eliot Glacier, the road is largely obliterated by vegetative regeneration, and in places by subsequent development. Faint traces of the roadbed are presently visible along the crest of the ridge.

2. Site of Cooper's Tent Camp, 1885-1889: The spur road entering Tilly Jane Meadows from the north, campfire ash mixed with surface soil, a squared and leveled area 15' x 25' on the west side of the clearing, sill logs, 15' x 20', on the east side, and two toilet pits remain as evidence of Cooper's Tent Camp.

3. Traces of 1889-1926 Wagon Road: Ascending a minor ridge between Crystal Springs Creek and Evans Creek, traces of the road built in 1889 to access Cloud Cap Inn are clearly visible.

4. Cabin Sites: No structural remains: two leveled areas, each measuring ca 12' x 15' are cut out of the hillside above the present junction of the Cloud Cap and Tilly Jane Campground Roads, adjacent to a small loop of the 1889-1926 Wagon Road.

5. Cloud Cap Inn: Situated on a rocky prominence, the Inn, designed by William M. Whidden, is a single story structure with a modified V-shaped plan, broken coursed native stone foundations, exterior walls of horizontally laid logs with square-notched jointure, massive stone chimneys and wood-shingled hipped and gable roofs.

6. Stables: The log structure built in 1889-90, has collapsed: three tiers of saddle-notched logs remain in place, revealing the structure's 12 x 15 foot dimensions and doorway in the center of the west elevation.

7. Snowshoe Club Cabin: 1910. Rectangular plan, ca 25' x 70', long axis north/south. Built into slope, partial basement on north end: uncoursed native stone foundation, large stone exterior chimney off-set on east elevation, horizontally laid logs, square-notched at corners and partially hewn form exterior walls, wood-shingled high hipped roof.

8. American Legion Amphitheater: Port of American Legion Camp facilities built ca 1920 on the south side of Tilly Jane Creek approximately 1 km southeast Cloud Cap Inn. Nine tiers of half-log benches to the south and west of central fireplace, built into natural hillside, and accessed by flights of stone steps at the ends of the rows.

9. American Legion Cookhouse: Located to the east of the amphitheater, with its long axis lying north/south, the cookhouse is a one-room single story log structure. Essentially an Adirondack-type shelter with a split shake gable roof of unequal pitches, the cookhouse was formerly open but is now enclosed by removable board and batten walls. The entrance is off-center on the north gable end. A concrete cook stove, 15 feet long, occupies the center of the building.

10. 1926 Cloud Cap Road - Forest Road S-12: Now designated Forest Road S-12, the Cloud Cap road was built in 1926 by the Forest Service to provide more convenient access to the developing recreation area. With a graded gravel surface, the road gradually ascends 10 miles from its beginning opposite Cooper Spur Inn to a junction at one of the branches of Tilly Jane Creek. From this junction, Tilly Jane Campground is 1/2 mile east and the Cloud Cap area is 3/4 mile west at the 6,000 foot level, on dirt-surface roads.

11. Tilly Jane Campground: A formal public occupancy site extending along the north bank of Tilly Jane Creek. Initially developed by the Forest Service in 1926, the facility was enlarged and improved under the auspices of the Civilian Conservation Corps in 1934. Retains its rustic character with little to moderate site modification.

12. CCC Campsite: Occupied by Civilian Conservation Corps in 1934, the site is bounded by the present road, Tilly Jane Creek, the cabin sites and the hillside to the west. No structures remain, but structural outlines and foundations indicate the locations of former built features. These include traces of the camp access road, three tent platform outlines, each 15' x 18', the foundations of a building 15' x 30', the foundations of a plumbed structure ca 25' x 25', and evidence of a smaller wood-frame structure.

13. Tilly Jane Guard Station, Residence and Garage: 1934. Residence is 1½ story wood-frame structure with poured concrete foundation, split-shake hipped-gable roof. Exterior walls are horizontal clapboard to window level, vertical board and batten above. Multi-light sash windows; main entry, center, east facade. Rectangular plan, with gabled addition off-set to left on west elevation: a smaller wood-shingled extension abuts the west gable end of the addition off-center.

    The garage is a single vehicle capacity wood-frame structure, with poured concrete foundation, split-shake hipped-gable roof, horizontal clapboard exterior walls to four-foot level, vertical board and batten above. Double-leaf vertical board doors, reinforced, off-center on north gable end.

14. Ski Warming Hut: 1939. Located on the south side of Tilly Jane Creek, approximately 200 feet east of American Legion cookhouse, the warming hut is a rectangular, 1½ story, A-frame log structure, with a poured concrete foundation, split-shake high gable roof. Exterior walls are covered with shakes except lower level of east (main facade) which exhibits half-round vertical log walls. Four-light single sash windows; main entry, vestibuled at center, east facade.

15. Cloud Cap Saddle Campground: A more recent formal public occupancy site, located in Cloud Cap Saddle to the south of Cloud Cap Inn. Low level site development consistent with the overall rustic character of the recreation area.

SIGNIFICANCE

PERIOD	AREAS OF SIGNIFICANCE -- CHECK AND JUSTIFY BELOW				
_ PREHISTORIC	__ARCHEOLOGY-PREHISTORIC	__COMMUNITY PLANNING	__LANDSCAPE ARCHITECTURE	__RELIGION	
__ 1400-1499	__ARCHEOLOGY-HISTORIC	__CONSERVATION	__LAW	__SCIENCE	
__ 1500-1599	__AGRICULTURE	__ECONOMICS	__LITERATURE	__SCULPTURE	
__ 1600-1699	X ARCHITECTURE	__EDUCATION	__MILITARY	__SOCIAL-HUMANITARIAN	
__ 1700-1799	__ART	__ENGINEERING	__MUSIC	__THEATER	
X 1800-1899	__COMMERCE	X EXPLORATION/SETTLEMENT	__ PHILOSOPHY	X TRANSPORTATION	
X 1900-	__COMMUNICATIONS	__INDUSTRY	__POLITICS/GOVERNMENT	X OTHER (SPECIFY)	
		__INVENTION		Recreation	

SPECIFIC DATES

BUILDER/ARCHITECT

STATEMENT OF SIGNIFICANCE

The Cloud Cap/Tilly Jane Area has a full history which encompasses nearly all of the activity on the north side of Mt. Hood from its first exploration to its extensive development for recreational use. This area has very strong ties to the growth and history of the Hood River Valley.

In 1886, a huge forest fire raged on the north slope of Mt. Hood below what is now Cooper Spur and Eliot Glacier. Hoping the fire had cleared the way for them, Oscar Stranahan and Henry C. Coe set out to blaze their way up onto the mountain. Climbing up a way, they made camp and were met by David R. Cooper who had the same idea in mind. These three men, all from Hood River, were friends who climbed together frequently around the mountain. During their adventures, they had named certain points such as Cooper Spur, Coe Glacier and Stranahan Ridge for each other.

Oscar Stranahan was a native of New York who migrated to Minnesota and then to Hood River, Oregon in 1877 at the age of 43. He came here because of poor health. He was a veteran of the Civil War, having been a member of the 5th Minnesota Infantry which fought with General Sherman in his "March to the Sea." Upon arriving in the Hood River area, he became an employee of the Oregon Steam Navigation Company for three years and filed a claim for a piece of land adjacent to that of Henry C. Coe.

Henry Coe was also a native of New York where he was born in 1844. He arrived in Oregon sometime before he was ten years of age. He went to the University at Forest Grove for two years, beginning when he was 19, after which he returned to Hood River and began steamboating as an apprentice pilot for the Oregon Steam Navigation Company on the Colonel Wright. He continued this occupation, eventually becoming a pilot on the Owyhee which ran to Lewiston, Idaho until 1869 when he married Kitty Catton and took up farming. Ten years later, he joined the newly organized Oregon Railway and Navigation Company and helped build the railway through the Columbia River Gorge.

David R. Cooper was the late-comer to the group. He was born in Scotland in 1845 and immigrated to America in 1872. The next year he met his brother in Oakland, Oregon and took out citizenship papers in Roseburg. Cooper finally made it to the Hood River region in 1882 and filed on a quarter section of land where the town of Mt. Hood is located. At that time, Upper Hood River Valley was unoccupied by settlers and his wife had the distinction of being the first white woman to live in the area.

(see continuation sheet)

Cooper was very much the frontier-explorer type and spent a great deal of time exploring on Mt. Hood. In 1885, he and his wife set up a tent camp for visitors on the north slope of Mt. Hood, just below timberline, on a site which had been used previously by sheepherders. It was Cooper's idea to bring settlers and tourists into Upper Hood River Valley and onto the mountain.

The tent camp, run by Mrs. Cooper, consisted of one cook tent, one dining tent and from three to five living tents, and offered all the comforts of home. White dishes and oilcloth on the tables gave the camp a hotel atmosphere. Water was piped in from the stream nearby and two cows provided milk, cream and butter. Fresh elk, deer and trout were constant fare brought in by the men on their romps around the mountain. Guests were picked up in Hood River at 5 a.m., by Bert Stranahan, who was 16, and brought to the camp. It cost $1 a day to stay at the camp and $10 round trip to come up in Stranahan's Democrat wagon.

Bert Stranahan was the son of Oscar. He always had an interest in the livery business and in 1903, after working several years for the Oregon Railway and Navigation Company, became a partner in the Fashion Livery and Dray Company.

When the fire swept over the north side of Mt. Hood in 1886, David Cooper, Coe and Stranahan tried to discover a route up farther onto the mountain. They followed an old Indian trail up the mountain, but found their path blocked by impenetrable deadfalls which had not burned. To combat this, they set the forest on fire again and returned a couple of weeks later to try again. It is from the fire-killed snags that Ghost Ridge got its name. When they returned, they were able to make their way through to timberline. Two weeks were spent widening the path to accommodate wagons all the way to Eliot Glacier by way of where Cloud Cap Inn now stands. The route received much more use than they expected and so improvements were made the next year. Coe, Stranahan and Cooper joined in a partnership as the Mt. Hood Trail and Wagon Road Company and received a permit from Wasco County to operate their road for a toll and run a stage line.

In April 1889, William M. Ladd (son of Portland business tycoon William S. Ladd) and C.E.S. Wood (poet, attorney and Indian fighter) bought the rights of the Mt. Hood Trail and Wagon Road Company. They set up the Mt. Hood Stage Company whose purpose was to "construct, buy, sell, lease, own and operate wagon roads, railroads, steamboats, flumes, hotels, stage lines, water-power mills, parks, timber lands and farms." They immediately constructed a more passable wagon road using Chinese laborers who did all of the grading by hand

after the route was chopped out by a clearing crew. A deep gulch was filled by these laborers and still bears the name of China Fill. Later that year, Ladd and Wood contracted with James L. Langille to build Cloud Cap Inn. Langille had come to the Hood River area in 1883 and settled near the present town of Mt. Hood. Workers on the Lodge camped at a place known as Roaring Camp north of Cloud Cap Inn where there was a spring and Chinese were used as cooks. With the completion of Cloud Cap Inn, Cooper's Tent Camp went out of existence.

The first visitors to Cloud Cap Inn arrived in August 1889 even though the Inn was not quite finished. A stage line was set up the next year which made daily round trips to Cloud Cap from Hood River. The men who ran the stage were Lewis Adams (later the president of the Baggage and Omnibus Transfer Company of Portland) and Charles Bone. Sarah Langille, the estranged wife of James, acted as hostess on the stage until she took over the running of the Inn which she continued to do for 16 years with the aid of her sons. After Hyde and Bone, Osmond Royal operated a lozier as a stage for several years.

An open coach and four horses met the Portland train every day at noon in Hood River. Guests were taken ten miles to the ranch of John Divers where they ate lunch and changed horses. The journey then continued to the spring at the Elk Beds where a stage station and barn had been built. Here, six horses were hitched to the wagon for the long steep haul up the mountainside to the Inn where dinner was waiting. The entire trip took between five and six hours.

In 1906, an auto stage was begun from Hood River in a Pierce Arrow. It could only go as far as China Fill, which was a grade of 22% over soft ground on a sharp curve. A turnaround was built and the journey continued on a three-seat hack drawn by four horses. Late in that first summer, a one-cylinder Cadillac made the first journey all the way to Cloud Cap Inn. It was put into regular service the next year and cut the time from Hood River to three hours. The Inn maintained its own transportation system well into the 1930s, picking up passengers at 8:30 every morning and returning again at 3:30 in the afternoon.

The tourist traffic to Cloud Cap Inn was never as good as expected. Guests at the Lodge included scientists, climbers and tourists from many parts of the world. William M. Ladd and his wife, for whom Tilly Jane Creek was named, were among the first people to arrive annually for many seasons, staying at the Inn for extended periods of time. There were always guests at the Inn but the beautiful scenery, congeniality of the hostess, Sarah Langille, and reasonable rates ($3 a day plus $12.50 round trip auto coach fare from Hood River), did not draw enough people to make it an overwhelming success.

Although the Inn itself did not draw great throngs of visitors, the area was used by groups fairly extensively. The first mention of skiing on Mt. Hood, according to Mazama records, was in February 1897 when three men made their way to the snowbound Cloud Cap Inn on long, heavy wooden skis by propelling themselves with long poles.

The Snowshoe Club originated at Cloud Cap due to a group of men invited to the area by Wesley Ladd in 1904. They were Walter Honeyman, Bert C. Ball, Dr. Herbert Nichols, Rodney Glisan, Henry Corbett and John Kallock, several of whom were prominent Portlanders. They enjoyed themselves so much that they formed a club and made their visitations an annual event. In 1910, they received a 99 year lease from the Forest Service for a piece of land just north of Cloud Cap Inn on which they built their log clubhouse. Mark Weygandt, a well known Mt. Hood mountaineer, was put in charge of constructing the building with the help of David Cooper, Sr. and Jr., Bert Sandman and Russell Gobin. Weygandt remained as caretaker of the building until 1926. The building is still occupied and cared for by the Snowshoe Club under a Special Use Permit with the U. S. Forest Service.

In July of 1921, American Legion Post No. 22 of Hood River began sponsoring annual climbs to the top of the mountain. A camp with a cookhouse and amphitheater was set up to accommodate the hundreds of participants each year. The night before the climb, a huge campfire program was held with wild festivities well into the night. Those still in condition to climb would wake early the next morning to attempt the summit of Mt. Hood by the Cooper Spur route. Mark Weygandt was the guide on the first expedition. Climbs continued, though not always successfully, until 1953 when interest dropped off. Probably the most remarkable feature of the Legion climbs is that even with so many participants through the years, they never had a single serious accident.

Beginning in 1922, plans were being made for a new road which could be easily negotiated by automobile up to Cloud Cap and also connect to the American Legion Camp. In the summer of 1926, at a cost of nearly $200,000, a new road was built by the Forest Service from the newly completed Mt. Hood Loop Highway. A Forest Service campground was constructed across Tilly Jane Creek from the American Legion Camp in anticipation of increased use of the area.

As a condition for having the new road built, the City of Portland agreed to replace Cloud Cap Inn with a more suitable tourist facility. Several gradiose plans were proposed including one by A.E. Doyle (noted Portland Architect), designer of Multnomah Falls Lodge, but nothing was ever done. When Timberline

Lodge was built in 1938, the focal point for activity on Mt. Hood changed from the Cloud Cap/Tilly Jane Area to the south side of the mountain. Pressure to have the old Inn torn down and replaced continued long after its closure in 1940 when it was sold to the Forest Service.

Faced with the responsibility of maintenance and safety, the Forest Service planned to eliminate the Inn. The Crag Rats, a Hood River climbing and rescue organization, proposed to upgrade and maintain the Inn in exchange for a Special Use Permit to occupy the Inn around 1955. Presently, the Crag Rats occupy the Inn as a base for their climbing and snow surveying operations.

Throughout the 1930s, CCC crews were stationed in the Cloud Cap/Tilly Jane Area. In 1934, they constructed the guard residence and garage in Tilly Jane Campground. It was probably also at this time that the facilities in the campground were upgraded and fireplaces and tables improved. Since being discontinued as a guard station, the residence has been occupied by the Alpinees, a Hood River climbing group, for a search and rescue base.

Another project the CCC was involved in was brushing out the old wagon road for a winter ski trail. The old road was originally built by the Mt. Hood Stage Company in 1889. The Ski Warming Hut, across from Tilly Jane Campground, was also built by the CCC in 1939 and serves many recreation visitors throughout the year. Some maintenance and repair work was done by the CCC on Cloud Cap Inn upon its acquisition by the Forest Service.

The history of the Cloud Cap/Tilly Jane Area is very significant in the development of Mt. Hood. Beginning inauspiciously with Cooper's Tent Camp, the area bloomed as the center of activity on the mountain. The relative remoteness, which is one of the area's key elements, has also been a hindrance through the years in drawing great numbers of people to it. As a result, other areas, such as Timberline Lodge, have been built up and have replaced the Cloud Cap/Tilly Jane Area as the center of activity. This, in many ways, has been a blessing in disguise, since those who make the added effort to reach the Cloud Cap/Tilly Jane area are rewarded with a rustic, uncrowded place, almost stopped in time, in which to enjoy the unspoiled beauties of Mt. Hood.

9 MAJOR BIBLIOGRAPHICAL REFERENCES

Coon, Delia M., compiler. History of Early Pioneer Families of Hood River, Oregon. N.p.:n.d.

Gaston, Joseph. Portland, Oregon: Its History and Builders . . . Portland: the S. J. Clarke Publishing Company. 1911.

(see continuation sheet)

10 GEOGRAPHICAL DATA

ACREAGE OF NOMINATED PROPERTY ~~642~~ 1071.6

UTM REFERENCES

SEE CORRECTED BOUNDARY DESCRIPTION ATTACHED

	ZONE	EASTING	NORTHING		ZONE	EASTING	NORTHING
A	1,0	6 0,6 7,8,3	5,0 3,1 0,1,0	B	1,0	6 0,6 3,4,4	5,0 3,0 1,3,0
C	1,0	6 0,6 2,2,2	5,0 2,9 7,3,5	D	1,0	6 0,5 8,2,2	5,0 2,9 2,1,1

VERBAL BOUNDARY DESCRIPTION

~~At section corner of 35/36 Township 1 South, Range 9 East W.M., as monumented and described in the records of the Surveyor General, thence south 48° 45' west 3040 feet (calculated) to Angle Point A, point of beginning. Angle Point A is 200 feet east of old wagon road intersecting Forest Road S-12 [illegible] miles west of State Highway 35, and perpendicular to old wagon road. From POB, the line ascends a minor ridge between Crystal Spring Creek and Evans Creek;~~

LIST ALL STATES AND COUNTIES FOR PROPERTIES OVERLAPPING STATE OR COUNTY BOUNDARIES

STATE	CODE	COUNTY	CODE

11 FORM PREPARED BY

NAME / TITLE

Jon Horn, Ron Cohen, and Carol Gibson

ORGANIZATION: USDA, Mt. Hood National Forest — DATE: 12/6/79

STREET & NUMBER: 19559 S.E. Division — TELEPHONE: 667-0511

CITY OR TOWN: Gresham, — STATE: Oregon 97030

12 CERTIFICATION OF NOMINATION

STATE HISTORIC PRESERVATION OFFICER RECOMMENDATION

YES X NO___ NONE___ 5-22-80

Deputy STATE HISTORIC PRESERVATION OFFICER SIGNATURE

In compliance with Executive Order 11593, I hereby nominate this property to the National Register, certifying that the State Historic Preservation Officer has been allowed 90 days in which to present the nomination to the State Review Board and to evaluate its significance. The evaluated level of significance is ___National ___State ___Local.

FEDERAL REPRESENTATIVE SIGNATURE

TITLE — DATE

FOR NPS USE ONLY

I HEREBY CERTIFY THAT THIS PROPERTY IS INCLUDED IN THE NATIONAL REGISTER

DATE

DIRECTOR, OFFICE OF ARCHEOLOGY AND HISTORIC PRESERVATION

ATTEST: — DATE

KEEPER OF THE NATIONAL REGISTER

Form No 10-300a
(Rev. 10-74)

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

FOR NPS USE ONLY
RECEIVED
DATE ENTERED

CONTINUATION SHEET ITEM NUMBER 9 PAGE 1 of 1

Grauer, Jack. Mt. Hood: A Complete History. N.p.: Jack Grauer. 1975.

McNeal, William H. History of Wasco County, Oregon. The Dalles, Oregon: n.p., ca. 1953.

Peattie, Roderick, editor. The Cascades: Mountains of the Pacific Northwest. New York: The Vanguard Press. 1949.

State of Oregon. An Illustrated History of Central Oregon Embracing Wasco, Sherman, Gilliam, Wheeler, Crook, Lake and Klamath Counties. Spokane, Washington: Western Historical Publishing Company, Publishers. 1905.

USDA, Forest Service. Mt. Hood National Forest, Oregon: Its Purposes and Resources. N.p.: USDA, Forest Service. 1927.

Wood, Ruth Kedzie. The Tourist's Northwest. New York: Dodd, Mead and Company. 1916.

Wooley, Ivan M. "Mt. Hood or Bust: the Old Road" Oregon Historical Quarterly 60 (March 1959).

Wright, E.W. Lewis and Dryden's Marine History of the Pacific Northwest. Portland: The Lewis and Dryden Printing Company. 1895.

"Road to Cooper's Spur Would Cut Out Heavy Climb." Oregon Journal. January 29, 1922. Section 3, p.3.

"Cloud Cap Plans Take Form." Oregon Journal. March 10, 1926. p.1.

"First Lady of the Mountain." Oregon Journal. March 12, 1939. Feature Section, p.1.

"Cloud Cap Remodeling Work Halts for Season." Oregon Journal. October 12, 1940, p.2.

In Rare Books Room at the Oregon Historical Society, Portland: "Mt. Hood Stage Company." Articles of incorporation.

GPO 892 455

Form No. 10-300a
(Rev. 10-74)

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

FOR NPS USE ONLY
RECEIVED
DATE ENTERED

CONTINUATION SHEET ITEM NUMBER 10 PAGE 1 of 2

Acreage = 1071.6 acres Amended 3/81

UTM References: Amended 3/81

Zone 10

Point	Easting	Northing
A	606783	5031010
A1	606444	5030305
B1	606819	5029828
C1	606686	5029739
C	606222	5029735
D1	606329	5029350
E1	606616	5028906
F1	606271	5028688
G	606350	5027642
H	605440	5027618
I	605052	5028088
J	605084	5028657
K	605336	5029823
L	605508	5030101
M	605509	5030364
N	605626	5030629
O	605601	5031313
P	605629	5031399
Q	605882	5031618

Form No. 10-300a
(Rev. 10-74)

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

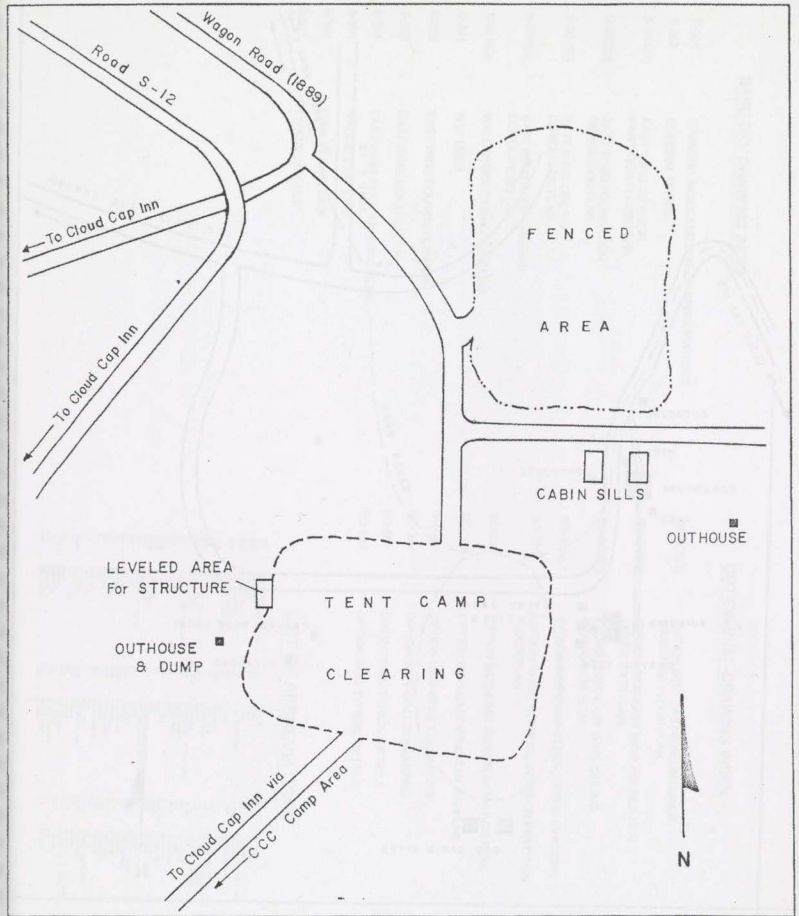
NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

FOR NPS USE ONLY
RECEIVED
DATE ENTERED

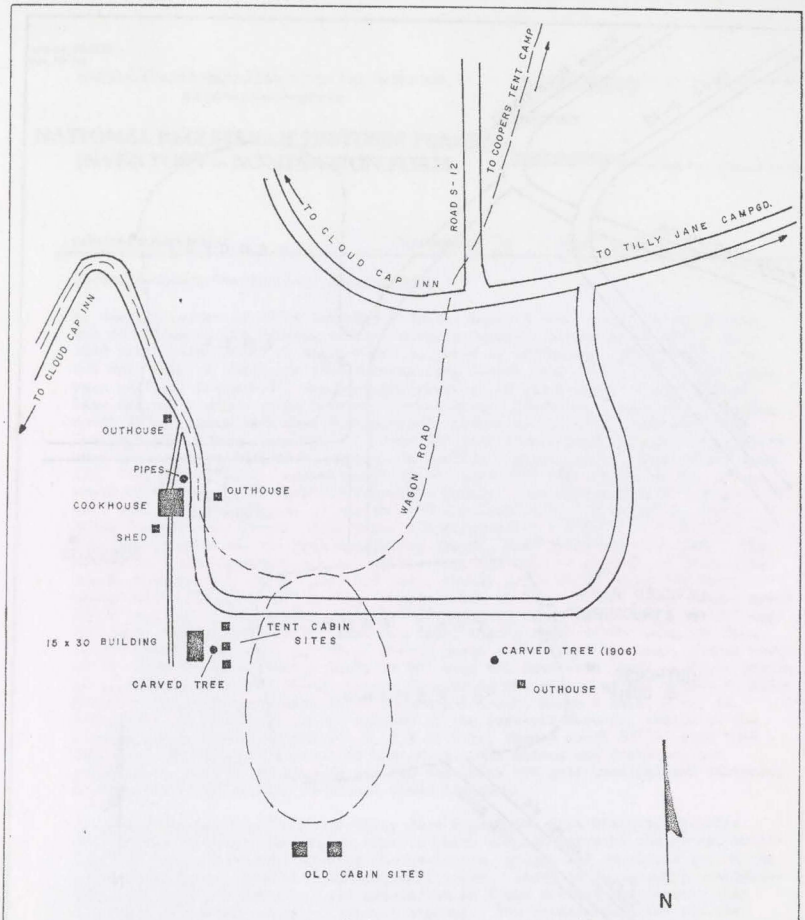
Verbal Boundary Description, Amended 3/81

At section corner of 35/36 Township 1 South, Range 9 East, W.M., as monumented and described in the records of the Surveyor General, thence south 48°45' west 3040 feet (calculated) to Angle Point A, point of beginning. Angle Point A is 200 feet east of old wagon road intersecting Forest Road S-12 7 7/8 linear miles west of State Highway 35, and perpendicular to old wagon road. From POB, the line ascends a minor ridge between Crystal Spring Creek and Evans Creek, bearing south 25°41' west 2566 feet (calculated), thence south 38°10' east 1990 feet (calculated), thence south 56°13' west 525 feet (calculated), thence south 89°30' west 1522 feet (calculated), thence, descending a gentle slope south 15°32' east 1311 feet (calculated), thence south 32°53' east 1735 feet (calculated), thence south 57°43' west 1339 feet (calculated), thence, over broken ground, south 04°19' east 3441 feet calculated, to a point (<G X = 1706762.4, Y = 632526.2, State Plane Coordinates, Oregon North Zone; UTM Reference X = 606350, Y = 5027642) on Polallie Creek where the line intersects the Mt. Hood Wilderness Boundary. The common line then proceeds south 87°00' - west 3311 feet to a point on Tilly Jane Creek, thence north 38°00' east 428 feet, thence north 14°15' west 394 feet, thence north 59°45' west 162 feet, thence north 34°00' west 389 feet, thence south 79°15' west 102 feet, thence north 38°30' west 117 feet, thence north 58°50' west 117 feet, thence north 03°30' east 401 feet, thence south 64°00' west 180 feet, thence north 00°30' east 120 feet, thence north 48°45' west 185 feet, thence south 42°30' west 540 feet, thence wouth 40°00' west 441 feet to a point on Eliot Branch of the Middle Fork Hood River, thence descending the thread of the stream of Eliot Branch to the section corner 34/35 Township 1 South, Range 9 East, W.M., as monumented and described in the records of the Surveyor General, thence to the Witness Corner Section 34/35 T 1 S, R 9 E, W.M., thence south 55°59' east 3566 feet (calculated) to the point of beginning. All points and distances are caluclated from UTM coordinates and the resulting UTM grid bearings and distances are subject to adjustment in actual field location.

The boundaries of the Cloud Cap-Tilly Jane Recreation Area Historic District delineate a definable geographic area in which are concentrated the sites, buildings and structures that describe the evolution, growth and continued use of the north slope of Mt. Hood as a recreational locus. Based on topographic considerations and land use patterns, the boundaries as drawn present and protect that continuum of history in environmental context. The visual character and the scenic and experiential values of the Historic District are protected and enhanced by contiguity with the Mt. Hood Wilderness.



COOPER'S TENT CAMP AREA	Hood River R.D.
USDA Mt. Hood Nat'l Forest	no scale
	drawn 12/6/79 9. Hoy



CCC CAMP AREA	HOOD RIVER R.D.
USDA MT. HOOD NAT'L FOREST	no scale
	drawn 12/6/79 Q. Hoy

BASE BID- DRAWING INDEX

S-001	DRAWING INDEX AND LIST OF ABBREVIATIONS
S-002	GENERAL NOTES
S-201(D)	EAST WING INTERIOR PARTITION FLOOR PLAN
S-202(D)	EAST WING FOUNDATION DEMOLITION PLAN
S-203(D)	EAST WING CEILING DEMOLITION PLAN
S-204(D)	EAST WING ROOF FRAMING DEMOLITION PLAN
S-301(D)	WALL DEMOLITION ELEVATIONS
S-201	NOT USED
S-202	EAST WING FOUNDATION PLAN
S-203	EAST WING CEILING PLAN
S-204	EAST WING ROOF FRAMING PLAN
S-301	WALL ELEVATIONS
S-302	WALL ELEVATIONS
S-501	TYPICAL DETAILS

OPTION BIDS -DRAWING INDEX

S0-201(D)	OPTION BIDS-EAST WING INTERIOR PARTITION FLOOR PLAN
SO-202(D)	OPTION BIDS-EAST WING FOUNDATION DEMOLITION PLAN
SO-203(D)	OPTION BIDS-EAST WING CEILING DEMOLITION PLAN
SO-301(D)	OPTION BIDS-WALL DEMOLITION ELEVATIONS
SO-201	OPTION BIDS-EAST WING INTERIOR PARTITION FLOOR PLAN
SO-202	OPTION BIDS-EAST WING FOUNDATION PLAN
SO-203	OPTION BIDS-EAST WING CEILING PLAN
SO-301	OPTION BIDS-WALL ELEVATIONS
SO-302	OPTION BIDS-WALL ELEVATIONS
SO-501	OPTION BIDS-TYPICAL DETAILS
SO-502	OPTION BIDS-TYPICAL DETAILS

LIST OF ABBREVIATIONS

A.B.	ANCHOR BOLT
ACI	AMERICAN CONCRETE INSTITUTE
ADD'L.	ADDITIONAL
ALT.	ALTERNATE
ASCE	AMERICAN SOCIETY OF CIVIL ENGINEERS
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
BLDG.	BUILDING
BOT.	BOTTOM
B.O.	BOTTOM OF
C.G.	CENTER OF GRAVITY
C.I.P.	CAST-IN-PLACE
C.J.	CONTROL JOINT
C.J.P.	COMPLETE JOINT PENETRATION
CL	CENTERLINE
CLR.	CLEAR
COL.	COLUMN
CONC.	CONCRETE
CONN.	CONNECTION
CONST.	CONSTRUCTION
CONT.	CONTINUOUS
DBA	DEFORMED BAR ANCHOR
DBL.	DOUBLE
DET.	DETAIL
DIA., #	DIAMETER
DIAG.	DIAGONAL
D.L.	DEAD LOAD
DWG.	DRAWING
EA.	EACH
E.E.	EACH END
E.F.	EACH FACE
EL.	ELEVATION
EMBED.	EMBEDMENT
E.N.	EDGE NAILING
EQ.	EQUAL
EXIST.,(E)	EXISTING
EXP.	EXPANSION
EXT.	EXTERIOR
FDN.	FOUNDATION
F.F.	FAR FACE
FIG.	FIGURE
FIN.	FINISH
FLR.	FLOOR
F.P.	FULL PENETRATION
FT.	FOOT
FTG.	FOOTING
GA.	GAUGE
GALV.	GALVANIZED
GB	GRADE BEAM
GL	GLULAM BEAM
HD'D.	HEADED
HORIZ.	HORIZONTAL
IBC	INTERNATIONAL BUILDING CODE
I.D.	INSIDE DIAMETER
I.F.	INSIDE FACE
IN.	INCH
INT.	INTERIOR
JT.	JOINT
K	KIPS
KSF	KIPS PER SQUARE FOOT
KSI	KIPS PER SQUARE INCH
LB.	POUND
L.L.	LIVE LOAD
LOC.	LOCATION
LONG.	LONGITUDINAL
MAX.	MAXIMUM
MFR.	MANUFACTURER
MIN.	MINIMUM
MISC.	MISCELLANEOUS
(N)	NEW
N.F.	NEAR FACE
N.I.C.	NOT IN CONTRACT
NOM.	NOMINAL
NO.	NUMBER
N.T.S.	NOT TO SCALE
o.c.	ON CENTER
O.D.	OUTSIDE DIAMETER
O.F.	OUTSIDE FACE
OPNG.	OPENING
OPP.	OPPOSITE
PART.	PARTITION
P/C	PRECAST
PCF	POUNDS PER CUBIC FOOT
PERIM.	PERIMETER
PERP.	PERPENDICULAR
PL	PLATE
PLC'S.	PLACES
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
P.T.	PRESSURE TREATED
PVC	POLYVINYL CHLORIDE
R, RAD.	RADIUS
REF	REFERENCE
RET.	RETURN
REINF.	REINFORCING
REQ'D.	REQUIRED
REQ'MTS.	REQUIREMENTS
SCHED.	SCHEDULE
SECT.	SECTION
SHT.	SHEET
SIM.	SIMILAR
S.O.G.	SLAB ON GRADE
SPEC.	SPECIFICATION
SQ.	SQUARE
STD.	STANDARD
STRUCT.	STRUCTURAL
SYM.	SYMMETRICAL
THRU	THROUGH
T.O.	TOP OF
T & G	TONGUE AND GROOVE
TRANS.	TRANSVERSE
TYP.	TYPICAL
U.N.O.	UNLESS NOTED OTHERWISE
USFS	UNITED STATES FOREST SERVICE
VERT.	VERTICAL
w/	WITH
w/o	WITHOUT

UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff Consulting Engineers
111 SW 5th Avenue
Suite 2500
Portland, Oregon 97204
503-227-3251

PRELIMINARY NOT FOR CONSTRUCTION

CLOUD CAP INN EAST WING REPAIR
MT HOOD
HOOD RIVER

FOREST SUPERVISOR DATE
FOREST ENGINEER DATE
DISTRICT RANGER DATE

MARK	DATE	DESCRIPTION

ISSUE INFORMATION	NOV. 8, 2005
PROJECT NO:	204331
CAD DWG FILE:	
DESIGNED BY:	TR
DRAWN BY:	BDF
CHECKED BY:	CT

DRAWING INDEX AND LIST OF ABBREVIATIONS

GENERAL NOTES

THESE GENERAL NOTES SUPPLEMENT THE PROJECT SPECIFICATIONS. REFER TO THE PROJECT SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS. NOTES AND DETAILS ON THE DRAWINGS SHALL TAKE PRECEDENCE OVER THE GENERAL NOTES AND TYPICAL DETAILS. WHERE NO DETAILS ARE GIVEN, CONSTRUCTION SHALL BE AS SHOWN FOR SIMILAR WORK.

CODE REQUIREMENTS:
PER SECTION 3407.1 OF THE 2004 OREGON STRUCTURAL SPECIALTY CODE (OSSC), BASED ON THE 2003 INTERNATIONAL BUILDING CODE (IBC), THE PROVISIONS OF THE 2004 OSSC ARE NOT MANDATORY AS DETERMINED BY THE USFS. DESIGN OF NEW WORK BASED ON EXCEEDING STRENGTH OF ORIGINAL (DECAY FREE) CONSTRUCTION.

TEMPORARY CONDITIONS:
THE STRUCTURE IS DESIGNED TO FUNCTION AS A UNIT UPON COMPLETION. THE CONTRACTOR IS RESPONSIBLE FOR FURNISHING ALL TEMPORARY BRACING AND/OR SUPPORT THAT MAY BE REQUIRED AS THE RESULT OF THE CONTRACTOR'S CONSTRUCTION METHODS AND/OR SEQUENCES.

CONTRACTOR'S CONSTRUCTION AND/OR ERECTION SEQUENCES SHALL RECOGNIZE AND CONSIDER THE EFFECTS OF THERMAL MOVEMENTS OF STRUCTURAL ELEMENTS DURING THE CONSTRUCTION PERIOD.

EXISTING CONDITIONS:
ALL EXISTING CONDITIONS, DIMENSIONS AND ELEVATIONS SHALL BE FIELD VERIFIED. THE CONTRACTOR SHALL NOTIFY THE COR OF ANY SIGNIFICANT DISCREPANCIES FROM CONDITIONS SHOWN ON THE DRAWINGS.

DESIGN CRITERIA:
DESIGN OF THE NEW FLOOR FRAMING WAS BASED ON THE STRENGTH AND DEFLECTION CRITERIA OF THE 2004 OSSC. IN ADDITION TO THE DEAD LOADS, THE FOLLOWING LOADS AND ALLOWABLES WERE USED FOR DESIGN, WITH LIVE LOADS REDUCED PER 2004 OSSC:

FLOORS:

CORRIDORS	100	PSF L.L.
BEDROOMS	40	PSF L.L.
WOOD STORAGE ROOMS	200	PSF L.L.
ASSUMED ALLOWABLE SOIL BEARING PRESSURE	2000	PSF

SUBMITTALS:
SHOP DRAWINGS SHALL BE SUBMITTED TO THE COR PRIOR TO FABRICATION AND CONSTRUCTION REGARDING ALL ITEMS, INCLUDING THE FOLLOWING:

CONCRETE MIX DESIGNS, CONCRETE REINFORCEMENT AND EMBEDDED STEEL ITEMS.

IF THE SHOP DRAWINGS DIFFER FROM OR ADD TO THE DESIGN OF THE STRUCTURAL DRAWINGS, THEY SHALL BEAR THE SEAL AND SIGNATURE OF A STRUCTURAL ENGINEER REGISTERED IN THE STATE OF OREGON. ANY CHANGES TO THE DRAWINGS SHALL BE SUBMITTED TO THE COR AND ARE SUBJECT TO REVIEW AND ACCEPTANCE OF THE COR.

FIELD ENGINEERED DETAILS DEVELOPED BY THE CONTRACTOR THAT DIFFER FROM OR ADD TO THE DRAWINGS SHALL BEAR THE SEAL AND SIGNATURE OF A STRUCTURAL ENGINEER REGISTERED IN THE STATE OF OREGON AND SHALL BE SUBMITTED TO THE COR PRIOR TO CONSTRUCTION.

CONCRETE:
CONCRETE WORK SHALL CONFORM TO CHAPTER 19 OF THE 2004 OSSC. CONCRETE STRENGTH SHALL BE 4,000 PSI AS VERIFIED BY STANDARD 28-DAY CYLINDER TESTS PER ASTM C39. ABSOLUTE WATER-CEMENT RATIO BY WEIGHT SHALL BE 0.45. MINIMUM CEMENT CONTENT PER CUBIC YARD SHALL BE 550 LBS PER CUBIC YARD.

FLYASH CONFORMING TO ASTM C618 (INCLUDING TABLE 2A) TYPE F OR TYPE C, MAY BE USED TO REPLACE UP TO 20% OF THE CEMENT CONTENT, PROVIDED THAT THE MIX STRENGTH IS SUBSTANTIATED BY TEST DATA.

THE CONTRACTOR SHALL SUBMIT CONCRETE MIX DESIGNS, ALONG WITH TEST DATA COMPLIANT WITH 2004 OSSC SECTION 1905, A MINIMUM OF TWO WEEKS PRIOR TO PLACING CONCRETE. NO WATER MAY BE ADDED TO CONCRETE IN THE FIELD UNLESS SPECIFICALLY APPROVED IN WRITING BY THE CONCRETE SUPPLIER IN CONJUNCTION WITH THE CONCRETE MIX DESIGN.

A WATER-REDUCING ADMIXTURE CONFORMING TO ASTM C494, USED IN STRICT ACCORDANCE WITH THE MANUFACTURERS' RECOMMENDATIONS, SHALL BE INCORPORATED IN CONCRETE DESIGN MIXES. A HIGH-RANGE WATER-REDUCING (HRWR) ADMIXTURE CONFORMING TO ASTM C494, TYPE F OR G, MAY BE USED IN CONCRETE MIXES PROVIDING THAT THE SLUMP DOES NOT EXCEED 10". AN AIR-ENTRAINING AGENT CONFORMING TO ASTM C260 SHALL BE USED IN CONCRETE MIXES. THE AMOUNT OF ENTRAINED AIR SHALL BE 5% ± 1% BY VOLUME.

REINFORCING STEEL:
REINFORCING STEEL SHALL CONFORM TO ASTM A615, GRADE 50, FOR DEFORMED BARS UNLESS OTHERWISE NOTED. REINFORCING STEEL SHALL BE SECURELY TIED IN PLACE WITH #16 ANNEALED WIRE.

REINFORCING STEEL SHALL BE DETAILED IN ACCORDANCE WITH THE "ACI MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES," ACI 315. LAP ALL REINFORCING PER THE TYPICAL LAP SPLICE LENGTH SCHEDULE, EXCEPT AS NOTED.

TYPICAL LAP SPLICE LENGTH SCHEDULE

BAR SIZE	4000 P.S.I. CASE 1	4000 P.S.I. CASE 2
# 3	19	28
# 4	25	37
# 5	31	47
# 6	37	56
# 7	54	81
# 8	62	93
# 9	70	105
# 10	78	118
# 11	87	131

NOTES:
1. DIMENSIONS ARE IN INCHES.
2. CASES 1 AND 2 ARE DEFINED AS FOLLOWS (d_b = BAR DIAMETER)
   BEAMS OR COLUMNS: CASE 1: COVER $\geq d_b$ AND c-c SPACING $\geq 2_b d$
   CASE 2: COVER $< d_b$ OR c-c SPACING $< 2_b d$
   ALL OTHERS: CASE 1: COVER $\geq d_b$ AND c-c SPACING $\geq 3_b d$
   CASE 2: COVER $< d_b$ OR c-c SPACING $< 3_b d$
3. FOR TOP BARS, MULTIPLY LAP LENGTH ABOVE BY 1.3. TOP BARS ARE HORIZONTAL BARS WITH MORE THAN 12" OF CONCRETE CAST BELOW THE BARS.

CONCRETE WALL REINFORCING (UNLESS OTHERWISE NOTED):

WALL THICKNESS	HORIZONTAL BARS	VERTICAL BARS	LOCATION
6"	#4 @ 12" O.C.	#4 @ 12" O.C.	@ CL OF WALL

CONTINUE HORIZONTAL WALL BARS THROUGH INTERSECTING WALLS. PROVIDE HOOKED DOWELS FROM FOOTINGS TO MATCH VERTICAL WALL REINFORCING.

SAWN LUMBER:
SAWN LUMBER SHALL CONFORM TO WEST COAST LUMBER INSPECTION BUREAU OR WESTERN WOOD PRODUCTS ASSOCIATION GRADING RULES. LUMBER SHALL BE KILN DRIED AND BE THE SPECIES AND GRADE NOTED BELOW:

USE	SPECIES/GRADE	Fb (PSI) (BASE VALUE)
DIM. LUMBER 2" TO 4" THICK	DOUGLAS FIR-LARCH NO. 2	900
BEAMS 5" X 5" AND GREATER	DOUGLAS FIR-LARCH NO. 1	1350
POSTS	DOUGLAS FIR-LARCH NO. 1	1200
T & G DECKING	DOUGLAS FIR-LARCH COMMERCIAL DEX	1450

ALL LUMBER IN CONTACT WITH CONCRETE SHALL BE PRESSURE TREATED. FRAMING ACCESSORIES AND STRUCTURAL FASTENERS SHALL BE MANUFACTURED BY SIMPSON STRONG TIE (OR APPROVED EQUAL) AND OF THE SIZE AND TYPE SHOWN ON THE DRAWINGS. ALL NAIL HOLES SHALL BE FILLED WITH STRUCTURAL FASTENERS, UNLESS NOTED OTHERWISE ON THE DRAWINGS AND FASTENERS SHALL BE INSTALLED FOLLOWING ALL MANUFACTURERS REQUIREMENTS. IF A SUBSTITUTION IS MADE, A DOCUMENT SHALL BE SUBMITTED TO THE COR FOR APPROVAL OUTLINING THE FRAMING ACCESSORIES BEING REPLACED AND THE SUBSTITUTED FRAMING ACCESSORIES. ALLOWABLE LOADS FOR THE SIMPSON ACCESSORIES SHALL BE TABULATED ALONG WITH ALLOWABLE LOADS FOR THE SUBSTITUTED ACCESSORIES, WHICH CLEARLY INDICATE THE SUBSTITUTED ACCESSORIES HAVING AN EQUAL OR GREATER CAPACITY. HANGERS NOT SHOWN SHALL BE SIMPSON U-TYPE OR B-TYPE OF SIZE RECOMMENDED FOR THE MEMBER.

ALL FRAMING NAILS SHALL BE HOT DIPPED GALVANIZED AND BE OF THE SIZE AND NUMBER INDICATED ON THE DRAWINGS AND CONFORM TO ASTM F 1667, "STANDARD SPECIFICATION OF DRIVEN FASTENERS: NAILS, SPIKES, AND STAPLES AND NER-272 "POWER-DRIVEN STAPLES AND NAILS FOR USE IN ALL TYPES OF BUILDING CONSTRUCTION." NAILS SHALL BE IDENTIFIED BY LABELS (ATTACHED TO THEIR CONTAINERS) THAT SHOW THE MANUFACTURER'S NAME AND NES REPORT NUMBER, NAIL SHANK DIAMETER, AND LENGTH. PREDRILL NAIL HOLES AS REQUIRED TO AVOID SPLITTING WOOD. NAILING NOT SHOWN SHALL BE AS INDICATED ON 2004 OSSC TABLE 2304.9.1 OR NER-272. THE FOLLOWING NAIL SIZES SHALL BE USED:

NAIL TYPE	SHANK DIAMETER (IN.)	MINIMUM PENETRATION INTO FRAMING MEMBER (IN.)
6d	0.113	1.25
8d	0.131	1.5
10d	0.148	1.625
12d	0.148	1.625
16d	0.148	1.625
20d	0.192	2.125
30d	0.207	2.625
40d	0.225	2.625
50d	0.244	2.875
60d	0.263	3.000

BOLTS, SPIKES, RODS AND LAG SCREWS SHALL BE HOT DIPPED GALVANIZED AND CONFORM TO ANSI/ASME STANDARD B18.2.1-1981. ALL BOLTS, SPIKES, RODS AND LAG SCREWS SHALL BE INSTALLED IN PREDRILLED HOLES AS REQUIRED TO AVOID SPLITTING WOOD. BOLTS AND LAG SCREWS SHALL HAVE STANDARD CUT WASHERS. ALL A307 BOLTS SHALL HAVE CUT THREADS.

CUTTING AND NOTCHING OF JOISTS AND STUDS SHALL CONFORM TO 2004 OSSC SECTIONS 2308.8.2, 2308.9.10 AND 2308.10.4.2.

SALVAGED LUMBER SHALL BE GRADED BY AN APPROVED GRADING AGENCY PRIOR TO USE AND SHALL MEET THE MINIMUM BENDING STRESSES SHOWN ABOVE.

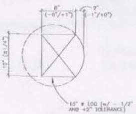
WOOD STRUCTURAL PANELS:
WOOD STRUCTURAL PANELS SHALL CONFORM TO THE REQUIREMENTS OF "U.S. PRODUCT STANDARD PS 1 FOR CONSTRUCTION AND INDUSTRIAL PLYWOOD", "U.S. PRODUCT STANDARD PS 2 PERFORMANCE STANDARD FOR WOOD-BASED STRUCTURAL-USE PANELS", OR "APA PRP-108 PERFORMANCE STANDARDS". UNLESS NOTED, PANELS SHALL BE APA RATED SHEATHING, EXPOSURE 1, OF THE THICKNESS AND SPAN RATING SHOWN ON THE DRAWINGS.

WOOD STRUCTURAL PANEL INSTALLATION SHALL BE IN CONFORMANCE WITH APA RECOMMENDATIONS. ALLOW 1/8" SPACING AT PANEL ENDS AND EDGES, UNLESS OTHERWISE RECOMMENDED BY THE PANEL MANUFACTURER.

ALL SUB-FLOORING SHALL BE INSTALLED WITH FACE GRAIN PERPENDICULAR TO SUPPORTS, EXCEPT AS INDICATED ON THE DRAWINGS. SUB-FLOOR SHEATHING SHALL EITHER BE BLOCKED, TONGUE-AND-GROOVE, OR HAVE EDGES SUPPORTED BY PLYCLIPS. NAILING NOT SHOWN SHALL BE AS INDICATED ON 2004 OSSC TABLE 2304.9.1. ALL NAILS SHALL BE COMMON NAILS.

USFS FURNISHED MATERIALS:
THE FOLLOWING MATERIALS WILL BE PROVIDED BY THE USFS. REFERENCE PROJECT SPECIFICATIONS FOR DIMENSIONS AND QUANTITIES. MATERIALS ARE STORED AT THE USFS FACILITY IN PARKDALE AND SHALL BE TRANSPORTED TO THE SITE BY THE CONTRACTOR:

1. 1x4 T&G FLOOR, CEILING OR WALL BOARDS:
2. EXTERIOR WALL LOGS:



UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff Consulting Engineers
111 SW 5th Avenue
Suite 2500
Portland, Oregon 97204
503-227-3251

PRELIMINARY NOT FOR CONSTRUCTION

CLOUD CAP INN EAST WING REPAIR
MT HOOD
HOOD RIVER

FOREST SUPERVISOR	DA
FOREST ENGINEER	DA
DISTRICT RANGER	DA

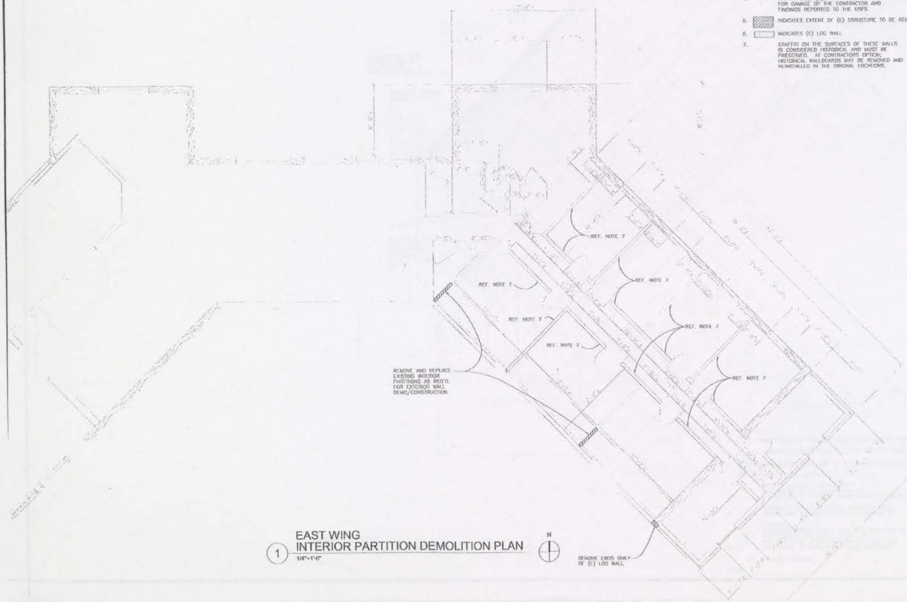
MARK	DATE	DESCRIPTION

ISSUE INFORMATION	NOV. 8, 2005
PROJECT NO:	204331
CAD DWG FILE:	
DESIGNED BY:	TR
DRAWN BY:	BDF
CHECKED BY:	CT

GENERAL NOTES

NOTES:

1. (E) INDICATES EXISTING.
2. CONTRACTOR TO VERIFY ALL EXISTING CONDITIONS, DIMENSIONS AND ELEVATIONS PRIOR TO FABRICATION AND ERECTION AND NOTIFY USFS OF ANY SIGNIFICANT DISCREPANCIES FROM THAT SHOWN ON THE DRAWINGS.
3. CONTRACTOR TO SHORE ALL EXISTING FRAMING AS REQUIRED FOR DEMOLITION AND REFRAMING WORK.
4. ALL EXPOSED (E) FRAMING LUMBER SHALL BE INSPECTED FOR DAMAGE BY THE CONTRACTOR AND FINDINGS REPORTED TO THE USFS.
5. [hatched box] INDICATES EXTENT OF (E) STRUCTURE TO BE REMOVED
6. [dashed box] INDICATES (E) LOG WALL.
7. GRAFFITI ON THE SURFACES OF THESE WALLS IS CONSIDERED HISTORICAL AND MUST BE PRESERVED. AT CONTRACTORS OPTION; HISTORICAL WALLBOARDS MAY BE REMOVED AND REINSTALLED IN THE ORIGNAL LOCATIONS.



1 EAST WING
INTERIOR PARTITION DEMOLITION PLAN
1/4"=1'-0"

UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff Consulting Engineers
111 SW 5th Avenue
Suite 2500
Portland, Oregon 97204
503-227-3251

PRELIMINARY
NOT FOR
CONSTRUCTION

CLOUD CAP INN
EAST WING
REPAIR
MT HOOD
HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

MARK	DATE	DESCRIPTION

ISSUE INFORMATION	NOV. 8, 2005
PROJECT NO:	204331
CAD DWG FILE:	
DESIGNED BY:	TR
DRAWN BY:	BDF
CHECKED BY:	CT

EAST WING
INTERIOR
PARTITION

NOTES:

1. (E) INDICATES EXISTING.
2. CONTRACTOR TO VERIFY ALL EXISTING CONDITIONS, DIMENSIONS AND ELEVATIONS PRIOR TO FABRICATION AND ERECTION AND NOTIFY USFS OF ANY SIGNIFICANT DISCREPANCIES FROM THAT SHOWN ON THE DRAWINGS.
3. CONTRACTOR TO SHORE ALL EXISTING FRAMING AS REQUIRED FOR DEMOLITION AND RETAINING WORK.
4. ALL EXPOSED (E) FRAMING LUMBER SHALL BE INSPECTED FOR DAMAGE BY THE CONTRACTOR AND FINDINGS REPORTED TO THE USFS.
5. INDICATES (E) 10IC WALL.
6. INDICATES (E) STRUCTURE TO BE REMOVED AND REPLACED
7. INDICATES SPAN DIRECTION OF (E) 1x (ACTUAL) SUBFLOORING
8. INDICATES SPAN DIRECTION OF (E) 3/4" PLYWOOD SUBFLOORING

REMOVE (E) CONCRETE FOOTING

REMOVE AND REPLACE (E) TIMBER DECK AS REQUIRED FOR NEW CONSTRUCTION WORK

REMOVE (E) ROCK FOUNDATION

1 EAST WING FOUNDATION DEMOLITION PLAN
1/8"=1'-0"

N

UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff Consulting Engineers
111 SW 5th Avenue
Suite 2500
Portland, Oregon 97204
503-227-3251

PRELIMINARY NOT FOR CONSTRUCTION

CLOUD CAP INN
EAST WING
REPAIR
MT HOOD
HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

MARK	DATE	DESCRIPTION

ISSUE INFORMATION	NOV. 8, 2005
PROJECT NO.	204351
CAD DWG FILE:	
DESIGNED BY:	HR
DRAWN BY:	MDF
CHECKED BY:	CT

EAST WING
FOUNDATION
DEMOLITION

NOTES:

1. (E) INDICATES EXISTING.
2. CONTRACTOR TO VERIFY ALL EXISTING CONDITIONS, DIMENSIONS AND ELEVATIONS PRIOR TO FABRICATION AND ERECTION AND NOTIFY USFS OF ANY SIGNIFICANT DISCREPANCIES FROM THAT SHOWN ON THE DRAWINGS.
3. CONTRACTOR TO SHORE ALL EXISTING FRAMING AS REQUIRED FOR DEMOLITION AND RETRAMING WORK.
4. ALL EXPOSED (E) FRAMING LUMBER SHALL BE INSPECTED FOR DAMAGE BY THE CONTRACTOR AND FINDINGS REPORTED TO THE USFS.
5. INDICATES (E) STRUCTURE TO BE REMOVED AND REPLACED

DISCONNECT ALL PIPING TO (E) SINK AND DRAIN AS REQUIRED TO PREVENT FUTURE USE

1 EAST WING CEILING DEMOLITION PLAN

UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Regi

PROJECT TEAM

kpff Consulting Engineers

111 SW 5th Avenue Suite 2500 Portland, OR 97204 503-227-3251

PRELIMINARY NOT FOR CONSTRUCTION

CLOUD CAP INN EAST WING REPAIR MT HOOD HOOD RIVER

FOREST SUPERVISOR	DA
FOREST ENGINEER	DA
DISTRICT RANGER	DA

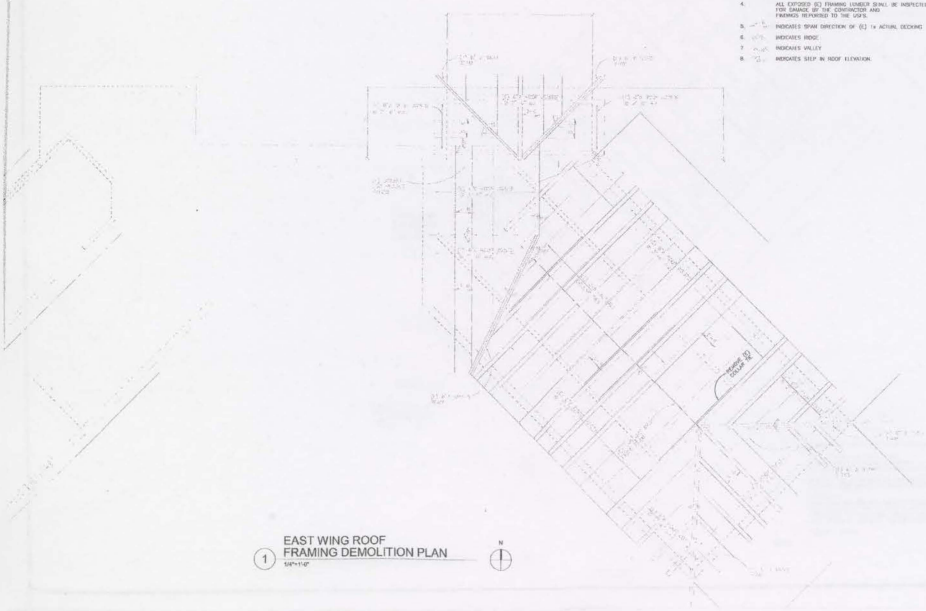
MARK	DATE	DESCRIPTION

ISSUE INFORMATION	NOV. 15, 2021
PROJECT NO.	204.431
CAD DWG FILE	
DESIGNED BY	TR
DRAWN BY	BDF
CHECKED BY	CT

EAST WING CEILING DEMOLITION

NOTES:

1. (E) INDICATES EXISTING.
2. CONTRACTOR TO VERIFY ALL EXISTING CONDITIONS, DIMENSIONS AND CLEARANCES PRIOR TO FABRICATION AND ERECTION AND NOTIFY USFS OF ANY SIGNIFICANT DISCREPANCIES FROM THAT SHOWN ON THE DRAWINGS.
3. CONTRACTOR TO SHORE ALL EXISTING FRAMING AS REQUIRED FOR DEMOLITION AND REFRAMING WORK.
4. ALL EXPOSED (E) FRAMING LUMBER SHALL BE INSPECTED FOR DAMAGE BY THE CONTRACTOR AND FRAMINGS REVIEWED TO THE USFS.
5. INDICATES SPAN DIRECTION OF (E) 1x ACTUAL DECKING
6. INDICATES RIDGE
7. INDICATES VALLEY
8. INDICATES STEP IN ROOF ELEVATION.



1 EAST WING ROOF FRAMING DEMOLITION PLAN
1/4"=1'-0"

N

UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff Consulting Engineers
111 SW 5th Avenue
Suite 2500
Portland, Oregon 97204
503-727-3257

PRELIMINARY NOT FOR CONSTRUCTION

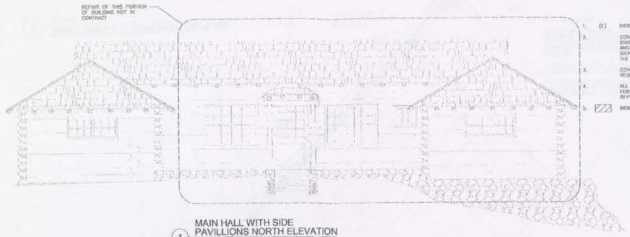
CLOUD CAP INN
EAST WING
REPAIR
MT HOOD
HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

MARK	DATE	DESCRIPTION

ISSUE INFORMATION	NOV. 8, 2005
PROJECT NO:	204.33
CAD DWG FILE:	
DESIGNED BY:	TF
DRAWN BY:	BDF
CHECKED BY:	CT

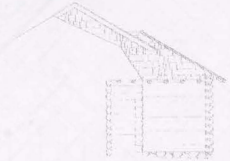
EAST WING
ROOF FRAMING



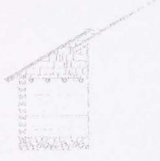
1. (E) INDICATES EXISTING.
2. CONTRACTOR SO VERIFY ALL EXISTING CONDITIONS, DIMENSIONS AND ELEVATIONS PRIOR TO FABRICATION AND ERECTION AND NOTIFY KPFF OF ANY SIGNIFICANT DISCREPANCIES FROM THAT SHOWN ON THE DRAWINGS.
3. CONTRACTOR TO BRACE ALL EXISTING FRAMING AS REQUIRED FOR DEMOLITION AND REFRAMING WORK.
4. ALL EXPOSED FRAMING LUMBER SHALL BE INSPECTED FOR DRYNESS BY THE CONTRACTOR AND FINDINGS REPORTED TO THE USFS.
5. INDICATES (E) STRUCTURE TO BE REMOVED & REPLACED.

1 MAIN HALL WITH SIDE PAVILLIONS NORTH ELEVATION
SCALE

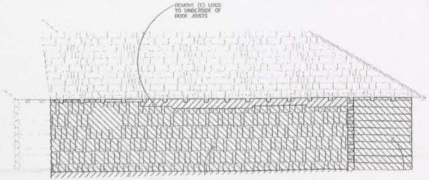
4 EAST WING NORTH ELEVATION
SCALE

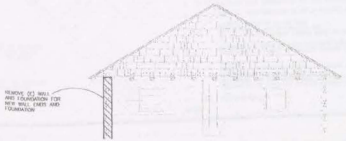


3 EAST WING PAVILION ELEVATION
SCALE



2 EAST WING PAVILION ELEVATION
SCALE





UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff
Consulting Engineers
111 SW 5th Avenue
Suite 1500
Portland, Oregon 97204
503-227-3251

PRELIMINARY
NOT FOR
CONSTRUCTION

CLOUD CAP INN
EAST WING
REPAIR
MT HOOD
HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

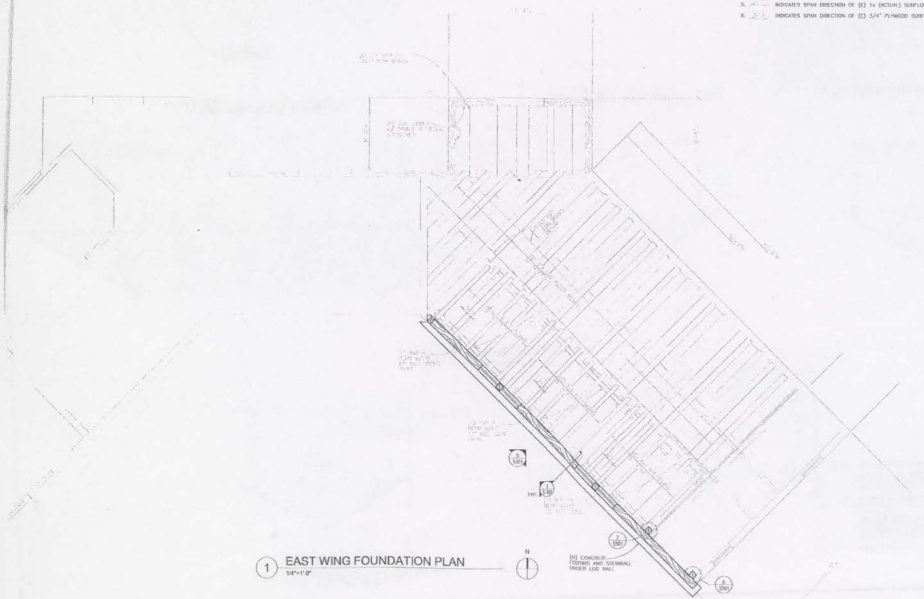
MARK	DATE	DESCRIPTION

ISSUE INFORMATION	NOV. 8, 2002
PROJECT NO.	204331
CAD DWG FILE:	
DESIGNED BY:	TR
DRAWN BY:	BDF
CHECKED BY:	CT

WALL

NOTES:

1. (E) INDICATES EXISTING
2. CONTRACTOR TO VERIFY ALL EXISTING CONDITIONS, DIMENSIONS AND ELEVATIONS PRIOR TO FABRICATION AND ERECTION AND NOTIFY KPFF OF ANY SIGNIFICANT DISCREPANCIES FROM THAT SHOWN ON THE DRAWINGS.
3. CONTRACTOR TO SHORE ALL EXISTING FRAMING AS REQUIRED FOR DEMOLITION AND RETRAMING WORK.
4. ALL EXPOSED (E) FRAMING LUMBER SHALL BE INSPECTED FOR DAMAGE BY THE CONTRACTOR AND DAMAGES REPORTED TO SHP KPFF.
5. INDICATES SPAN DIRECTION OF (E) 1x (ACTUAL) SUBFLOORING
6. INDICATES SPAN DIRECTION OF (E) 3/4" PLYWOOD SUBFLOORING



1 EAST WING FOUNDATION PLAN
1/4"=1'-0"

UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff Consulting Engineers
111 SW 5th Avenue
Suite 2500
Portland, Oregon 97204
503.227.3251

PRELIMINARY NOT FOR CONSTRUCTION

CLOUD CAP INN
EAST WING
REPAIR
MT HOOD
HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

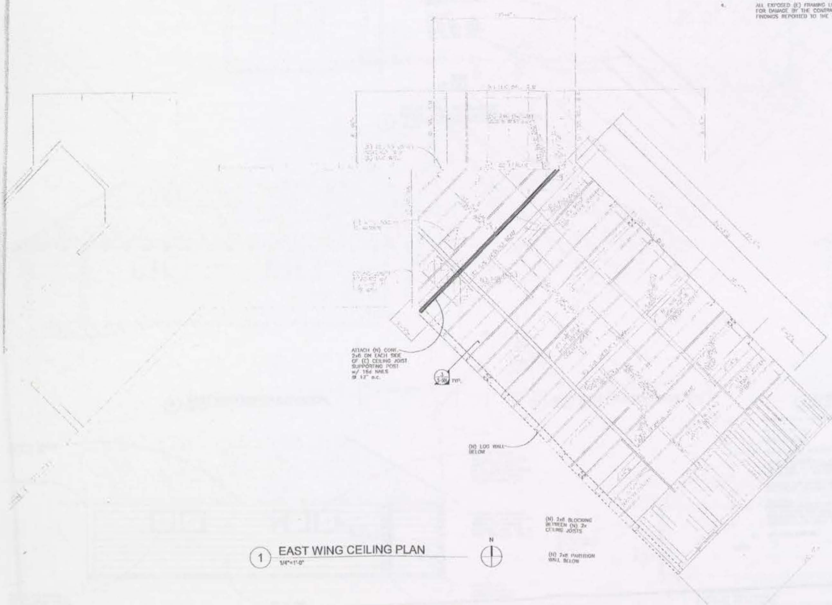
MARK	DATE	DESCRIPTION

ISSUE INFORMATION	NOV. 8, 2005
PROJECT NO.	204331
CAD DWG FILE:	
DESIGNED BY:	TR
DRAWN BY:	BDF
CHECKED BY:	CT

EAST WING
FOUNDATION PLAN

NOTES:

1. (E) INDICATES EXISTING.
2. CONTRACTOR TO VERIFY ALL EXISTING CONDITIONS, DIMENSIONS AND ELEVATIONS PRIOR TO FABRICATION AND ERECTION AND NOTIFY USFS OF ANY SIGNIFICANT DISCREPANCIES FROM THAT SHOWN ON THE DRAWINGS.
3. CONTRACTOR TO SHORE ALL EXISTING FRAMING AS REQUIRED FOR DEMOLITION AND REFRAMING WORK.
4. ALL EXPOSED (E) FRAMING LUMBER SHALL BE INSPECTED FOR DAMAGE BY THE CONTRACTOR AND FINDINGS REPORTED TO THE USFS.



1 EAST WING CEILING PLAN
1/4"=1'-0"

UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff
Consulting Engineers
111 SW 5th Avenue
Suite 2500
Portland, Oregon 97204
503-227-3251

PRELIMINARY NOT FOR CONSTRUCTION

CLOUD CAP INN
EAST WING
REPAIR
MT HOOD
HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

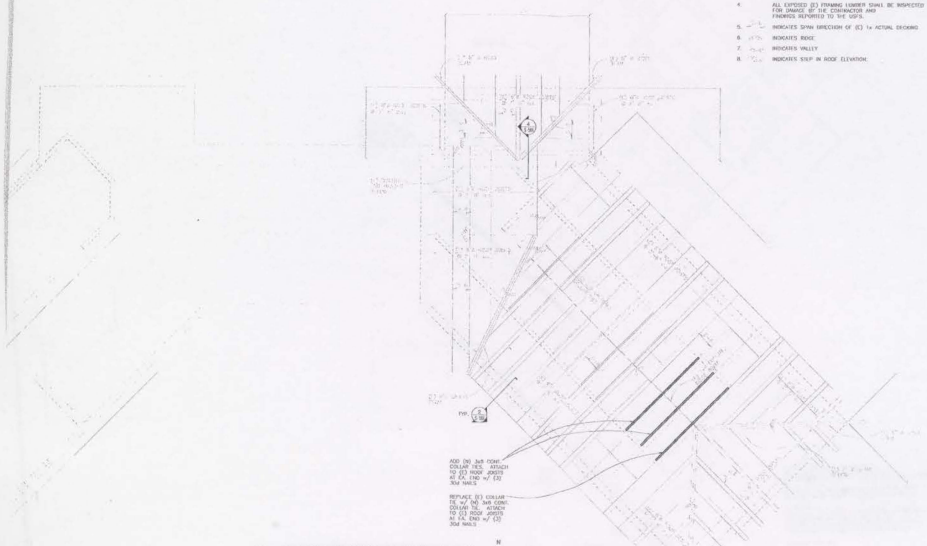
MARK	DATE	DESCRIPTION

ISSUE INFORMATION	NOV. 8, 2005
PROJECT NO:	204331
CAD DWG FILE:	
DESIGNED BY:	IR
DRAWN BY:	BDF
CHECKED BY:	CI

EAST WING
CEILING PLAN

NOTES:

1. (E) INDICATES EXISTING
2. CONTRACTOR TO VERIFY ALL EXISTING CONDITIONS, DIMENSIONS AND ELEVATIONS PRIOR TO FABRICATION AND ERECTION AND NOTIFY USFS OF ANY SIGNIFICANT DISCREPANCIES FROM THAT SHOWN ON THE DRAWINGS.
3. CONTRACTOR TO SHORE ALL EXISTING FRAMING AS REQUIRED FOR DEMOLITION AND REFRAMING WORK.
4. ALL EXPOSED (E) FRAMING LUMBER SHALL BE INSPECTED FOR DAMAGE BY THE CONTRACTOR AND FINDINGS REPORTED TO THE USFS.
5. INDICATES SPAN DIRECTION OF (E) 1x ACTUAL DECKING
6. INDICATES RIDGE
7. INDICATES VALLEY
8. INDICATES STEP IN ROOF ELEVATION



1 EAST WING ROOF FRAMING PLAN
1/4"=1'-0"

UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff Consulting Engineers

111 SW 5th Avenue
Suite 2500
Portland, Oregon 97204
503-227-3251

PRELIMINARY NOT FOR CONSTRUCTION

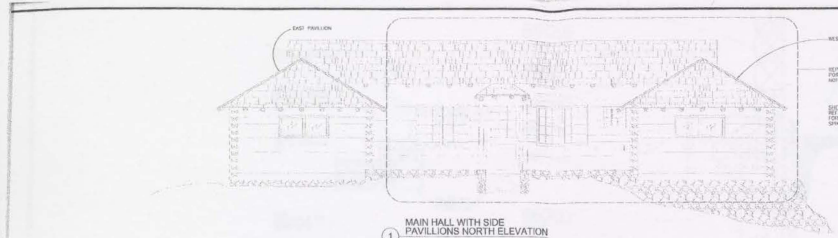
CLOUD CAP INN
EAST WING
REPAIR
MT HOOD
HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

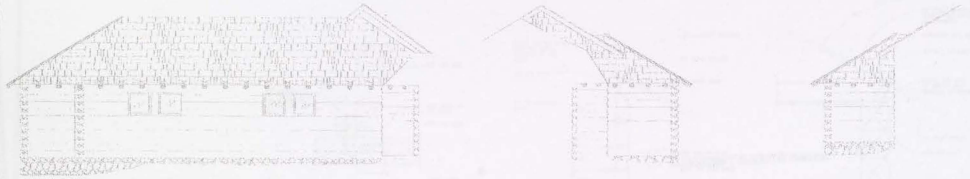
MARK	DATE	DESCRIPTION

ISSUE INFORMATION	NOV. 8, 2005
PROJECT NO.	204331
CAD DWG FILE:	
DESIGNED BY:	TR
DRAWN BY:	BDF
CHECKED BY:	CT

EAST WING ROOF



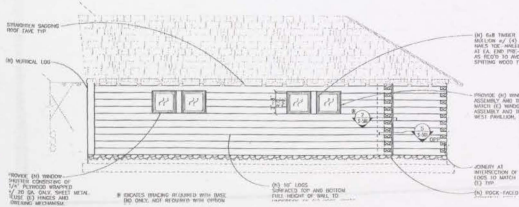
1 MAIN HALL WITH SIDE PAVILLIONS NORTH ELEVATION
SCALE: 1/8"=1'-0"

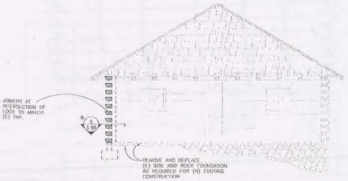


4 EAST WING NORTH ELEVATION
SCALE: 1/8"=1'-0"

3 EAST WING PAVILION ELEVATION
SCALE: 1/8"=1'-0"

2 EAST WING PAVILION ELEVATION
SCALE: 1/8"=1'-0"





UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff Consulting Engineers

111 SW 5th Avenue
Suite 2500
Portland, Oregon 97204
503.227-3251

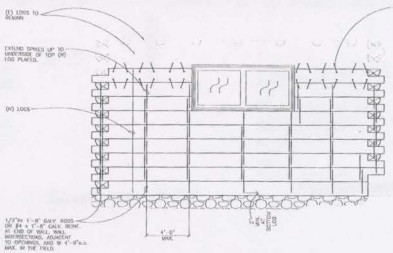
PRELIMINARY NOT FOR CONSTRUCTION

CLOUD CAP INN
EAST WING
REPAIR
MT HOOD
HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

MARK	DATE	DESCRIPTION
ISSUE INFORMATION	NOV. 8, 2005	
PROJECT NO.	204.331	
CAD DWG FILE		
DESIGNED BY	TR	
DRAWN BY	BEF	
CHECKED BY	CT	

WALL



1 TYPICAL WALL SPIKING ELEVATION
1/2"=1'-0"

UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff Consulting Engineers
111 SW 5th Avenue
Suite 2500
Portland, OR 97204
503-227-3251

PRELIMINARY NOT FOR CONSTRUCTION

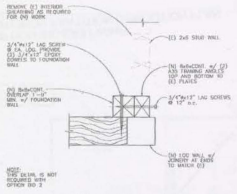
CLOUD CAP INN
EAST WING
REPAIR
MT HOOD
HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

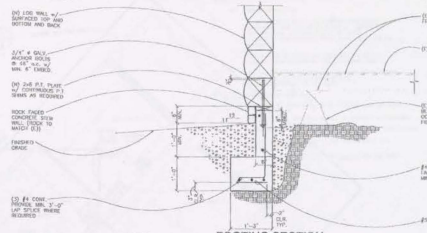
MARK	DATE	DESCRIPTION

ISSUE INFORMATION	NOV. 8, 2005
PROJECT NO.	20433.1
CAD DWG FILE:	
DESIGNED BY:	TR
DRAWN BY:	BDF
CHECKED BY:	CT

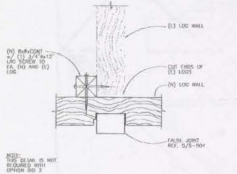
WALL ELEVATIONS



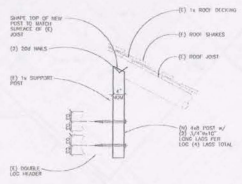
6 TEMPORARY BRACING DETAIL
1"=1'-0"



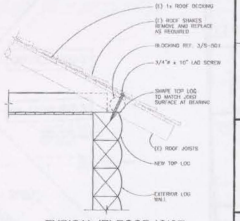
1 FOOTING SECTION
1"=1'-0" S-202



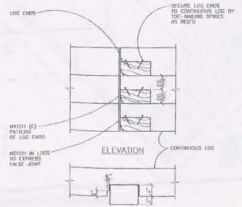
7 TEMPORARY BRACING DETAIL
1"=1'-0"

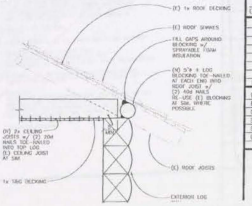


4 RIDGE BEAM SUPPORT DETAIL
1"=1'-0" S-202



2 TYPICAL (E) ROOF JOIST CONN. AT NEW TOP LOG
1"=1'-0" S-202





UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVIC

The Pacific Northwest Regio

PROJECT TEAM

kpff Consulting Engineers

111 SW 5th Avenue Suite 2500 Portland, Oregon 97204 503-227-3251

PRELIMINARY NOT FOR CONSTRUCTION

CLOUD CAP INN EAST WING REPAIR
MT HOOD HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

MARK	DATE	DESCRIPTION

ISSUE INFORMATION	NOV. 8, 2005
PROJECT NO.	204331
CAD DWG FILE	
DESIGNED BY:	RR
DRAWN BY:	DDF
CHECKED BY:	CT

FRAMING

NOTES:

1. (E) INDICATES EXISTING.
2. CONTRACTOR TO VERIFY ALL EXISTING CONDITIONS, DIMENSIONS AND ELEVATIONS PRIOR TO FABRICATION AND ERECTION AND NOTIFY USFS OF ANY SIGNIFICANT DISCREPANCIES FROM THAT SHOWN ON THE DRAWINGS.
3. CONTRACTOR TO SHORE ALL EXISTING FRAMING AS REQUIRED FOR DEMOLITION AND REFRAMING WORK.
4. ALL EXPOSED (E) FRAMING LUMBER SHALL BE INSPECTED FOR DAMAGE BY THE CONTRACTOR AND FINDINGS REPORTED TO THE USFS.
5. INDICATES EXTENT OF (E) STRUCTURE TO BE REMOVED
6. INDICATES (E) LOG WALL
7. DENOTE ON THE SURFACES OF THESE WALLS IS CONSIDERED HISTORICAL AND MUST BE PRESERVED. IF CONSTRUCTION OPTION, HISTORICAL WALLBOARDS MAY BE REMOVED AND REINSTALLED IN THE ORIGINAL LOCATIONS.

OPTION BID 1

OPTION BID 2

REMOVE VERTICAL BOARDS AND BATTENS FROM WALLS TO EXPOSE ORIGINAL HORIZ. BOARDS. TYPICAL ALL WALLS.

REMOVE EXTENT OF (E) PARTITION SHOWN

REF. NOTE 7

REMOVE (1) DOOR

REMOVE (E) LOG WALL

1 OPTION BID-EAST WING
INTERIOR PARTITION DEMOLITION PLAN
1/4"=1'-0"

N

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff
Consulting Engineers
111 SW 5th Avenue
Suite 2500
Portland, OR 97204
503.227.3251

PRELIMINARY
NOT FOR
CONSTRUCTION

CLOUD CAP INN
EAST WING
REPAIR
MT HOOD
HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

MARK	DATE	DESCRIPTION

ISSUE INFORMATION	MARCH 29, 2005
PROJECT NO.	264331
CAD DWG FILE:	
DESIGNED BY:	TR
DRAWN BY:	RDF
CHECKED BY:	CE

OPTION BID-
EAST WING
INTERIOR

NOTES:

1. (E) INDICATES EXISTING
2. CONTRACTOR TO VERIFY ALL EXISTING CONDITIONS, DIMENSIONS AND ELEVATIONS PRIOR TO FABRICATION AND ERECTION AND NOTIFY USFS OF ANY SIGNIFICANT DISCREPANCIES FROM THAT SHOWN ON THE DRAWINGS.
3. CONTRACTOR TO SHORE ALL EXISTING FRAMING AS REQUIRED FOR DEMOLITION AND REFRAMING WORK.
4. ALL EXPOSED (E) FRAMING LUMBER SHALL BE INSPECTED FOR DAMAGE BY THE CONTRACTOR AND FINDINGS REPORTED TO THE USFS.
5. INDICATES (E) LOG WALL.
6. INDICATES (E) STRUCTURE TO BE REMOVED AND REPLACED
7. INDICATES SPAN DIRECTION OF (E) 1x (ACTUAL) SUBFLOORING.
8. INDICATES SPAN DIRECTION OF (E) 3/4" PLYWOOD SUBFLOORING.
9. INDICATES MINIMUM EXTENT OF (E) SUBFLOORING AND FLOORING TO BE REMOVED.

OPTION BID 1

REMOVE (E) CONCRETE FOOTING

OPTION BID 2

REMOVE (E) TREE AND STUMP

EXCAVATE 3'-6"x3'-0" CRAWL SPACE AROUND PERIMETER OF BUILDING REF. S0-501

BID OPTION 3: REMOVE SUBFLOORING AND FLOORING

REMOVE (E) LOG WALL

REMOVE THIS ADDITION IN ITS ENTIRETY UP TO THE (E) ROOF JOISTS

1 OPTIONS BID-EAST WING FOUNDATION DEMOLITION PLAN
1/4"=1'-0"

N

UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff Consulting Engineers
111 SW 5th Avenue
Suite 2500
Portland, Oregon 97204
503-227-3251

PRELIMINARY NOT FOR CONSTRUCTION

CLOUD CAP INN EAST WING REPAIR
MT HOOD
HOOD RIVER

FOREST SUPERVISOR DATE

FOREST ENGINEER DATE

DISTRICT RANGER DATE

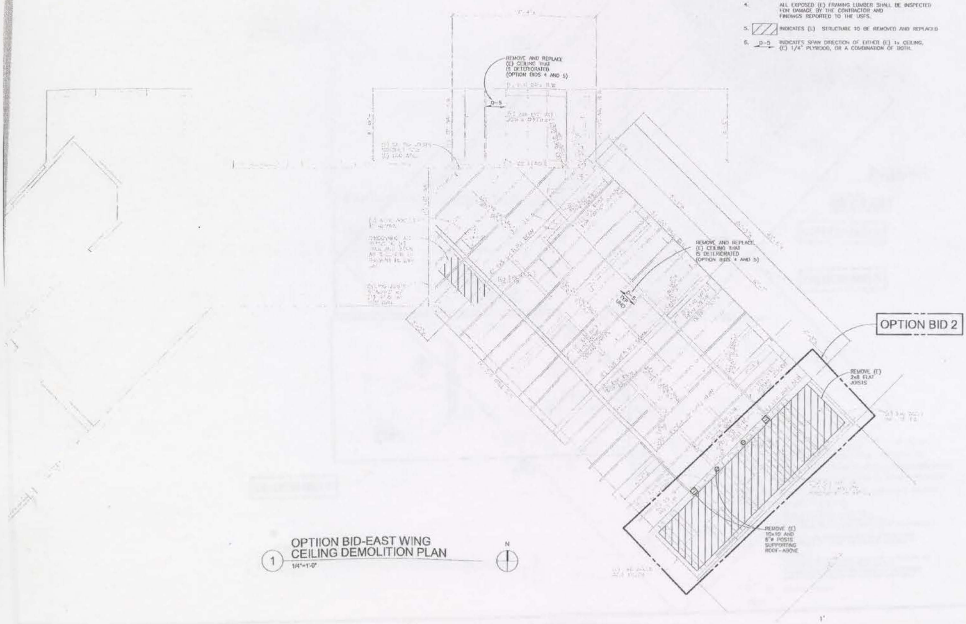
MARK	DATE	DESCRIPTION

ISSUE INFORMATION	MARCH 29, 2005
PROJECT NO.	104331
CAD DWG FILE:	
DESIGNED BY:	TR
DRAWN BY:	BCF
CHECKED BY:	CT

OPTION BID-EAST WING FOUNDATION DEMOLITION

NOTES:

1. (E) INDICATES EXISTING.
2. CONTRACTOR TO VERIFY ALL EXISTING CONDITIONS, DIMENSIONS AND ELEVATIONS PRIOR TO FABRICATION AND ERECTION AND NOTIFY USFS OF ANY SIGNIFICANT DISCREPANCIES FROM THAT SHOWN ON THE DRAWINGS.
3. CONTRACTOR TO SHORE ALL EXISTING FRAMING AS REQUIRED FOR DEMOLITION AND REFRAMING WORK.
4. ALL EXPOSED (E) FRAMING LUMBER SHALL BE INSPECTED FOR DAMAGE BY THE CONTRACTOR AND FINDINGS REPORTED TO THE USFS.
5. [hatched box] INDICATES (E) STRUCTURE TO BE REMOVED AND REPLACED
6. D-5 (arrow) INDICATES SPAN DIRECTION OF EITHER (E) 1x CEILING, (E) 1/4" PLYWOOD, OR A COMBINATION OF BOTH.



1 OPTIION BID-EAST WING CEILING DEMOLITION PLAN
1/4"=1'-0"

UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff Consulting Engineers
111 SW 5th Avenue
Suite 2500
Portland, Oregon 97204
503-227-3251

PRELIMINARY NOT FOR CONSTRUCTION

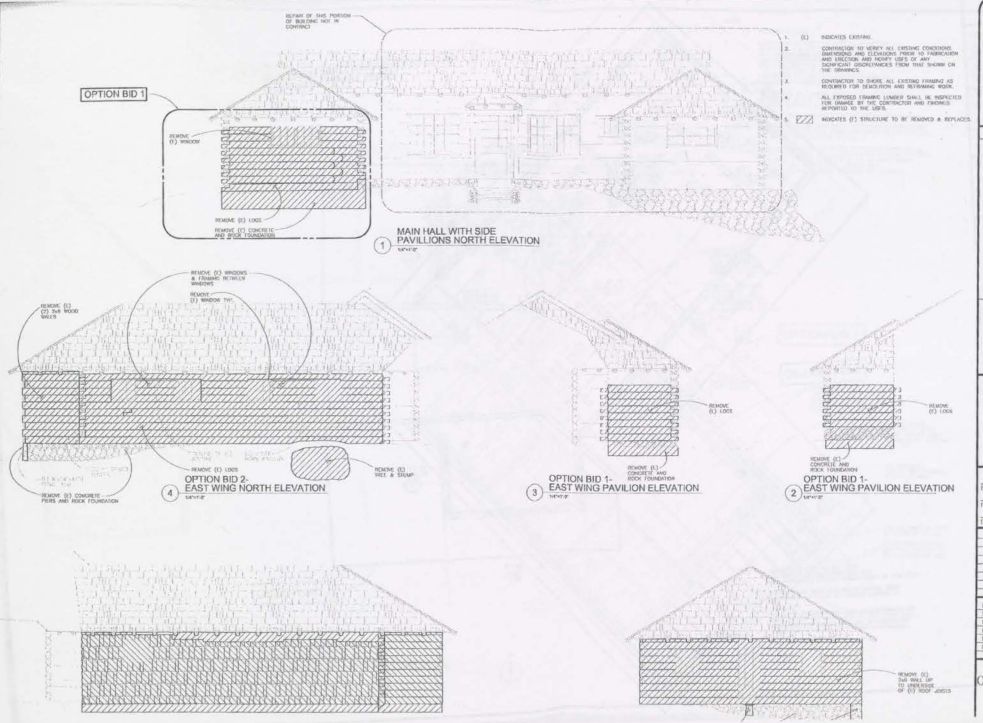
CLOUD CAP INN
EAST WING
REPAIR
MT HOOD
HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

MARK	DATE	DESCRIPTION

ISSUE INFORMATION	MARCH 29, 2005
PROJECT NO:	204331
CAD DWG FILE:	
DESIGNED BY:	TR
DRAWN BY:	BDF
CHECKED BY:	CT

OPTION BID–EAST WING CEILING DEMOLITION PLAN



UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff Consulting Engineers

111 SW 5th Avenue Suite 2500 Portland, Oregon 97204 503-727-3251

PRELIMINARY NOT FOR CONSTRUCTION

CLOUD CAP INN EAST WING REPAIR MT HOOD HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

MARK	DATE	DESCRIPTION

ISSUE INFORMATION	MARCH 28, 2005
PROJECT NO.	204331
CAD DWG FILE:	
DESIGNED BY:	TR
DRAWN BY:	BDF
CHECKED BY:	CT

OPTION BID-WALL DEMOLITION ELEVATIONS

NOTES:

1. (E) INDICATES EXISTING.
2. CONTRACTOR TO VERIFY ALL EXISTING CONDITIONS, DIMENSIONS AND ELEVATIONS PRIOR TO FABRICATION AND INSTALLATION OF ALL NEW ITEMS. NOTIFY USTS OF ANY SIGNIFICANT DISCREPANCIES FROM THIS SHOWN ON THE DRAWINGS.
3. CONTRACTOR TO SHORE ALL EXISTING FRAMING AS REQUIRED FOR DEMOLITION AND REFRAMING WORK.
4. ALL EXPOSED (E) FRAMING LUMBER SHALL BE INSPECTED FOR DAMAGE BY THE CONTRACTOR AND FINDINGS REPORTED TO THE USFS.

OPTION BID 1

OPTION BID 2

TYP. OPTION BID NO. 6&7

WOOD STORAGE ROOM

(N) INTERIOR PARTITION TO MATCH (E)

REMOVE (E) DOOR OPENING

INFILL (E) DOOR OPENING

REMAND (E) DOORS

REF. 2/S0-301 FOR NEW WALL

NEW DOOR TO MATCH CONSTRUCTION OF NORTH MAIN ENTRY DOOR

1 OPTION BID-EAST WING INTERIOR PARTITION FLOOR PLAN
1/4"=1'-0"

N

UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff Consulting Engineers

111 SW 5th Avenue
Suite 1920
Portland, Oregon 97204
503-227-3251

PRELIMINARY NOT FOR CONSTRUCTION

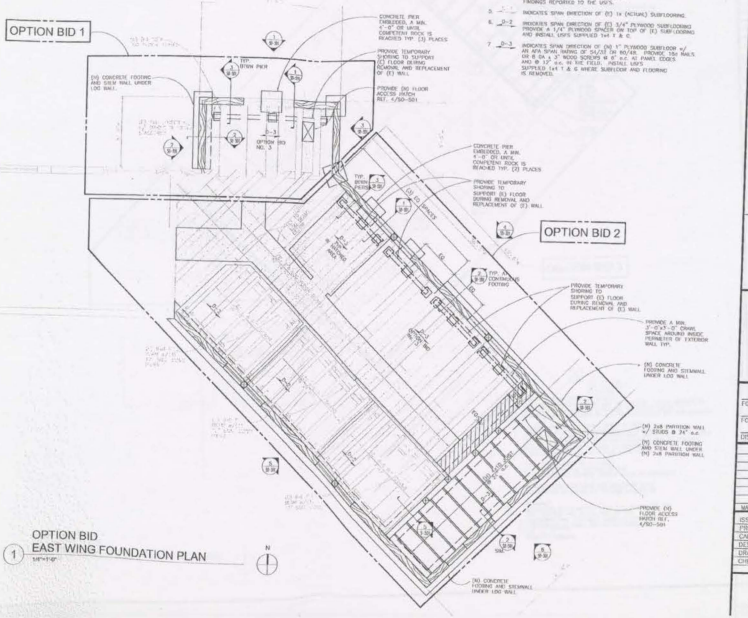
CLOUD CAP INN
EAST WING
REPAIR
MT HOOD
HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

MARK	DATE	DESCRIPTION

ISSUE INFORMATION	MARCH 29, 2002
PROJECT NO.	204331
CAD DWG FILE	
DESIGNED BY:	BR
DRAWN BY:	BDF
CHECKED BY:	CS

OPTION BID-
EAST WING
INTERIOR



OPTION BID
1 EAST WING FOUNDATION PLAN
1/4"=1'-0"

N

NOTES:

1. (E) INDICATES EXISTING.
2. CONTRACTOR TO VERIFY ALL EXISTING CONDITIONS, DIMENSIONS AND ELEVATIONS PRIOR TO FABRICATION AND ERECTION AND NOTIFY USFS OF ANY SIGNIFICANT DISCREPANCIES FROM THAT SHOWN ON THE DRAWINGS.
3. CONTRACTOR TO SHORE ALL EXISTING FRAMING AS REQUIRED FOR DEMOLITION AND RETURNING WORK.
4. ALL EXPOSED (E) FRAMING LUMBER SHALL BE INSPECTED FOR DAMAGE BY THE CONTRACTOR AND FINDINGS REPORTED TO THE USFS.
5. INDICATES SPAN DIRECTION OF (E) 1x (NOMINAL) SUBFLOORING.
6. PROVIDES SPAN DIRECTION OF (E) 3/4" PLYWOOD SUBFLOORING PROVIDE A 1/4" PLYWOOD SPACER ON TOP OF (E) SUBFLOORING AND INSTALL USFS SUPPLIED 1x4 T & G.
7. INDICATES SPAN DIRECTION OF (N) 1" PLYWOOD SUBFLOOR w/ AN APA SPAN RATING OF 24/32 OR WO/AIR. PROVIDE 10d NAILS @ 6" o.c. AT WOOD BORDERS @ 6" o.c. AT PANEL EDGES AND @ 12" o.c. IN RE. FIELD. INSTALL USFS SUPPLIED 1x4 T & G WHERE SUBFLOOR AND FLOORING IS REMOVED.

UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff Consulting Engineers

111 SW 5th Avenue Suite 2500 Portland, OR 97204 503.227.3251

PRELIMINARY NOT FOR CONSTRUCTION

CLOUD CAP INN EAST WING REPAIR MT HOOD HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

MARK	DATE	DESCRIPTION

ISSUE INFORMATION	MARCH 28, 2005
PROJECT NO.	204331
CAD DWG FILE:	
DESIGNED BY:	TR
DRAWN BY:	BDF
CHECKED BY:	CF

OPTION BID-

NOTES:

1. (E) INDICATES EXISTING.
2. CONTRACTOR TO VERIFY ALL EXISTING CONDITIONS, DIMENSIONS AND ELEVATIONS PRIOR TO FABRICATION AND ERECTION AND NOTIFY USFS OF ANY SIGNIFICANT DISCREPANCIES FROM THAT SHOWN ON THE DRAWINGS.
3. CONTRACTOR TO SHORE ALL EXISTING FRAMING AS REQUIRED FOR DEMOLITION AND REFRAMING WORK.
4. ALL EXPOSED (E) FRAMING LUMBER SHALL BE INSPECTED FOR DAMAGE BY THE CONTRACTOR AND FINDINGS REPORTED TO THE USFS.
5. D-4 INDICATES SPAN DIRECTION OF (N) 1x4 T AND G DOUGLAS FIR DECKING ATTACHED TO UNDERSIDE OF CEILING JOISTS w/ RING SHANK NAILS MATCHING SIZE OF EXISTING FASTENERS. INSTALL (N) 1x DECKING ONLY WHERE DIRECTED BY USFS WHERE (E) CEILING IS DETERIORATED AND/OR REMOVED. FINISH SURFACE OF (N) 1x DECKING SHALL BE SANDED.
6. D-7 INDICATES SPAN DIRECTION OF (N) USFS FURNISHED 1x4 T&G DOUGLAS FIR DECKING ATTACHED TO UNDERSIDE OF CEILING JOISTS w/ RING SHANK NAILS MATCHING SIZE OF EXISTING. FINISH SURFACE OF (N) 1x DECKING SHALL BE SANDED.

1 OPTION BID- EAST WING CEILING PLAN
1/4"=1'-0"

UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff Consulting Engineers
111 SW 5th Avenue Suite 2500
Portland, Oregon 97204
503-227-3251

PRELIMINARY NOT FOR CONSTRUCTION

CLOUD CAP INN
EAST WING REPAIR
MT HOOD
HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

MARK	DATE	DESCRIPTION

ISSUE INFORMATION	MARCH 29, 2005
PROJECT NO:	204331
CAD DWG FILE:	
DESIGNED BY:	TR
DRAWN BY:	DDF
CHECKED BY:	CT

OPTION BID- EAST WING

NOTES:

1. (E) INDICATES EXISTING.
2. CONTRACTOR TO VERIFY ALL EXISTING CONDITIONS, DIMENSIONS AND ELEVATIONS PRIOR TO FABRICATION AND ERECTION AND NOTIFY KPFF OF ANY SIGNIFICANT DISCREPANCIES FROM THIS SHEET OR ON THE DRAWINGS.
3. CONTRACTOR TO SHORE ALL EXISTING FRAMING AS REQUIRED FOR DEMOLITION AND RETAINING WORK.
4. ALL EXPOSED (E) FRAMING LUMBER SHALL BE INSPECTED FOR DAMAGE BY THE CONTRACTOR AND FINDINGS REPORTED TO THE KPFF.
5. INDICATES SPAN DIRECTION OF (E) 1x ACTUAL DECKING
6. INDICATES RIDGE
7. INDICATES VALLEY
8. INDICATES SKIP IN ROOF ELEVATION

TYP. AT NEW TOP LOG ONLY OPTION BID 2

EXT. OPTION BID 2

1 OPTION BID-
EAST WING ROOF FRAMING PLAN
1/8"=1'-0"

N

UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff
Consulting Engineers

111 SW 5th Avenue
Suite 2500
Portland, Oregon 97204
503-227-3251

PRELIMINARY
NOT FOR
CONSTRUCTION

CLOUD CAP INN
EAST WING
REPAIR
MT HOOD
HOOD RIVER

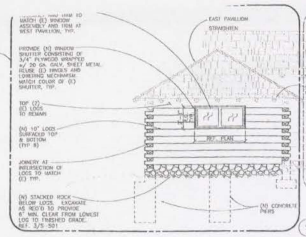
FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

MARK	DATE	DESCRIPTION

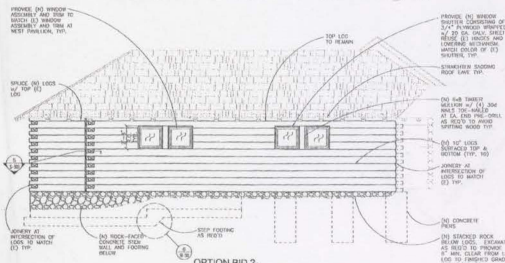
ISSUE INFORMATION	MARCH 28, 2005
PROJECT NO.	204331
CAD DWG FILE	
DESIGNED BY:	IR
DRAWN BY:	BDF
CHECKED BY:	CT

OPTION BID-
EAST WING ROOF

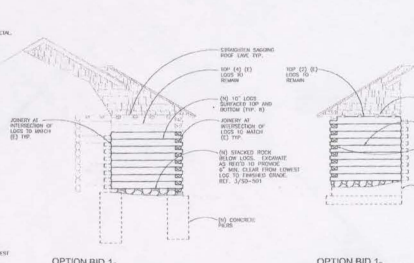
OPTION BID 1



1 MAIN HALL WITH SIDE PAVILLIONS NORTH ELEVATION

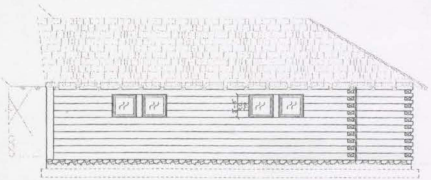


4 OPTION BID 2- EAST WING NORTH ELEVATION

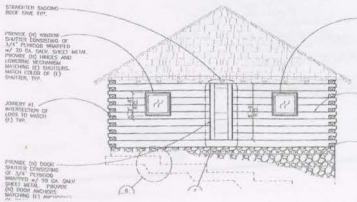


3 OPTION BID 1- EAST WING PAVILION ELEVATION

2 OPTION BID 1- EAST WING PAVILION ELEVATION



BASE BID



UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff Consulting Engineers

111 SW 5th Avenue, Suite 2500
Portland, OR 97204
503.227-3251

PRELIMINARY NOT FOR CONSTRUCTION

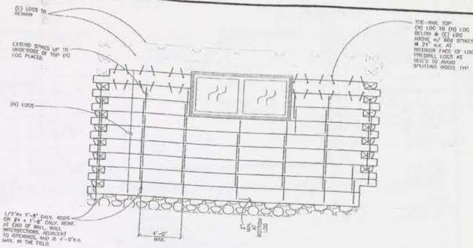
CLOUD CAP INN EAST WING REPAIR MT HOOD HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

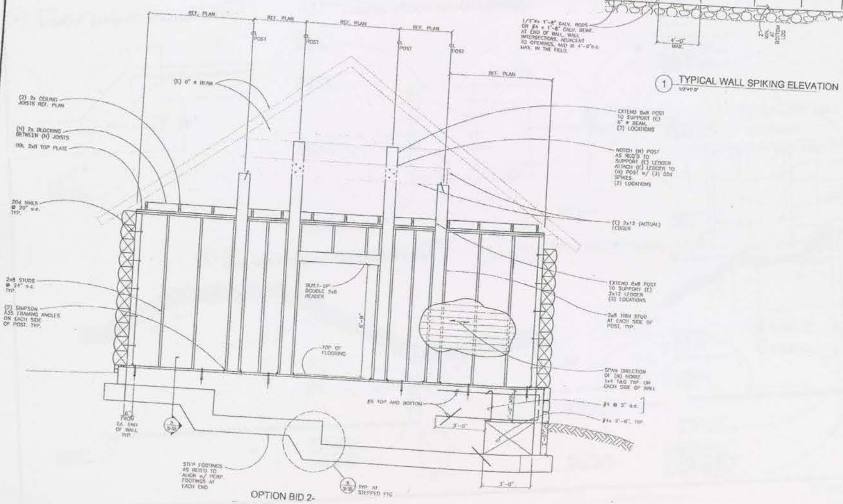
MARK	DATE	DESCRIPTION

ISSUE INFORMATION	MARCH 29, 2005
PROJECT NO.	204331
CAD DWG FILE	
DESIGNED BY:	JR
DRAWN BY:	BDF
CHECKED BY:	CI

OPTION BID- WALL



1 TYPICAL WALL SPIKING ELEVATION



OPTION BID 2-

UNITED STATE DEPARTMENT OF AGRICULTURE FOREST SERVIC

The Pacific Northwest Regio

PROJECT TEAM

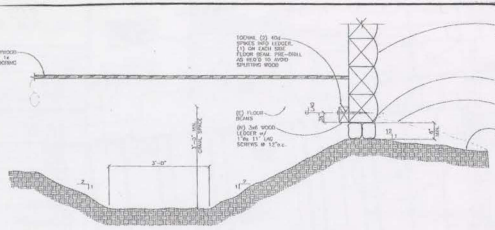
kpff Consulting Engineers
111 SW 5th Avenue, Suite 2500
Portland, Oregon 97204
503-227-3251

PRELIMINARY NOT FOR CONSTRUCTION

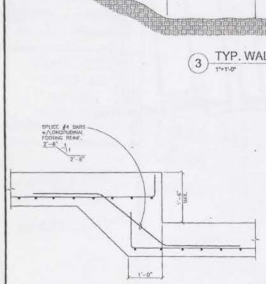
CLOUD CAP INN
EAST WING
REPAIR
MT HOOD
HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

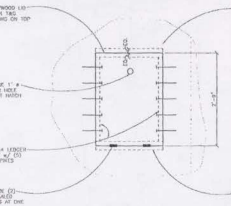
MARK	DATE	DESCRIPTION
ISSUE INFORMATION		MARCH 29, 2005
PROJECT NO:		204331
CAD DWG FILE:		
DESIGNED BY:		TR
DRAWN BY:		BDF
CHECKED BY:		CT



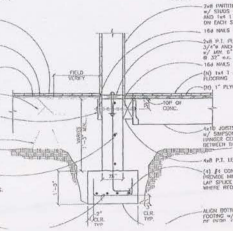
3 TYP. WALL SECTION BETWEEN PIERS
1"=1'-0" SO-202

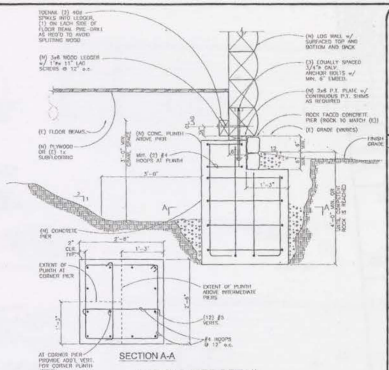


6 TYPICAL STEPPED FOOTING DETAIL
1"=1'-0" SO-202

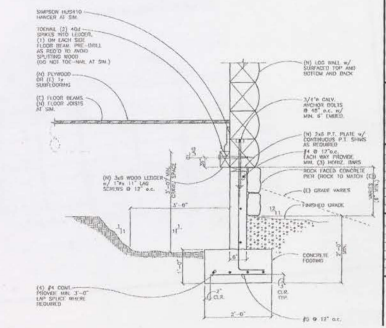


4 TYPICAL FLOOR HATCH FRAMING
1"=1'-0" SO-203





1 TYPICAL PIER DETAIL
1"=1'-0" SO-202



UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff
Consulting Engineers
111 SW 5th Avenue
Suite 2500
Portland, OR 97204
503-227-3251

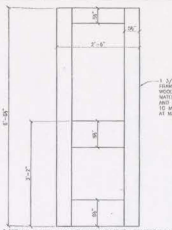
PRELIMINARY NOT FOR CONSTRUCTION

CLOUD CAP IN EAST WING REPAIR
MT HOOD
HOOD RIVER

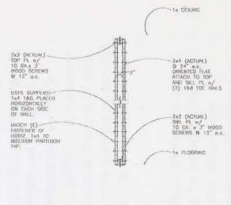
FOREST SUPERVISOR	E
FOREST ENGINEER	D
DISTRICT RANGER	D

MARK	DATE	DESCRIPTION
ISSUE INFORMATION		MARCH 29, 2
PROJECT NO.		204331
CAD DWG FILE:		
DESIGNED BY:		IR
DRAWN BY:		IR/F
CHECKED BY:		CT

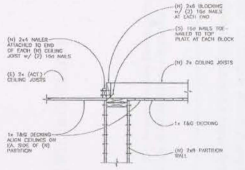
OPTION BID–FRAMING



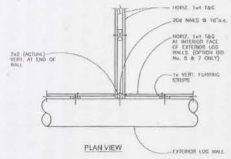
4 NEW EXTERIOR DOOR ELEVATION
1"=1'-0" S-202



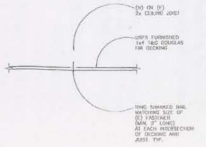
1 TYPICAL INTERIOR PARTITION WALL
1"=1'-0" SO-202

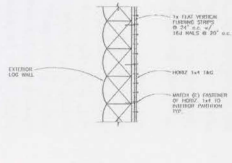


5 TOP OF (N) PARTITION WALL DETAIL
1"=1'-0" SO-202



2 TYP. INTERIOR PARTITION TO EXTERIOR WALL
1"=1'-0" SO-202





OPTION BID No. 6 & 7

UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE

The Pacific Northwest Region

PROJECT TEAM

kpff Consulting Engineers

111 SW 5th Avenue Suite 2500 Portland, Oregon 97204 503 227 3251

PRELIMINARY NOT FOR CONSTRUCTION

CLOUD CAP INN EAST WING REPAIR MT HOOD HOOD RIVER

FOREST SUPERVISOR	DATE
FOREST ENGINEER	DATE
DISTRICT RANGER	DATE

MARK	DATE	DESCRIPTION

ISSUE INFORMATION	MARCH 29, 2005
PROJECT NO.	264331
CAD DWG FILE:	
DESIGNED BY:	TR
DRAWN BY:	BDF
CHECKED BY:	CT

OPTION BID FRAMING DETAILS

2 Preservation Briefs

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

Repointing Mortar Joints in Historic Masonry Buildings

Robert C. Mack, FAIA, and John P. Speweik

»Historical Background
Identifying the Problem Before Repointing

»Finding an Appropriate Mortar Match
»Properties of Mortar
»Mortar Analysis
»Components of Mortar
»Mortar Type and Mix
»Budgeting and Scheduling
»Contractor Selection
»Execution of the Work
»Visually Examining the Mortar and the Masonry Units
»Summary
»Conclusion
»Selected Reading

A NOTE TO OUR USERS: The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

Masonry--brick, stone, terra-cotta, and concrete block--is found on nearly every historic building. Structures with all-masonry exteriors come to mind immediately, but most other buildings at least have masonry foundations or chimneys. Although generally considered "permanent," masonry is subject to deterioration, especially at the mortar joints. Repointing, also known simply as "pointing"or--somewhat inaccurately--"tuck pointing"*, is the process of removing deteriorated mortar from the joints of a masonry wall and replacing it with new mortar. Properly done, repointing restores the visual and physical integrity of the masonry. Improperly done, repointing not only detracts from the appearance of the building, but may also cause physical damage to the masonry units themselves.

The purpose of this Brief is to provide general guidance on appropriate materials and methods for repointing historic masonry buildings and it is intended to benefit building owners, architects, and contractors. The Brief should serve as a guide to prepare specifications for repointing historic masonry buildings. It should also help develop sensitivity to the particular needs of historic masonry, and to assist historic building owners in working cooperatively with architects, architectural conservators and historic

preservation consultants, and contractors. Although specifically intended for historic buildings, the guidance is appropriate for other masonry buildings as well. This publication updates *Preservation Briefs 2: Repointing Mortar Joints in Historic Brick Buildings* to include all types of historic unit masonry. The scope of the earlier Brief has also been expanded to acknowledge that the many buildings constructed in the first half of the 20th century are now historic and eligible for listing in the National Register of Historic Places, and that they may have been originally constructed with portland cement mortar.

**Tuckpointing technically describes a primarily decorative application of a raised mortar joint or lime putty joint on top of flush mortar joints.*

Historical Background

Mortar consisting primarily of lime and sand has been used as an integral part of masonry structures for thousands of years. Up until about the mid-19th century, lime or quicklime (sometimes called lump lime) was delivered to construction sites, where it had to be slaked, or combined with water. Mixing with water caused it to boil and resulted in a wet lime putty that was left to mature in a pit or wooden box for several weeks, up to a year. Traditional mortar was made from lime putty, or slaked lime, combined with local sand, generally in a ratio of 1 part lime putty to 3 parts sand by volume. Often other ingredients, such as crushed marine shells (another source of lime), brick dust, clay, natural cements, pigments, and even animal hair were also added to mortar, but the basic formulation for lime putty and sand mortar remained unchanged for centuries until the advent of portland cement or its forerunner, Roman cement, a natural, hydraulic cement.

Portland cement was patented in Great Britain in 1824. It was named after the stone from Portland in Dorset which it resembled when hard. This is a fast-curing, hydraulic cement which hardens under water. Portland cement was first manufactured in the United States in 1872, although it was imported before this date. But it was not in common use throughout the country until the early 20th century. Up until the turn of the century portland cement was considered primarily an additive, or "minor ingredient" to help accelerate mortar set time. By the 1930s, however, most masons used a mix of equal parts portland cement and lime putty. Thus, the mortar found in masonry structures built between 1873 and 1930 can range from pure lime and sand mixes to a wide variety of lime, portland cement, and sand combinations.

In the 1930s more new mortar products intended to hasten and simplify masons' work were introduced in the U.S. These included **masonry cement**, a premixed, bagged mortar which is a combination of portland cement and ground limestone, and **hydrated lime**, machine-slaked lime that eliminated the necessity of slaking quicklime into putty at the site.

Identifying the Problem Before Repointing

The decision to repoint is most often related to some obvious sign of deterioration, such as disintegrating mortar, cracks in mortar joints, loose bricks or stones, damp walls, or damaged plasterwork. It is, however, erroneous to assume that repointing alone will solve deficiencies that result from other problems. The root cause of the deterioration--leaking roofs or gutters, differential settlement of the building, capillary action causing rising

damp, or extreme weather exposure--should always be dealt with prior to beginning work.

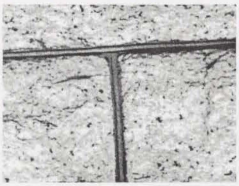
Without appropriate repairs to eliminate the source of the problem, mortar deterioration will continue and any repointing will have been a waste of time and money.

Masons practice using lime putty mortar to repair historic marble. Photo: NPS files.

Use of Consultants. Because there are so many possible causes for deterioration in historic buildings, it may be desirable to retain a consultant, such as a historic architect or architectural conservator, to analyze the building. In addition to determining the most appropriate solutions to the problems, a consultant can prepare specifications which reflect the particular requirements of each job and can provide oversight of the work in progress. Referrals to preservation consultants frequently can be obtained from State Historic Preservation Offices, the American Institute for Conservation of Historic and Artistic Works (AIC), the Association for Preservation Technology (APT), and local chapters of the American Institute of Architects (AIA).

Finding an Appropriate Mortar Match

Preliminary research is necessary to ensure that the proposed repointing work is both physically and visually appropriate to the building. Analysis of unweathered portions of the historic mortar to which the new mortar will be matched can suggest appropriate mixes for the repointing mortar so that it will not damage the building because it is excessively strong or vapor impermeable.



This late 19th century granite has recently been repointed with the joint profile and mortar color carefully matched to the original. Photo: NPS files.

Examination and analysis of the masonry units--brick, stone or terra cotta--and the techniques used in the original construction will assist in maintaining the building's historic appearance. A simple, non-technical, evaluation of the masonry units and mortar can provide information concerning the relative strength and permeability of each--critical factors in selecting the repointing mortar--while a visual analysis of the historic mortar can provide the information necessary for developing the new mortar mix and application techniques.

Although not crucial to a successful repointing project, for projects involving properties of special historic significance, a mortar analysis by a qualified laboratory can be useful by providing information on the original ingredients. However, there are limitations with such an analysis, and replacement mortar specifications should not be based solely on laboratory analysis. Analysis requires interpretation, and there are important factors which affect the condition and performance of the mortar that cannot be established through laboratory analysis. These may include: the original water content, rate of curing, weather conditions during original construction, the method of mixing and

placing the mortar, and the cleanliness and condition of the sand. *The most useful information that can come out of laboratory analysis is the identification of sand by gradation and color.* This allows the color and the texture of the mortar to be matched with some accuracy because sand is the largest ingredient by volume.

In creating a repointing mortar that is compatible with the masonry units, the objective is to achieve one that matches the historic mortar as closely as possible, so that the new material can coexist with the old in a sympathetic, supportive and, if necessary, sacrificial capacity. The exact physical and chemical properties of the historic mortar are not of major significance as long as the new mortar conforms to the following criteria:

- The new mortar must match the historic mortar in **color, texture and tooling.** (If a laboratory analysis is undertaken, it may be possible to match the binder components and their proportions with the historic mortar, if those materials are available.)
- The **sand must match the sand** in the historic mortar. (The color and texture of the new mortar will usually fall into place if the sand is matched successfully.)
- The new mortar must have **greater vapor permeability** and be **softer** (measured in compressive strength) than the masonry units.
- The new mortar must be **as vapor permeable** and **as soft or softer** (measured in compressive strength) than the historic mortar. (Softness or hardness is not necessarily an indication of permeability; old, hard lime mortars can still retain high permeability.)

This mortar is the proper consistency for repointing historic brick. Photo: John P. Speweik.

Mortar Analysis

Methods for analyzing mortars can be divided into two broad categories: **wet chemical** and **instrumental.** Many laboratories that analyze historic mortars use a simple **wet-chemical** method called acid digestion, whereby a sample of the mortar is crushed and then mixed with a dilute acid. The acid dissolves all the carbonate-containing minerals not only in the binder, but also in the aggregate (such as oyster shells, coral sands, or other carbonate-based materials), as well as any other acid-soluble materials. The sand and fine-grained acid-insoluble material is left behind. There are several variations on the simple acid digestion test. One involves collecting the carbon dioxide gas given off as the carbonate is digested by the acid; based on the gas volume the carbnate content of the mortar can be accurately determined (Jedrzejewska, 1960). Simple acid digestion methods are rapid, inexpensive, and easy to perform, but the information they provide about the original composition of a mortar is limited to the color and texture of the sand. The gas collection method provides more information about the binder than a simple acid digestion test.

Instrumental analysis methods that have been used to evaluate mortars include

polarized light or thin-section microscopy, scanning electron microscopy, atomic absorption spectroscopy, X-ray diffraction, and differential thermal analysis. All instrumental methods require not only expensive, specialized equipment, but also highly-trained experienced analysts. However, instrumental methods can provide much more information about a mortar. Thin-section microscopy is probably the most commonly used instrumental method. Examination of thin slices of a mortar in transmitted light is often used to supplement acid digestion methods, particularly to look for carbonate-based aggregate. For example, the new ASTM test method, ASTM C 1324-96 "Test Method for Examination and Analysis of Hardened Mortars" which was designed specifically for the analysis of modern lime-cement and masonry cement mortars, combines a complex series of wet chemical analyses with thin-section microscopy.

The drawback of most mortar analysis methods is that mortar samples of known composition have not been analyzed in order to evaluate the method. Historic mortars were not prepared to narrowly defined specifications from materials of uniform quality; they contain a wide array of locally derived materials combined at the discretion of the mason. While a particular method might be able to accurately determine the original proportions of a lime-cement-sand mortar prepared from modern materials, the usefulness of that method for evaluating historic mortars is questionable unless it has been tested against mortars prepared from materials more commonly used in the past. **Lorraine Schnabel.**

Properties of Mortar

Mortars for repointing should be softer or more permeable than the masonry units and no harder or more impermeable than the historic mortar to prevent damage to the masonry units. It is a common error to assume that hardness or high strength is a measure of appropriateness, particularly for lime-based historic mortars. Stresses within a wall caused by expansion, contraction, moisture migration, or settlement must be accommodated in some manner; in a masonry wall, these stresses should be relieved by the mortar rather than by the masonry units. A mortar that is stronger in compressive strength than the masonry units will not "give," thus causing stresses to be relieved through the masonry units--resulting in permanent damage to the masonry, such as cracking and spalling, that cannot be repaired easily.

While stresses can also break the bond between the mortar and the masonry units, permitting water to penetrate the resulting hairline cracks, this is easier to correct in the joint through repointing than if the break occurs in the masonry units.

Permeability, or rate of vapor transmission, is also critical. High lime mortars are more permeable than denser cement mortars. Historically, mortar acted as a bedding material--not unlike an expansion joint--rather than a "glue" for the masonry units, and moisture was able to migrate through the mortar joints rather than the masonry units. When moisture evaporates from the masonry it deposits any soluble salts either on the surface as *efflorescence* or below the surface as *subflorescence*. While salts deposited on the surface of masonry units are usually relatively harmless, salt crystallization within a masonry unit

creates pressure that can cause parts ofthe outer surface to spall off or delaminate. If the mortar does not permitmoisture or moisture vapor to migrate out of the wall and evaporate, theresult will be damage to the masonry units.

This early 19th century building is being repointed with lime mortar. Photo: Travis McDonald.

Components of Mortar

Sand. Sand is the largest component of mortar and the material that gives mortar its distinctive color, texture and cohesiveness. Sand must be free of impurities, such as salts or clay. The three key characteristics of sand are: particle shape, gradation and void ratios.

When viewed under a magnifying glass or low-power microscope, particles of sand generally have either rounded edges, such as found in beach and river sand, or sharp, angular edges, found in crushed or manufactured sand. For repointing mortar, rounded or natural sand is preferred for two reasons. It is usually similar to the sand in the historic mortar and provides a better visual match. It also has better working qualities or plasticity and can thus be forced into the joint more easily, forming a good contact with the remaining historic mortar and the surface of the adjacent masonry units. Although manufactured sand is frequently more readily available, it is usually possible to locate a supply of rounded sand.

The gradation of the sand (particle size distribution) plays a very important role in the durability and cohesive properties of a mortar. Mortar must have a certain percentage of large to small particle sizes in order to deliver the optimum performance. Acceptable guidelines on particle size distribution may be found in ASTM C 144 (American Society for Testing and Materials). However, in actuality, since neither historic nor modern sands are always in compliance with ASTM C 144, matching the same particle appearance and gradation usually requires sieving the sand.

A scoop of sand contains many small voids between the individual grains. A mortar that performs well fills all these small voids with binder (cement/lime combination or mix) in a balanced manner. Well-graded sand generally has a 30 per cent void ratio by volume. Thus, 30 per cent binder by volume generally should be used, unless the historic mortar had a different binder: aggregate ratio. This represents the 1:3 binder to sand ratios often seen in mortar specifications.

For repointing, sand generally should conform to ASTM C 144 to assure proper gradation and freedom from impurities; some variation may be necessary to match the original size and gradation. Sand color and texture also should match the original as closely as possible to provide the proper color match without other additives.

Lime. Mortar formulations prior to the late-19th century used lime as the primary binding material. Lime is derived from heating limestone at high temperatures which burns off the carbon dioxide, and turns the limestone into quicklime. There are three types of limestone--calcium, magnesium, and dolomitic--differentiated by the different levels of magnesium carbonate they contain which impart specific qualities to mortar. Historically, calcium lime was used for mortar rather than the dolomitic lime (calcium magnesium carbonate) most often used today. But it is also important to keep in mind the fact that the historic limes, and other components of mortar, varied a great deal because they were natural, as opposed to modern lime which is manufactured and, therefore, standardized.

Because some of the kinds of lime, as well as other components of mortar, that were used historically are no longer readily available, even when a conscious effort is made to replicate a "historic" mix, this may not be achievable due to the differences between modern and historic materials.

Caulking was inappropriately used here in place of mortar on the top of the wall. As a result, it has not been durable. Photo: NPS files.

Lime, itself, when mixed with water into a paste is very plastic and creamy. It will remain workable and soft indefinitely, if stored in a sealed container. Lime (calcium hydroxide) hardens by carbonation absorbing carbon dioxide primarily from the air, converting itself to calcium carbonate. Once a lime and sand mortar is mixed and placed in a wall, it begins the process of carbonation. If lime mortar is left to dry too rapidly, carbonation of the mortar will be reduced, resulting in poor adhesion and poor durability. In addition, lime mortar is slightly water soluble and thus is able to re-seal any hairline cracks that may develop during the life of the mortar. Lime mortar is soft, porous, and changes little in volume during temperature fluctuations thus making it a good choice for historic buildings. *Because of these qualities, high calcium lime mortar may be considered for many repointing projects, not just those involving historic buildings.*

For repointing, lime should conform to ASTM C 207, Type S, or Type SA, Hydrated Lime for Masonry Purposes. This machine-slaked lime is designed to assure high plasticity and water retention. The use of quicklime which must be slaked and soaked by hand may have advantages over hydrated lime in some restoration projects if time and money allow.

Lime putty. Lime putty is slaked lime that has a putty or paste-like consistency. It should conform to ASTM C 5. Mortar can be mixed using lime putty according to ASTM C 270 property or proportion specification.

Portland cement. More recent, 20th-century mortar has used portland cement as a primary binding material. A straight portland cement and sand mortar is extremely hard, resists the movement of water, shrinks upon setting, and undergoes relatively large thermal movements. When mixed with water, portland cement forms a harsh, stiff paste that is quite unworkable, becoming hard very quickly. (Unlike lime, portland cement will harden regardless of weather conditions and does not require wetting and drying cycles.) Some portland cement assists the workability and plasticity of the mortar without adversely affecting the finished project; it also provides early strength to the mortar and speeds setting. Thus, it may be appropriate to add some portland cement to an essentially lime-based mortar even when repointing relatively soft 18th or 19th century brick under some circumstances when a slightly harder mortar is required. The more portland cement that is added to a mortar formulation the harder it becomes--and the faster the initial set.

For repointing, portland cement should conform to ASTM C 150. White, non- staining portland cement may provide a better color match for some historic mortars than the more commonly available grey portland cement. But, it should not be assumed, however, that white portland cement is always appropriate for all historic buildings, since the original mortar may have been mixed with grey cement. The cement should not have more than

0.60 per cent alkali to help avoid efflorescence.

Masonry cement. Masonry cement is a preblended mortar mix commonly found at hardware and home repair stores. It is designed to produce mortars with a compressive strength of 750 psi or higher when mixed with sand and water at the job site. It may contain hydrated lime, but it always contains a large amount of portland cement, as well as ground limestone and other workability agents, including air-entraining agents. Because masonry cements are not required to contain hydrated lime, and generally do not contain lime, they produce high strength mortars that can damage historic masonry. *For this reason, they generally are not recommended for use on historic masonry buildings.*

Lime mortar (pre-blended). Hydrated lime mortars, and pre-blended lime putty mortars with or without a matched sand are commercially available. Custom mortars are also available with color. In most instances, pre-blended lime mortars containing sand may not provide an exact match; however, if the project calls for total repointing, a pre-blended lime mortar may be worth considering as long as the mortar is compatible in strength with the masonry. If the project involves only selected, "spot" repointing, then it may be better to carry out a mortar analysis which can provide a custom pre-blended lime mortar with a matching sand. In either case, if a preblended lime mortar is to be used, it should contain Type S or SA hydrated lime conforming to ASTM C 207.

Water. Water should be potable--clean and free from acids, alkalis, or other dissolved organic materials.

Other Components

Historic components. In addition to the color of the sand, the texture of the mortar is of critical importance in duplicating historic mortar. Most mortars dating from the mid-19th century on--with some exceptions--have a fairly homogeneous texture and color. Some earlier mortars are not as uniformly textured and may contain lumps of partially burned lime or "dirty lime", shell (which often provided a source of lime, particularly in coastal areas), natural cements, pieces of clay, lampblack or other pigments, or even animal hair. The visual characteristics of these mortars can be duplicated through the use of similar materials in the repointing mortar.

Replicating such unique or individual mortars will require writing new specifications for each project. If possible, suggested sources for special materials should be included. For example, crushed oyster shells can be obtained in a variety of sizes from poultry supply dealers.

Pigments. Some historic mortars, particularly in the late 19th century, were tinted to match or contrast with the brick or stone. Red pigments, sometimes in the form of brick dust, as well as brown, and black pigments were commonly used. Modern pigments are available which can be added to the mortar at the job site, but they should not exceed 10 per cent by weight of the portland cement in the mix, and carbon black should be limited to 2 per cent. Only synthetic mineral oxides, which are alkali-proof and sun-fast, should be used to prevent bleaching and fading.

Modern components. Admixtures are used to create specific characteristics in mortar, and whether they should be used will depend upon the individual project. *Air entraining agents*, for example, help the mortar to resist freeze-thaw damage in northern climates. *Accelerators* are used to reduce mortar freezing prior to setting while *retarders* help to

extend the mortar life in hot climates. Selection of admixtures should be made by the architect or architectural conservator as part of the specifications, not something routinely added by the masons.

Generally, modern chemical additives are unnecessary and may, in fact, have detrimental effects in historic masonry projects. The use of antifreeze compounds is not recommended. They are not very effective with high lime mortars and may introduce salts, which may cause efflorescence later. A better practice is to warm the sand and water, and to protect the completed work from freezing. No definitive study has determined whether air-entraining additives should be used to resist frost action and enhance plasticity, but in areas of extreme exposure requiring high-strength mortars with lower permeability, air-entrainment of 10-16 percent may be desirable (see formula for "severe weather exposure" in **Mortar Type and Mix**). Bonding agents are not a substitute for proper joint preparation, and they should generally be avoided. If the joint is properly prepared, there will be a good bond between the new mortar and the adjacent surfaces. In addition, a bonding agent is difficult to remove if smeared on a masonry surface.

Mortar Type and Mix

Mortars for repointing projects, especially those involving historic buildings, typically are custom mixed in order to ensure the proper physical and visual qualities. These materials can be combined in varying proportions to create a mortar with the desired performance and durability. The actual specification of a particular mortar type should take into consideration all of the factors affecting the life of the building including: current site conditions, present condition of the masonry, function of the new mortar, degree of weather exposure, and skill of the mason.

Here, a hammer and chisel are being correctly used to prepare a joint for repointing. Photo: John P. Speweik.

Thus, no two repointing projects are exactly the same. Modern materials specified for use in repointing mortar should conform to specifications of the American Society for Testing and Materials (ASTM) or comparable federal specifications, and the resulting mortar should conform to ASTM C 270, Mortar for Unit Masonry.

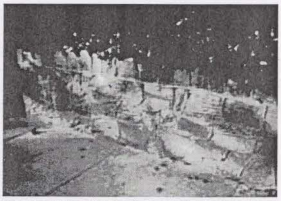
Specifying the proportions for the repointing mortar for a specific job is not as difficult as it might seem. Five mortar types, each with a corresponding recommended mix, have been established by ASTM to distinguish high strength mortar from soft flexible mortars. The ASTM designated them in decreasing order of approximate general strength as Type M (2,500 psi), Type S (1,800 psi), Type N (750 psi), Type O (350 psi) and Type K (75 psi). (The letters identifying the types are from the words MASON WORK using every other letter.) Type K has the highest lime content of the mixes that contain portland cement, although it is seldom used today, except for some historic preservation projects. The designation "L" in the accompanying chart identifies a straight lime and sand mix. Specifying the appropriate ASTM mortar by proportion of ingredients, will ensure the desired physical properties. Unless specified otherwise, measurements or proportions for mortar mixes are always given in the following order: cement-lime-sand. Thus, a Type K mix, for example, would be referred to as 1-3-10, or 1 part cement to 3 parts lime to 10 parts sand. Other requirements to create the desired visual qualities should be included in the specifications.

The strength of a mortar can vary. If mixed with higher amounts of portland cement, a harder mortar is obtained. The more lime that is added, the softer and more plastic the mortar becomes, increasing its workability. A mortar strong in compressive strength might be desirable for a hard stone (such as granite) pier holding up a bridge deck, whereas a softer, more permeable lime mortar would be preferable for a historic wall of soft brick. Masonry deterioration caused by salt deposition results when the mortar is less permeable than the masonry unit. A strong mortar is still more permeable than hard, dense stone. However, in a wall constructed of soft bricks where the masonry unit itself has a relatively high permeability or vapor transmission rate, a soft, high lime mortar is necessary to retain sufficient permeability.

Budgeting and Scheduling

Repointing is both expensive and time consuming due to the extent of handwork and special materials required. It is preferable to repoint only those areas that require work rather than an entire wall, as is often specified. But, if 25 to 50 per cent or more of a wall needs to be repointed, repointing the entire wall may be more cost effective than spot repointing.

Total repointing may also be more sensible when access is difficult, requiring the erection of expensive scaffolding (unless the majority of the mortar is sound and unlikely to require replacement in the foreseeable future). Each project requires judgement based on a variety of factors. Recognizing this at the outset will help to prevent many jobs from becoming prohibitively expensive.



When repairing this stone wall, the mason matched the raised profile of the original tuckpointing. Photo: NPS files.

In scheduling, seasonal aspects need to be considered first. Generally speaking, wall temperatures between 40 and 95 degrees F (8 and 38 degrees C) will prevent freezing or excessive evaporation of the water in the mortar. Ideally, repointing should be done in shade, away from strong sunlight in order to slow the drying process, especially during hot weather. If necessary, shade can be provided for large-scale projects with appropriate modifications to scaffolding.

The relationship of repointing to other work proposed on the building must also be recognized. For example, if paint removal or cleaning is anticipated, and if the mortar joints are basically sound and need only selective repointing, it is generally better to postpone repointing until after completion of these activities. However, if the mortar has eroded badly, allowing moisture to penetrate deeply into the wall, repointing should be accomplished before cleaning. Related work, such as structural or roof repairs, should be scheduled so that they do not interfere with repointing and so that all work can take maximum advantage of erected scaffolding.

Building managers also must recognize the difficulties that a repointing project can create.

The process is time consuming, and scaffolding may need to remain in place for an extended period of time. The joint preparation process can be quite noisy and can

A mechanical grinder improperly used to cut out the horizontal joint and incompatible repointing have seriously damaged the 19th century brick. Photo: NPS files.

generate large quantities of dust which must be controlled, especially at air intakes to protect human health, and also where it might damage operating machinery. Entrances may be blocked from time to time making access difficult for both building tenants and visitors. Clearly, building managers will need to coordinate the repointing work with other events at the site.

Contractor Selection

The ideal way to select a contractor is to ask knowledgeable owners of recently repointed historic buildings for recommendations. Qualified contractors then can provide lists of other repointing projects for inspection. More commonly, however, the contractor for a repointing project is selected through a competitive bidding process over which the client or consultant has only limited control. In this situation it is important to ensure that the specifications stipulate that masons must have a minimum of five years' experience with repointing historic masonry buildings to be eligible to bid on the project. Contracts are awarded to the lowest responsible bidder, and bidders who have performed poorly on other projects usually can be eliminated from consideration on this basis, even if they have the lowest prices.

The contract documents should call for unit prices as well as a base bid. Unit pricing forces the contractor to determine in advance what the cost addition or reduction will be for work which varies from the scope of the base bid. If, for example, the contractor has fifty linear feet less of stone repointing than indicated on the contract documents but thirty linear feet more of brick repointing, it will be easy to determine the final price for the work. Note that each type of work--brick repointing, stone repointing, or similar items--will have its own unit price. The unit price also should reflect quantities; one linear foot of pointing in five different spots will be more expensive than five contiguous linear feet.

Execution of the Work

Test Panels. These panels are prepared by the contractor using the same techniques that will be used on the remainder of the project. Several panel locations--preferably not on the front or other highly visible location of the building--may be necessary to include all types of masonry, joint styles, mortar colors, and other problems likely to be encountered on the job.

If cleaning tests, for example, are also to be undertaken, they should be carried out in the same location. Usually a 3 foot by 3 foot area is sufficient for brickwork, while a somewhat larger area may be required for stonework. These panels establish an acceptable standard of work and serve as a benchmark for evaluating and accepting subsequent work on the building.

Joint Preparation. Old mortar should be removed to a minimum depth of 2 to 2-1/2 times the width of the joint to ensure an adequate bond and to prevent mortar "popouts." For most brick joints, this will require removal of the mortar to a depth of approximately ½ to 1 inch; for stone masonry with wide joints, mortar may need to be removed to a depth of several inches. Any loose or disintegrated mortar beyond this minimum depth also should be removed.

Although some damage may be inevitable, careful joint preparation can help limit damage to masonry units. The traditional manner of removing old mortar is through the use of hand chisels and mash hammers. Though labor-intensive, in most instances this method poses the least threat for damage to historic masonry units and produces the best final product.

Unskilled repointing has negatively impacted the character of this late-19th century building. Photo: NPS files.

The most common method of removing mortar, however, is through the use of power saws or grinders. The use of power tools by unskilled masons can be disastrous for historic masonry, particularly soft brick. Using power saws on walls with thin joints, such as most brick walls, almost always will result in damage to the masonry units by breaking the edges and by overcutting on the head, or vertical joints.

However, small pneumatically-powered chisels generally can be used safely and effectively to remove mortar on historic buildings as long as the masons maintain appropriate control over the equipment. Under certain circumstances, thin diamond-bladed grinders may be used to cut out *horizontal* joints only on hard portland cement mortar common to most early-20th century masonry buildings. Usually, automatic tools most successfully remove old mortar without damaging the masonry units when they are used in combination with hand tools in preparation for repointing. Where horizontal joints are uniform and fairly wide, it may be possible to use a power masonry saw to assist the removal of mortar, such as by cutting along the middle of the joint; final mortar removal from the sides of the joints still should be done with a hand chisel and hammer. Caulking cutters with diamond blades can sometimes be used successfully to cut out joints without damaging the masonry. Caulking cutters are slow; they do not rotate, but vibrate at very high speeds, thus minimizing the possibility of damage to masonry units. Although mechanical tools may be safely used in limited circumstances to cut out horizontal joints in preparation for repointing, they should never be used on vertical joints because of the danger of slipping and cutting into the brick above or below the vertical joint. Using power tools to remove mortar without damaging the surrounding masonry units also necessitates highly skilled masons experienced in working on historic masonry buildings. Contractors should demonstrate proficiency with power tools before their use is approved.

Using any of these power tools may also be more acceptable on hard stone, such as quartzite or granite, than on terra cotta with its glass-like glaze, or on soft brick or stone. The test panel should determine the acceptability of power tools. If power tools are to be permitted, the contractor should establish a quality control program to account for worker fatigue and similar variables.

Mortar should be removed cleanly from the masonry units, leaving square corners at the back of the cut. Before filling, the joints should be rinsed with a jet of water to remove all loose particles and dust. At the time of filling, the joints should be damp, but with no standing water present. For masonry walls--limestone, sandstone and common brick--that are extremely absorbent, it is recommended that a continual mist of water be applied for a few hours before repointing begins.

Mortar Preparation. Mortar components should be measured and mixed carefully to

assure the uniformity of visual and physical characteristics. Dry ingredients are measured by volume and thoroughly mixed before the addition of any water. Sand must be added in a damp, loose condition to avoid over sanding. Repointing mortar is typically pre-hydrated by adding water so it will just hold together, thus allowing it to stand for a period of time before the final water is added. Half the water should be added, followed by mixing for approximately 5 minutes. The remaining water should then be added in small portions until a mortar of the desired consistency is reached. The total volume of water necessary may vary from batch to batch, depending on weather conditions. It is important to keep the water to a minimum for two reasons: first, a drier mortar is cleaner to work with, and it can be compacted tightly into the joints; second, with no excess water to evaporate, the mortar cures without shrinkage cracks. Mortar should be used within approximately 30 minutes of final mixing, and "retempering," or adding more water, should not be permitted.

Using Lime Putty to Make Mortar. Mortar made with lime putty and sand, sometimes referred to as roughage or course stuff, should be measured by volume, and may require slightly different proportions from those used with hydrated lime. No additional water is usually needed to achieve a workable consistency because enough water is already contained in the putty. Sand is proportioned first, followed by the lime putty, then mixed for five minutes or until all the sand is thoroughly coated with the lime putty. But mixing, in the familiar sense of turning over with a hoe, sometimes may not be sufficient if the best possible performance is to be obtained from a lime putty mortar. Although the old practice of chopping, beating and ramming the mortar has largely been forgotten, recent field work has confirmed that lime putty and sand rammed and beaten with a wooden mallet or ax handle, interspersed by chopping with a hoe, can significantly improve workability and performance. The intensity of this action increases the overall lime/sand contact and removes any surplus water by compacting the other ingredients. It may also be advantageous for larger projects to use a mortar pan mill for mixing. Mortar pan mills which have a long tradition in Europe produce a superior lime putty mortar not attainable with today's modern paddle and drum type mixers.

For larger repointing projects the lime putty and sand can be mixed together ahead of time and stored indefinitely, on or off site, which eliminates the need for piles of sand on the job site. This mixture, which resembles damp brown sugar, must be protected from the air in sealed containers with a wet piece of burlap over the top or sealed in a large plastic bag to prevent evaporation and premature carbonation. The lime putty and sand mixture can be recombined into a workable plastic state months later with no additional water.

If portland cement is specified in a lime putty and sand mortar--Type O (1:2:9) or Type K (1:3:11)--the portland cement should first be mixed into a slurry paste before adding it to the lime putty and sand. Not only will this ensure that the portland cement is evenly distributed throughout the mixture, but if dry portland cement is added to wet ingredients it tends to "ball up," jeopardizing dispersion. (Usually water must be added to the lime putty and sand anyway once the portland cement is introduced.) Any color pigments should be added at this stage and mixed for a full five minutes. The mortar should be used within 30 minutes to 1½ hours and it should not be retempered. Once portland cement has been added the mortar can no longer be stored.

Filling the Joint. Where existing mortar has been removed to a depth of greater than 1 inch, these deeper areas should be filled first, compacting the new mortar in several layers. The back of the entire joint should be filled successively by applying approximately

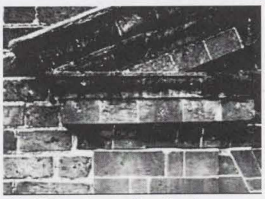
1/4 inch of mortar, packing it well into the back corners. This application may extend along the wall for several feet. As soon as the mortar has reached thumb-print hardness, another 1/4 inch layer of mortar--approximately the same thickness--may be applied. Several layers will be needed to fill the joint flush with the outer surface of the masonry. It is important to allow each layer time to harden before the next layer is applied; most of the mortar shrinkage occurs during the hardening process and layering thus minimizes overall shrinkage.

When the final layer of mortar is thumb-print hard, the joint should be tooled to match the historic joint. Proper timing of the tooling is important for uniform color and appearance. If tooled when too soft, the color will be lighter than expected, and hairline cracks may occur; if tooled when too hard, there may be dark streaks called "tool burning," and good closure of the mortar against the masonry units will not be achieved.

If the old bricks or stones have worn, rounded edges, it is best to recess the final mortar slightly from the face of the masonry. This treatment will help avoid a joint which is visually wider than the actual joint; it also will avoid creation of a large, thin featheredge which is easily damaged, thus admitting water. After tooling, excess mortar can be removed from the edge of the joint by brushing with a natural bristle or nylon brush. Metal bristle brushes should never be used on historic masonry.

Curing Conditions. The preliminary hardening of high-lime content mortars--those mortars that contain more lime by volume than portland cement, i.e., Type O (1:2:9), Type K (1:3:11), and straight lime/sand, Type "L" (0:1:3)--takes place fairly rapidly as water in the mix is lost to the porous surface of the masonry and through evaporation. A high lime mortar (especially Type "L") left to dry out too rapidly can result in chalking, poor adhesion, and poor durability. Periodic wetting of the repointed area after the mortar joints are thumb-print hard and have been finish tooled may significantly accelerate the carbonation process. When feasible, misting using a hand sprayer with a fine nozzle can be simple to do for a day or two after repointing. Local conditions will dictate the frequency of wetting, but initially it may be as often as every hour and gradually reduced to every three or four hours. Walls should be covered with burlap for the first three days after repointing. (Plastic may be used, but it should be tented out and not placed directly against the wall.) This helps keep the walls damp and protects them from direct sunlight. Once carbonation of the lime has begun, it will continue for many years and the lime will gain strength as it reverts back to calcium carbonate within the wall.

***Aging* the Mortar.** Even with the best efforts at matching the existing mortar color, texture, and materials, there will usually be a visible difference between the old and new work, partly because the new mortar has been matched to the unweathered portions of the historic mortar. Another reason for a slight mismatch may be that the sand is more exposed in old mortar due to the slight erosion of the lime or cement. Although spot repointing is generally preferable and some color difference should be acceptable, if the difference between old and new mortar is too extreme, it may be advisable in some instances to repoint an entire area of a wall, or an entire feature such as a bay, to minimize the



This 18th century pediment and surrounding wall exhibit distinctively different mortar joints. Photo: NPS files.

difference between the old and the new mortar. If the mortars have been properly matched, usually the best way to deal with surface color differences is to let the mortars age naturally. Other treatments to overcome these differences, including cleaning the non-repointed areas or staining the new mortar, should be carefully tested prior to implementation.

Staining the new mortar to achieve a better color match is generally not recommended, but it may be appropriate in some instances. Although staining may provide an initial match, the old and new mortars may weather at different rates, leading to visual differences after a few seasons. In addition, the mixtures used to stain the mortar may be harmful to the masonry; for example, they may introduce salts into the masonry which can lead to efflorescence.

Cleaning the Repointed Masonry. If repointing work is carefully executed, there will be little need for cleaning other than to remove the small amount of mortar from the edge of the joint following tooling. This can be done with a stiff natural bristle or nylon brush after the mortar has dried, but before it is initially set (1-2 hours). Mortar that has hardened can usually be removed with a wooden paddle or, if necessary, a chisel.

Further cleaning is best accomplished with plain water and natural bristle or nylon brushes. If chemicals must be used, they should be selected with extreme caution. Improper cleaning can lead to deterioration of the masonry units, deterioration of the mortar, mortar smear, and efflorescence. New mortar joints are especially susceptible to damage because they do not become fully cured for several months. Chemical cleaners, particularly acids, should never be used on dry masonry. The masonry should always be completely soaked once with water before chemicals are applied. After cleaning, the walls should be flushed again with plain water to remove all traces of the chemicals.

Several precautions should be taken if a freshly repointed masonry wall is to be cleaned. First, the mortar should be fully hardened before cleaning. Thirty days is usually sufficient, depending on weather and exposure; as mentioned previously, the mortar will continue to cure even after it has hardened. Test panels should be prepared to evaluate the effects of different cleaning methods. Generally, on newly repointed masonry walls, only very low pressure (100 psi) water washing supplemented by stiff natural bristle or nylon brushes should be used, except on glazed or polished surfaces, where only soft cloths should be used.**

New construction "bloom" or efflorescence occasionally appears within the first few months of repointing and usually disappears through the normal process of weathering. If the efflorescence is not removed by natural processes, the safest way to remove it is by dry brushing with stiff natural or nylon bristle brushes followed by wet brushing. Hydrochloric (muriatic) acid, is generally ineffective, and it should not be used to remove efflorescence. It may liberate additional salts, which, in turn, can lead to more efflorescence.

Surface Grouting is sometimes suggested as an alternative to repointing brick buildings, in particular. This process involves the application of a thin coat of cement-based grout to the mortar joints and the mortar/brick interface. To be effective, the grout must extend slightly onto the face of the masonry units, thus widening the joint visually. The change in the joint appearance can alter the historic character of the structure to an unacceptable degree. In addition, although masking of the bricks is intended to keep the grout off the remainder of the face of the bricks, some level of residue, called "veiling," will inevitably remain. Surface grouting cannot substitute for the more extensive work of repointing, and

it is not a recommended treatment for historic masonry.

***Additional information on masonry cleaning is presented in Preservation Briefs 1: Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings, Robert C. Mack, FAIA, and Anne Grimmer, Washington, D.C.: Technical Preservation Services, National Park Service, U.S. Department of the Interior, 2000; and Keeping it Clean: Removing Exterior Dirt, Paint, Stains & Graffiti from Historic Masonry Buildings, Anne E. Grimmer, Washington, D.C.: Technical Preservation Services, National Park Service, U.S. Department of the Interior, 1988.*

Visually Examining the Mortar and the Masonry Units

A simple *in situ* comparison will help determine the hardness and condition of the mortar and the masonry units. Begin by scraping the mortar with a screwdriver, and gradually tapping harder with a cold chisel and mason's hammer. Masonry units can be tested in the same way beginning, even more gently, by scraping with a fingernail. This relative analysis which is derived from the 10-point hardness scale used to describe minerals, provides a good starting point for selection of an appropriate mortar. It is described more fully in "The Russack System for Brick & Mortar Description" referenced in **Selected Reading** at the end of this Brief.

Mortar samples should be chosen carefully, and picked from a variety of locations on the building to find unweathered mortar, if possible. Portions of the building may have been repointed in the past while other areas may be subject to conditions causing unusual deterioration. There may be several colors of mortar dating from different construction periods or sand used from different sources during the initial construction. Any of these situations can give false readings to the visual or physical characteristics required for the new mortar. Variations should be noted which may require developing more than one mix.

1) Remove with a chisel and hammer three or four unweathered samples of the mortar to be matched from several locations on the building. (Set the largest sample aside--this will be used later for comparison with the repointing mortar). Removing a full representation of samples will allow selection of a "mean" or average mortar sample.

2) Mash the remaining samples with a wooden mallet, or hammer if necessary, until they are separated into their constituent parts. There should be a good handful of the material.

3) Examine the powdered portion--the lime and/or cement matrix of the mortar. Most particularly, note the color. There is a tendency to think of historic mortars as having white binders, but grey portland cement was available by the last quarter of the 19th century, and traditional limes were also sometimes grey. Thus, in some instances, the natural color of the historic binder may be grey, rather than white. The mortar may also have been tinted to create a colored mortar, and this color should be identified at this point.

4) Carefully blow away the powdery material (the lime and/or cement matrix which bound the mortar together).

5) With a low power (10 power) magnifying glass, examine the remaining sand and other materials such as lumps of lime or shell.

6) Note and record the wide range of color as well as the varying sizes of the individual

grains of sand, impurities, or other materials.

Other Factors to Consider

Color. Regardless of the color of the binder or colored additives, the sand is the primary material that gives mortar its color. A surprising variety of colors of sand may be found in a single sample of historic mortar, and the different sizes of the grains of sand or other materials, such as incompletely ground lime or cement, play an important role in the texture of the repointing mortar. Therefore, when specifying sand for repointing mortar, it may be necessary to obtain sand from several sources and to combine or screen them in order to approximate the range of sand colors and grain sizes in the historic mortar sample.

Pointing Style. Close examination of the historic masonry wall and the techniques used in the original construction will assist in maintaining the visual qualities of the building. Pointing styles and the methods of producing them should be examined. It is important to look at both the horizontal and the vertical joints to determine the order in which they were tooled and whether they were the same style. Some late-19th and early-20th century buildings, for example, have horizontal joints that were raked back while the vertical joints were finished flush and stained to match the bricks, thus creating the illusion of horizontal bands. Pointing styles may also differ from one facade to another; front walls often received greater attention to mortar detailing than side and rear walls. **Tuckpointing** is not true repointing but the application of a raised joint or lime putty joint on top of flush mortar joints. **Penciling** is a purely decorative, painted surface treatment over a mortar joint, often in a contrasting color.

Masonry Units. The masonry units should also be examined so that any replacement units will match the historic masonry. Within a wall there may be a wide range of colors, textures, and sizes, particularly with hand-made brick or rough-cut, locally-quarried stone. Replacement units should blend in with the full range of masonry units rather than a single brick or stone.

Matching Color and Texture of the Repointing Mortar

New mortar should match the unweathered interior portions of the historic mortar. The simplest way to check the match is to make a small sample of the proposed mix and allow it to cure at a temperature of approximately 70 degrees F for about a week, or it can be baked in an oven to speed up the curing; this sample is then broken open and the surface is compared with the surface of the largest "saved" sample of historic mortar.

If a proper color match cannot be achieved through the use of natural sand or colored aggregates like crushed marble or brick dust, it may be necessary to use a modern mortar pigment.

During the early stages of the project, it should be determined how closely the new mortar should match the historic mortar. Will "quite close" be sufficient, or is "exactly" expected? The specifications should state this clearly so that the contractor has a reasonable idea how much time and expense will be required to develop an acceptable match.

The same judgment will be necessary in matching replacement terra cotta, stone or brick. If there is a known source for replacements, this should be included in the specifications. If a source cannot be determined prior to the bidding process, the specifications should

include an estimated price for the replacement materials with the final price based on the actual cost to the contractor.

Mortar Types (Measured by volume)			
Designation	Cement	Hydrated Lime or Lime Putty	Sand
M	1	1/4	3 - 3 3/4
S	1	1/2	4 - 4 1/2
N	1	1	5 - 6
O	1	2	8 - 9
K	1	3	10 - 12
"L"	0	1	2 1/4 - 3

Suggested Mortar Types for Different Exposures			
	Exposure		
Masonry Material	Sheltered	Moderate	Severe
Very durable: granite, hard-cored brick, etc.	O	N	S
Moderately durable: limestone, durable stone, molded brick	K	O	N
Minimally durable: soft hand-made brick	"L"	K	O

Summary

For the Owner/Administrator. The owner or administrator of a historic building should remember that repointing is likely to be a lengthy and expensive process. First, there must be adequate time for evaluation of the building and investigation into the cause of problems. Then, there will be time needed for preparation of the contract documents. The work itself is precise, time-consuming and noisy, and scaffolding may cover the face of the building for some time. Therefore, the owner must carefully plan the work to avoid problems. Schedules for both repointing and other activities will thus require careful coordination to avoid unanticipated conflicts. The owner must avoid the tendency to rush the work or cut corners if the historic building is to retain its visual integrity and the job is to be durable.

For the Architect/Consultant. Because the primary role of the consultant is to ensure the life of the building, a knowledge of historic construction techniques and the special problems found in older buildings is essential. The consultant must assist the owner in planning for logistical problems relating to research and construction. It is the consultant's responsibility to determine the cause of the mortar deterioration and ensure that it is corrected before the masonry is repointed. The consultant must also be prepared to spend more time in project inspections than is customary in modern construction.

For the Masons. Successful repointing depends on the masons themselves. Experienced masons understand the special requirements for work on historic buildings and the added time and expense they require. The entire masonry crew must be willing and able to perform the work in conformance with the specifications, even when the specifications may not be in conformance with standard practice. At the same time, the masons should not hesitate to question the specifications if it appears that the work specified would damage the building.

Conclusion

A good repointing job is meant to last, at least 30 years, and preferably 50- 100 years. Shortcuts and poor craftsmanship result not only in diminishing the historic character of a building, but also in a job that looks bad, and will require future repointing sooner than if the work had been done correctly. The mortar joint in a historic masonry building has often been called a wall's "first line of defense." Good repointing practices guarantee the long life of the mortar joint, the wall, and the historic structure. Although careful maintenance will help preserve the freshly repointed mortar joints, it is important to remember that mortar joints are intended to be sacrificial and will probably require repointing some time in the future. Nevertheless, if the historic mortar joints proved durable for many years, then careful repointing should have an equally long life, ultimately contributing to the preservation of the entire building.

Selected Reading

Ashurst, John & Nicola. *Practical Building Conservation. Vol. 3: Mortars, Plasters and Renders.* New York: Halsted Press, a Division of John Wiley & Sons, Inc., 1988.

Cliver, E. Blaine. "Tests for the Analysis of Mortar Samples." *Bulletin of the Association for Preservation Technology.* Vol. 6, No. 1 (1974), pp. 68-73.

Coney, William B., AIA. *Masonry Repointing of Twentieth-Century Buildings.* Illinois Preservation Series. Number 10. Springfield, IL: Division of Preservation Services, Illinois Historic Preservation Agency, 1989.

Davidson, J.I. "Masonry Mortar." *Canadian Building Digest.* CBD 163. Ottawa, ONT: Division of Building Research, National Research Council of Canada, 1974.

Ferro, Maximillian L., AIA, RIBA. "The Russack System for Brick and Mortar Description: A Field Method for Assessing Masonry Hardness." *Technology and Conservation.* Vol. 5, No. 2 (Summer 1980), pp. 32-35.

Hooker, Kenneth A. "Field Notes on Repointing." *Aberdeen's Magazine of Masonry Construction.* Vol. 4, No. 8 (August 1991), pp. 326-328.

Jedrzejewska, H. "Old Mortars in Poland: A New Method of Investigation." Studies in Conservation. Vol. 5, No. 4 (1960), pp. 132-138.

"Lime's Role in Mortar." Aberdeen's Magazine of Masonry Construction. Vol. 9, No. 8 (August 1996), pp. 364-368.

Phillips, Morgan W. "Brief Notes on the Subjects of Analyzing Paints and Mortars and the Recording of Moulding Profiles: The Trouble with Paint and Mortar Analysis." *Bulletin of the*

Association for Preservation Technology. Vol. 10, No. 2 (1978), pp. 77-89.

Preparation and Use of Lime Mortars: An Introduction to the Principles of Using Lime Mortars. Scottish Lime Centre for Historic Scotland. Edinburgh: Historic Scotland, 1995.

Schierhorn, Carolyn. "Ensuring Mortar Color Consistency." *Aberdeen's Magazine of Masonry Construction.* Vol. 9, No. 1 (January 1996), pp. 33-35.

"Should Air-Entrained Mortars Be Used?" *Aberdeen's Magazine of Masonry Construction.* Vol. 7, No. 9 (September 1994), pp. 419-422.

Sickels-Taves, Lauren B. "Creep, Shrinkage, and Mortars in Historic Preservation." *Journal of Testing and Evaluation, JTEVA.* Vol. 23, No. 6 (November 1995), pp. 447-452.

Speweik, John P. *The History of Masonry Mortar in America*, 1720-1995. Arlington, VA: National Lime Association, 1995.

Speweik, John P. "Repointing Right: Why Using Modern Mortar Can Damage a Historic House." *Old-House Journal.* Vol. XXV, No. 4 (July-August 1997), pp. 46-51.

Technical Notes on Brick Construction. Brick Institute of America, Reston, VA.

"Moisture Resistance of Brick Masonry: Maintenance." 7F. February 1986.

"Mortars for Brick Masonry." 8 Revised II. November 1989.

"Standard Specification for Portland Cement-Lime Mortar for Brick Masonry." 8A Revised. September 1988.

"Mortar for Brick Masonry-Selection and Controls." 8B Reissued. September 1988. (July/August 1976).

"Guide Specifications for Brick Masonry, Part V Mortar and Grout." 11E Revised. September 1991.

"Bonds and Patterns in Brickwork." 30 Reissued. September 1988.

Useful Addresses

Brick Institute of America
11490 Commerce Park Drive
Reston, VA 22091

National Lime Association
200 N. Glebe Road, Suite 800
Arlington, VA 22203

Portland Cement Association
5420 Old Orchard Road
Skokie, IL 60077

Acknowledgments

Robert C. Mack, FAIA, is a principal in the firm of MacDonald & Mack, Architects, Ltd., an architectural firm that

specializes in historic buildings in Minneapolis, Minnesota. **John P. Speweik, CSI,** Toledo, Ohio, is a 5th-generation stonemason, and principal in U.S. Heritage Group, Inc., Chicago, Illinois, which does custom historic mortar matching. **Anne Grimmer,** Senior Architectural Historian, Heritage Preservation Services Program, National Park Service, was responsible for developing and coordinating the revision of this Preservation Brief, incorporating professional comments, and the technical editing.

The authors and the editor wish to thank the following for the professional and technical review they provided: Mark Macpherson and Ron Peterson, Masonry Restoration Contractors, Macpherson-Towne Company, Minneapolis, MN; Lorraine Schnabel, Architectural Conservator, John Milner Associates, Inc., Philadelphia, PA; Lauren B. Sickels-Taves, Ph.D., Architectural Conservator, Biohistory International, Huntington Woods, MI; and the following National Park Service professional staff, including: E. Blaine Cliver, Chief, Historic American Buildings Survey/Historic American Engineering Record; Douglas C. Hicks, Deputy Superintendent, Historic Preservation Training Center, Frederick, MD; Chris McGuigan, Supervisory Exhibits Specialist, Historic Preservation Training Center, Frederick, MD; Charles E. Fisher, Sharon C. Park, FAIA, John Sandor, Technical Preservation Services Branch, Heritage Preservation Services, and Kay D. Weeks, Heritage Preservation Services.

The original version of this brief, *Repointing Mortar Joints in Historic Brick Buildings*, was written by Robert C. Mack in 1976, and was revised and updated in 1980 by Robert C. Mack, de Teel Patterson Tiller, and James S. Askins.

Washington, D.C. October, 1998

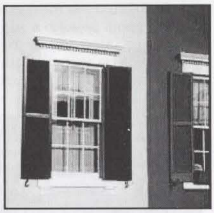
Home page logo: Soft mortar for repointing. Photo: John P. Speweik.

Questions

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

The Repair of Historic Wooden Windows

John H. Myers



- Architectural or Historical Significance
- Physical Evaluation
- Repair Class I: Routine Maintenance
- Repair Class II: Stabilization
- Repair Class III: Splices and Parts Replacement
- Weatherization
- Window Replacement
- Conclusion
- Additional Reading

A NOTE TO OUR USERS: The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

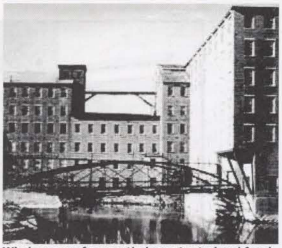
The windows on many historic buildings are an important aspect of the architectural character of those buildings. Their design, craftsmanship, or other qualities may make them worthy of preservation. This is self-evident for ornamental windows, but it can be equally true for warehouses or factories where the windows may be the most dominant visual element of an otherwise plain building. Evaluating the significance of these windows and planning for their repair or replacement can be a complex process involving both objective and subjective considerations. *The Secretary of the Interior's Standards for Rehabilitation* and the accompanying guidelines, call for respecting the significance of original materials and features, repairing and retaining them wherever possible, and when necessary, replacing them in kind. This Brief is based on the issues of significance and repair which are implicit in the standards, but the primary emphasis is on the technical issues of planning for the repair of windows including evaluation of their physical condition, techniques of repair, and design considerations when replacement is necessary.

Much of the technical section presents repair techniques as an instructional guide for the do-it-yourselfer. The information will be useful, however, for the architect, contractor, or developer on large-scale projects. It presents a methodology for approaching the evaluation and repair of existing windows, and considerations for replacement, from which the professional can develop alternatives and specify appropriate materials and procedures.

Architectural or Historical Significance

Evaluating the architectural or historical significance of windows is the first step in planning for window treatments, and a general understanding of the function and

history of windows is vital to making a proper evaluation. As a part of this evaluation, one must consider four basic window functions: admitting light to the interior spaces, providing fresh air and ventilation to the interior, providing a visual link to the outside world, and enhancing the appearance of a building. No single factor can be disregarded when planning window treatments; for example, attempting to conserve energy by closing up or reducing the size of window openings may result in the use of *more* energy by increasing electric lighting loads and decreasing passive solar heat gains.



Windows are frequently important visual focal points, especially on simple facades such as this mill building. Replacement of the multi-pane windows with larger panes could dramatically alter the appearance of the building. Photo: NPS files.

Historically, the first windows in early American houses were casement windows; that is, they were hinged at the side and opened outward. In the beginning of the eighteenth century single- and double-hung windows were introduced. Subsequently many styles of these vertical sliding sash windows have come to be associated with specific building periods or architectural styles, and this is an important consideration in determining the significance of windows, especially on a local or regional basis. Site-specific, regionally oriented architectural comparisons should be made to determine the significance of windows in question. Although such comparisons may focus on specific window types and their details, the ultimate determination of significance should be made within the context of the whole building, wherein the windows are one architectural element.

After all of the factors have been evaluated, **windows should be considered significant to a building if they: 1)** are original, **2)** reflect the original design intent for the building, **3)** reflect period or regional styles or building practices, **4)** reflect changes to the building resulting from major periods or events, or **5)** are examples of exceptional craftsmanship or design. Once this evaluation of significance has been completed, it is possible to proceed with planning appropriate treatments, beginning with an investigation of the physical condition of the windows.

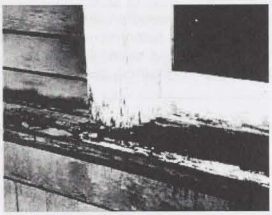
Physical Evaluation

The key to successful planning for window treatments is a careful evaluation of existing physical conditions on a unit-by-unit basis. A graphic or photographic system may be devised to record existing conditions and illustrate the scope of any necessary repairs. Another effective tool is a window schedule which lists all of the parts of each window unit. Spaces by each part allow notes on existing conditions and repair instructions. When such a schedule is completed, it indicates the precise tasks to be performed in the repair of each unit and becomes a part of the specifications. In any evaluation, one should note at a minimum:

- **1)** window location
- **2)** condition of the paint
- **3)** condition of the frame and sill
- **4)** condition of the sash (rails, stiles and muntins)
- **5)** glazing problems
- **6)** hardware, and
- **7)** the overall condition of the window (excellent, fair, poor, and so forth)

Many factors such as poor design, moisture, vandalism, insect attack, and lack of maintenance can contribute to window deterioration, but moisture is the primary contributing factor in wooden window decay. All window units should be inspected to see if water is entering around the edges of the frame and, if so, the joints or seams should be caulked to eliminate this danger. The glazing putty should be checked for cracked, loose, or missing sections which allow water to saturate the wood, especially at the joints. The back putty on the interior side of the pane should also be inspected, because it creates a seal which prevents condensation from running down into the joinery. The sill should be examined to insure that it slopes downward away from the building and allows water to drain off. In addition, it may be advisable to cut a dripline along the underside of the sill. This almost invisible treatment will insure proper water runoff, particularly if the bottom of the sill is flat. Any conditions, including poor original design, which permit water to come in contact with the wood or to puddle on the sill must be corrected as they contribute to deterioration of the window.

One clue to the location of areas of excessive moisture is the condition of the paint; therefore, each window should be examined for areas of paint failure. Since excessive moisture is detrimental to the paint bond, areas of paint blistering, cracking, flaking, and peeling usually identify points of water penetration, moisture saturation, and potential deterioration. Failure of the paint should not, however, be mistakenly interpreted as a sign that the wood is in poor condition and hence, irreparable. Wood is frequently in sound physical condition beneath unsightly paint. After noting areas of paint failure, the next step is to inspect the condition of the wood, particularly at the points identified during the paint examination.



Deterioration of poorly maintained windows usually begins on horizontal surfaces and at joints, where water can collect and saturate the wood. Photo: NPS files.

Each window should be examined for operational soundness beginning with the lower portions of the frame and sash. Exterior rainwater and interior condensation can flow downward along the window, entering and collecting at points where the flow is blocked. The sill, joints between the sill and jamb, corners of the bottom rails and muntin joints are typical points where water collects and deterioration begins. The operation of the window (continuous opening and closing over the years and seasonal temperature changes) weakens the joints, causing movement and slight separation. This process makes the joints more vulnerable to water which is readily absorbed into the endgrain of the wood. If severe deterioration exists in these areas, it will usually be apparent on visual inspection, but other less severely deteriorated areas of the wood may be tested by two traditional methods using a small ice pick.

An ice pick or an awl may be used to test wood for soundness. The technique is simply to jab the pick into a wetted wood surface at an angle and pry up a small section of the wood. Sound wood will separate in long fibrous splinters, but decayed wood will lift up in short irregular pieces due to the breakdown of fiber strength.

Another method of testing for soundness consists of pushing a sharp object into the wood, perpendicular to the surface. If deterioration has begun from the hidden side of a member and the core is badly decayed, the visible surface may appear to be sound wood. Pressure on the probe can force it through an apparently sound skin to penetrate deeply into decayed wood. This technique is especially useful for checking sills where visual access to the underside is restricted.

Following the inspection and analysis of the results, the scope of the necessary repairs will be evident and a plan for the rehabilitation can be formulated. Generally the actions necessary to return a window to "like new" condition will fall into three broad categories: ***1) routine maintenance procedures***, ***2) structural stabilization***, and ***3) parts replacement***. These categories will be discussed in the following sections and will be referred to respectively as **Repair Class I**, **Repair Class II**, and **Repair Class III.** Each successive repair class represents an increasing level of difficulty, expense, and work time. Note that most of the points mentioned in Repair Class I are routine maintenance items and should be provided in a regular maintenance program for any building. The neglect of these routine items can contribute to many common window problems.

Before undertaking any of the repairs mentioned in the following sections all sources of moisture penetration should be identified and eliminated, and all existing decay fungi destroyed in order to arrest the deterioration process. Many commercially available fungicides and wood preservatives are toxic, so it is extremely important to follow the manufacturer's recommendations for application, and store all chemical materials away from children and animals. After fungicidal and preservative treatment the windows may be stabilized, retained, and restored with every expectation for a long service life.

Repair Class I: Routine Maintenance

Repairs to wooden windows are usually labor intensive and relatively uncomplicated. On small scale projects this allows the do-it-yourselfer to save money by repairing all or part of the windows. On larger projects it presents the opportunity for time and money which might otherwise be spent on the removal and replacement of existing windows, to be spent on repairs, subsequently saving all or part of the material cost of new window units. Regardless of the actual costs, or who performs the work, the evaluation process described earlier will provide the knowledge from which to specify an appropriate work program, establish the work element priorities, and identify the level of skill needed by the labor force.

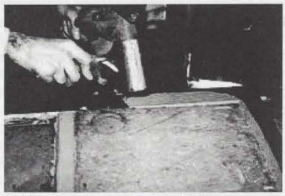
This historic double-hung window has many layers of paint, some cracked and missing putty, slight separation at the joints, broken sash cords, and one cracked pane. Photo: NPS files.

After removing paint from the seam between the interior stop and the jamb, the stop can be pried out and gradually worked loose using a pair of putty knives as shown. Photo: NPS files.

The routine maintenance required to upgrade a window to "like new" condition normally includes the following steps: 1) some degree of interior and exterior paint removal, 2) removal and repair of sash (including reglazing where necessary), 3) repairs to the frame, 4) weatherstripping and reinstallation of the sash, and 5) repainting. These operations are illustrated for a typical double-hung wooden window, but they may be adapted to other window types and styles as applicable.

Historic windows have usually acquired many layers of paint over time. Removal of excess layers or peeling and flaking paint will facilitate operation of the window and restore the clarity of the original detailing. Some degree of paint removal is also necessary as a first step in the proper surface preparation for subsequent refinishing (if paint color analysis is desired, it

should be conducted prior to the onset of the paint removal). There are several safe and effective techniques for removing paint from wood, depending on the amount of paint to be removed.



Sash can be removed and repaired in a convenient work area. Paint is being removed from this sash with a hot air gun. Photo: NPS files.

Paint removal should begin on the interior frames, being careful to remove the paint from the interior stop and the parting bead, particularly along the seam where these stops meet the jamb. This can be accomplished by running a utility knife along the length of the seam, breaking the paint bond. It will then be much easier to remove the stop, the parting bead and the sash. The interior stop may be initially loosened from the sash side to avoid visible scarring of the wood and then gradually pried loose using a pair of putty knives, working up and down the stop in small increments. With the stop removed, the lower or interior sash may be withdrawn. The sash cords should be detached from the sides of the sash and their ends may be pinned with a nail or tied in a knot to prevent them from falling into the weight pocket.

Removal of the upper sash on double-hung units is similar but the parting bead which holds it in place is set into a groove in the center of the stile and is thinner and more delicate than the interior stop. After removing any paint along the seam, the parting bead should be carefully pried out and worked free in the same manner as the interior stop. The upper sash can be removed in the same manner as the lower one and both sash taken to a convenient work area (in order to remove the sash the interior stop and parting bead need only be removed from one side of the window). Window openings can be covered with polyethylene sheets or plywood sheathing while the sash are out for repair.

The sash can be stripped of paint using appropriate techniques, but if any heat treatment is used, the glass should be removed or protected from the sudden temperature change which can cause breakage. An overlay of aluminum foil on gypsum board or asbestos can protect the glass from such rapid temperature change. It is important to protect the glass because it may be historic and often adds character to the window. Deteriorated putty should be removed manually, taking care not to damage the wood along the rabbet. If the glass is to be removed, the glazing points which hold the glass in place can be extracted and the panes numbered and removed for cleaning and reuse in the same openings. With the glass panes out, the remaining putty can be removed and the sash can be sanded, patched, and primed with a preservative primer. Hardened putty in the rabbets may be softened by heating with a soldering iron at the point of removal. Putty remaining on the glass may be softened by soaking the panes in linseed oil, and then removed with less risk of breaking the glass. Before reinstalling the glass, a bead of glazing compound or linseed oil putty should be laid around the rabbet to cushion and seal the glass. Glazing compound should only be used on wood which has been brushed with linseed oil and primed with an oil based primer or paint. The pane is then pressed into place and the glazing points are pushed into the wood around the perimeter of the pane.

The final glazing compound or putty is applied and beveled to complete the seal. The sash can be refinished as desired on the inside and painted on the outside as soon as a "skin" has formed on the putty, usually in 2 or 3 days. Exterior paint should cover the beveled glazing compound or putty and lap over onto the glass slightly to complete a weather-tight seal. After the proper curing times have elapsed for paint and putty, the sash will be ready for reinstallation.

While the sash are out of the frame, the condition of the wood in the jamb and sill can be evaluated. Repair and refinishing of the frame may proceed concurrently with repairs to the sash, taking advantage of the curing times for the paints and putty used on the sash. One of the most common work items is the replacement of the sash cords with new rope cords or with chains. The weight pocket is frequently accessible through a door on the face of the frame near the sill, but if no door exists, the trim on the interior face may be removed for access. Sash weights may be increased for easier window operation by elderly or handicapped persons. Additional repairs to the frame and sash may include consolidation or replacement of deteriorated wood. Techniques for these repairs are discussed in the following sections.

Following the relatively simple repairs, the window is weathertight, like new in appearance, and serviceable for many years to come.Photo: NPS files.

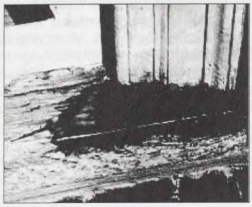
The operations just discussed summarize the efforts necessary to restore a window with minor deterioration to "like new" condition. The techniques can be applied by an unskilled person with minimal training and experience. To demonstrate the practicality of this approach, and photograph it, a Technical Preservation Services staff member repaired a wooden double-hung, two over two window which had been in service over ninety years. The wood was structurally sound but the window had one broken pane, many layers of paint, broken sash cords and inadequate, worn-out weatherstripping. The staff member found that the frame could be stripped of paint and the sash removed quite easily. Paint, putty and glass removal required about one hour for each sash, and the reglazing of both sash was accomplished in about one hour. Weatherstripping of the sash and frame, replacement of the sash cords and reinstallation of the sash, parting bead, and stop required an hour and a half. These times refer only to individual operations; the entire process took several days due to the drying and curing times for putty, primer, and paint, however, work on other window units could have been in progress during these lag times.

Repair Class II: Stabilization

The preceding description of a window repair job focused on a unit which was operationally sound. Many windows will show some additional degree of physical deterioration, especially in the vulnerable areas mentioned earlier, but even badly damaged windows can be repaired using simple processes. Partially decayed wood can be waterproofed, patched, built-up, or consolidated and then painted to achieve a sound condition, good appearance, and greatly extended life. Three techniques for repairing partially decayed or weathered wood are discussed in this section, and all three can be accomplished using products available at most hardware stores.

One established technique for repairing wood which is split, checked or shows signs of rot, is to: **1)** dry the wood, **2)** treat decayed areas with a fungicide, **3)** waterproof with two or three applications of boiled linseed oil (applications every 24 hours), **4)** fill cracks and holes with putty, and **5)** after a "skin" forms on the putty, paint the surface. Care should be taken with the use of fungicide which is toxic. Follow the manufacturers' directions and use only on areas which will be painted. When using any technique of building up or patching a flat surface, the finished surface should be sloped slightly to carry water away from the window and not allow it to puddle. Caulking of the joints

between the sill and the jamb will help reduce further water penetration.



This illustrates a two-part expoxy patching compound used to fill the surface of a weathered sill and rebuild the missing edge. When the epoxy cures, it can be sanded smooth and painted to achieve a durable and waterproof repair. Photo: NPS files.

When sills or other members exhibit surface weathering they may also be built-up using wood putties or homemade mixtures such as sawdust and resorcinol glue, or whiting and varnish. These mixtures can be built up in successive layers, then sanded, primed, and painted. The same caution about proper slope for flat surfaces applies to this technique.

Wood may also be strengthened and stabilized by consolidation, using semirigid epoxies which saturate the porous decayed wood and then harden. The surface of the consolidated wood can then be filled with a semirigid epoxy patching compound, sanded and painted. Epoxy patching compounds can be used to build up missing sections or decayed ends of members. Profiles can be duplicated using hand molds, which are created by pressing a ball of patching compound over a sound section of the profile which has been rubbed with butcher's wax. This can be a very efficient technique where there are many typical repairs to be done. The process has been widely used and proven in marine applications; and proprietary products are available at hardware and marine supply stores. Although epoxy materials may be comparatively expensive, they hold the promise of being among the most durable and long lasting materials available for wood repair. More information on epoxies can be found in the publication "Epoxies for Wood Repairs in Historic Buildings," cited in the bibliography.

Any of the three techniques discussed can stabilize and restore the appearance of the window unit. There are times, however, when the degree of deterioration is so advanced that stabilization is impractical, and the only way to retain some of the original fabric is to replace damaged parts.

Repair Class III: Splices and Parts Replacement

When parts of the frame or sash are so badly deteriorated that they cannot be stabilized there are methods which permit the retention of some of the existing or original fabric. These methods involve replacing the deteriorated parts with new matching pieces, or splicing new wood into existing members. The techniques require more skill and are more expensive than any of the previously discussed alternatives. It is necessary to remove the sash and/or the affected parts of the frame and have a carpenter or woodworking mill reproduce the damaged or missing parts. Most millwork firms can duplicate parts, such as muntins, bottom rails, or sills, which can then be incorporated into the existing window, but it may be necessary to shop around because there are several factors controlling the practicality of this approach. Some woodworking mills do not like to repair old sash because nails or other foreign objects in the sash can damage expensive knives (which cost far more than their profits on small repair jobs); others do not have cutting knives to duplicate muntin profiles. Some firms prefer to concentrate on larger jobs with more profit potential, and some may not have a craftsman who can duplicate the parts. A little searching should locate a firm which will do the job, and at a reasonable price. If such a firm does not exist locally, there are firms which undertake this kind of repair and ship nationwide. It is possible, however, for the advanced do-it-yourselfer or craftsman with a table saw to duplicate moulding profiles using techniques discussed by Gordie Whittington in "Simplified Methods for Reproducing Wood

Mouldings," *Bulletin* of the Association for Preservation Technology, Vol. III, No. 4, 1971, or illustrated more recently in *The Old House*, Time-Life Books, Alexandria, Virginia, 1979.

The repairs discussed in this section involve window frames which may be in very deteriorated condition, possibly requiring removal; therefore, caution is in order. The actual construction of wooden window frames and sash is not complicated. Pegged mortise and tenon units can be disassembled easily, if the units are out of the building. The installation or connection of some frames to the surrounding structure, especially masonry walls, can complicate the work immeasurably, and may even require dismantling of the wall. It may be useful, therefore, to take the following approach to frame repair: **1)** conduct regular maintenance of sound frames to achieve the longest life possible, **2)** make necessary repairs in place, wherever possible, using stabilization and splicing techniques, and **3)** if removal is necessary, thoroughly investigate the structural detailing and seek appropriate professional consultation.

Another alternative may be considered if parts replacement is required, and that is sash replacement. If extensive replacement of parts is necessary and the job becomes prohibitively expensive it may be more practical to purchase new sash which can be installed into the existing frames. Such sash are available as exact custom reproductions, reasonable facsimiles (custom windows with similar profiles), and contemporary wooden sash which are similar in appearance. There are companies which still manufacture high quality wooden sash which would duplicate most historic sash. A few calls to local building suppliers may provide a source of appropriate replacement sash, but if not, check with local historical associations, the state historic preservation office, or preservation related magazines and supply catalogs for information.

If a rehabilitation project has a large number of windows such as a commercial building or an industrial complex, there may be less of a problem arriving at a solution. Once the evaluation of the windows is completed and the scope of the work is known, there may be a potential economy of scale. Woodworking mills may be interested in the work from a large project; new sash in volume may be considerably less expensive per unit; crews can be assembled and trained on site to perform all of the window repairs; and a few extensive repairs can be absorbed (without undue burden) into the total budget for a large number of sound windows. While it may be expensive for the average historic home owner to pay seventy dollars or more for a mill to grind a custom knife to duplicate four or five bad muntins, that cost becomes negligible on large commercial projects which may have several hundred windows.

Most windows should not require the extensive repairs discussed in this section. The ones which do are usually in buildings which have been abandoned for long periods or have totally lacked maintenance for years. It is necessary to thoroughly investigate the alternatives for windows which do require extensive repairs to arrive at a solution which retains historic significance and is also economically feasible. Even for projects requiring repairs identified in this section, if the percentage of parts replacement per window is low, or the number of windows requiring repair is small, repair can still be a cost effective solution.

Weatherization

A window which is repaired should be made as energy efficient as possible by the use of appropriate weatherstripping to reduce air infiltration. A wide variety of products are available to assist in this task. Felt may be fastened to the top, bottom, and meeting rails, but may have the disadvantage of absorbing and holding moisture, particularly at the bottom rail. Rolled vinyl strips may also be tacked into place in appropriate locations

to reduce infiltration. Metal strips or new plastic spring strips may be used on the rails and, if space permits, in the channels between the sash and jamb. Weatherstripping is a historic treatment, but old weatherstripping (felt) is not likely to perform very satisfactorily. Appropriate contemporary weatherstripping should be considered an integral part of the repair process for windows. The use of sash locks installed on the meeting rail will insure that the sash are kept tightly closed so that the weatherstripping will function more effectively to reduce infiltration. Although such locks will not always be historically accurate, they will usually be viewed as an acceptable contemporary modification in the interest of improved thermal performance.

Many styles of storm windows are available to improve the thermal performance of existing windows. The use of exterior storm windows should be investigated whenever feasible because they are thermally efficient, cost-effective, reversible, and allow the retention of original windows (see "Preservation Briefs: 3"). Storm window frames may be made of wood, aluminum, vinyl, or plastic; however, the use of unfinished aluminum storms should be avoided. The visual impact of storms may be minimized by selecting colors which match existing trim color. Arched top storms are available for windows with special shapes. Although interior storm windows appear to offer an attractive option for achieving double glazing with minimal visual impact, the potential for damaging condensation problems must be addressed. Moisture which becomes trapped between the layers of glazing can condense on the colder, outer prime window, potentially leading to deterioration. The correct approach to using interior storms is to create a seal on the interior storm while allowing some ventilation around the prime window. In actual practice, the creation of such a durable, airtight seal is difficult.

Window Replacement

Although the retention of original or existing windows is always desirable and this Brief is intended to encourage that goal, there is a point when the condition of a window may clearly indicate replacement. The decision process for selecting replacement windows should not begin with a survey of contemporary window products which are available as replacements, but should begin with a look at the windows which are being replaced. Attempt to understand the contribution of the window(s) to the appearance of the facade including: **1)** the pattern of the openings and their size; **2)** proportions of the frame and sash; **3)** configuration of window panes; **4)** muntin profiles; **5)** type of wood; **6)** paint color; **7)** characteristics of the glass; and **8)** associated details such as arched tops, hoods, or other decorative elements. Develop an understanding of how the window reflects the period, style, or regional characteristics of the building, or represents technological development.

Armed with an awareness of the significance of the existing window, begin to search for a replacement which retains as much of the character of the historic window as possible. There are many sources of suitable new windows. Continue looking until an acceptable replacement can be found. Check building supply firms, local woodworking mills, carpenters, preservation oriented magazines, or catalogs or suppliers of old building materials, for product information. Local historical associations and state historic preservation offices may be good sources of information on products which have been used successfully in preservation projects.

Consider energy efficiency as one of the factors for replacements, but do not let it dominate the issue. Energy conservation is no excuse for the wholesale destruction of historic windows which can be made thermally efficient by historically and aesthetically acceptable means. In fact, a historic wooden window with a high quality storm window added should thermally outperform a new double-glazed metal window which does not have thermal breaks (insulation between the inner and outer frames intended to break

the path of heat flow). This occurs because the wood has far better insulating value than the metal, and in addition many historic windows have high ratios of wood to glass, thus reducing the area of highest heat transfer. One measure of heat transfer is the U-value, the number of Btu's per hour transferred through a square foot of material. When comparing thermal performance, the lower the U-value the better the performance. According to ASHRAE 1977 Fundamentals, the U-values for single glazed wooden windows range from 0.88 to 0.99. The addition of a storm window should reduce these figures to a range of 0.44 to 0.49. A non-thermal break, double-glazed metal window has a U-value of about 0.6.

Conclusion

Technical Preservation Services recommends the retention and repair of original windows whenever possible. We believe that the repair and weatherization of existing wooden windows is more practical than most people realize, and that many windows are unfortunately replaced because of a lack of awareness of techniques for evaluation, repair, and weatherization. Wooden windows which are repaired and properly maintained will have greatly extended service lives while contributing to the historic character of the building. Thus, an important element of a building's significance will have been preserved for the future.

Additional Reading

ASHRAE Handbook 1977 Fundamentals. New York: American Society of Heating, Refrigerating and Air-conditioning Engineers, 1978 (chapter 26).

Ferro, Maximillian. *Preservation: Present Pathway to Fall River's Future.* Fall River, Massachusetts: City of Fall River, 1979 (chapter 7).

"Fixing Double-hung Windows." *Old House Journal* (no. 12, 1979): 135.

Morrison, Hugh. *Early American Architecture*. New York: Oxford University Press, 1952.

Phillips, Morgan, and Selwyn, Judith. *Epoxies for Wood Repairs in Historic Buildings.* Washington, DC: Technical Preservation Services, U.S. Department of the Interior (Government Printing Office, Stock No. 024016000951), 1978.

Rehab Right. Oakland, California: City of Oakland Planning Department, 1978 (pp. 7883).

"Sealing Leaky Windows." *Old House Journal* (no. 1, 1973): 5.

Smith, Baird M. "Preservation Briefs: 3 Conserving Energy in Historic Buildings." Washington, DC: Technical Preservation Services, U.S. Department of the Interior, 1978.

Weeks, Kay D. and David W. Look, "Preservation Briefs: 10 Exterior Paint Problems on Historic Woodwork." Washington, DC: Technical Preservation Services, U.S. Department of the Interior, 1982.

Washington, D.C. 1981

Home page logo: Historic six-over-six windows--preserved. Photo: NPS files.

This publication has been prepared pursuant to the National Historic Preservation Act of 1966, as amended, which directs the Secretary of the Interior to develop and make available information concerning historic properties. Technical Preservation Services (TPS), Heritage Preservation Services Division, National Park Service prepares standards, guidelines, and other educational materials on responsible historic preservation treatments for a broad public.

Order Brief | Technical Preservation Services | Preservation Briefs | Search | Questions/Answers

KDW

19 Preservation Briefs

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

The Repair and Replacement of Historic Wooden Shingle Roofs

Sharon C. Park, AIA

»Wooden Shingle Roofs in America

»Replacing Deteriorated Roofs to Match
»Specifications for the Replacement Roof
»Roofing Practices to Avoid
»Maintenance
»Conclusion

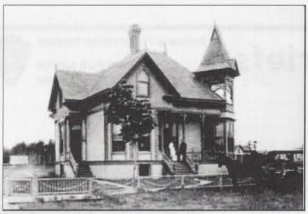
A NOTE TO OUR USERS: The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

The Secretary of the Interior's "Standards for Rehabilitation" call for the repair or replacement of missing architectural features "based on accurate duplication of features, substantiated by historic, physical, or pictorial evidence rather than on conjectural designs." On a wooden shingle roof, it is important not only to match the size, shape, texture, and configuration of historic shingles, but also to match the craftsmanship and details that characterize the historic roof. Proper installation and maintenance will extend the life of the new roof.

Wooden shingle roofs are important elements of many historic buildings. The special visual qualities imparted by both the historic shingles and the installation patterns should be preserved when a wooden shingle roof is replaced. This requires an understanding of the size, shape, and detailing of the historic shingle and the method of fabrication and installation. These combined to create roofs expressive of particular architectural styles, which were often influenced by regional craft practices. The use of wooden shingles from the early settlement days to the present illustrates an extraordinary range of styles.

Wooden shingle roofs need periodic replacement. They can last from 15 to over 60 years, but the shingles should be replaced before there is deterioration of other wooden components of the building. Appropriate replacement shingles are available, but careful research, design, specifications, and the selection of a skilled roofer are necessary to assure a job that will both preserve the appearance of the historic building and extend the useful life of the replacement roof.

Unfortunately, the wrong shingles are often selected or are installed in a manner



Readily available and inexpensive sawn shingles were used not only for roofs, but for gables and wall surfaces. Photo: Lane County Historical Society.

incompatible with the appearance of the historic roof. There are a number of reasons why the wrong shingles are selected for replacement roofs. They include the failure to identify the appearance of the original shingles; unfamiliarity with available products; an inadequate budget, or a confusion in terminology. In any discussion about historic roofing materials and practices, it is important to understand the historic definitions of terms like "shingles," as well as the modern definitions or use of those terms by craftsmen and the industry. Historically, from the first buildings in America, these wooden roofing products were called shingles, regardless of whether they were the earliest handsplit or the later machine-sawn type. The term shake is a relatively recent one and today is used by the industry to distinguish the sawn products from the split products, but through most of our building history there has been no such distinction.

Considering the confusion among architects and others regarding these terms as they relate to the appearance of early roofs, it should be stated that there is a considerable body of documentary information about historic roofing practices and materials in this country, and that many actual specimens of historic shingles from various periods and places have been collected and preserved so that their historic appearances are well established. Essentially, the rustic looking shake that we see used so much today has little in common with the shingles that were used on most of our early buildings in America.

Throughout this Brief, the term shingle will be used to refer to historic wooden roofs in general, whether split or sawn, and the term shake will be used only when it refers to a commercially available product. The variety and complexity of terminology used for currently available products will be seen in the accompanying chart entitled "Shingles and Shakes."

This Brief discusses what to look for in historic wooden shingle roofs and when to replace them. It discusses ways to select or modify modern products to duplicate the appearance of a historic roof, offers guidance on proper installation, and provides information on coatings and maintenance procedures to help preserve the new roof.*(1)*

Wooden Shingle Roofs in America

Because trees were plentiful from the earliest settlement days, the use of wood for all aspects of construction is not surprising. Wooden shingles were lightweight, made with simple tools, and easily installed. Wooden shingle roofs were prevalent in the Colonies, while in Europe at the same time, thatch, slate and tile were the prevalent roofing materials.

Distinctive roofing patterns exist in various regions of the country that were settled by the English, Dutch, Germans, and Scandinavians. These patterns and features include the size, shape and exposure length of shingles, special treatments such as swept valleys, combed

ridges, and decorative butt end or long side-lapped beveled handsplit shingles. Such features impart a special character to each building, and prior to any restoration or rehabilitation project the physical and photographic evidence should be carefully researched in order to document the historic building as much as possible. Care should be taken not to assume that aged or deteriorated shingles in photographs represent the historic appearance.

With the popularity of the revival of historic styles in the late 19th and early 20th centuries, a new technique was developed to imitate English thatch roofs. Photo: C.H. Roofing.

Shingle Fabrication. Historically wooden shingles were usually thin (3/8"3/4"), relatively narrow (3"8"), of varying length (14"36"), and almost always smooth. The traditional method for making wooden shingles in the 17th and 18th centuries was to handsplit them from log sections known as bolts. These bolts were quartered or split into wedges. A mallet and froe (or ax) were used to split or rive out thin planks of wood along the grain. If a tapered shingle was desired, the bolt was flipped after each successive strike with the froe and mallet. The wood species varied according to available local woods, but only the heartwood, or inner section, of the log was usually used. The softer sapwood generally was not used because it deteriorated quickly. Because handsplit shingles were somewhat irregular along the split surface, it was necessary to dress or plane the shingles on a shavinghorse with a draw-knife or draw-shave to make them fit evenly on the roof. This reworking was necessary to provide a tight-fitting roof over typically open shingle lath or sheathing boards. Dressing, or smoothing of shingles, was almost universal, no matter what wood was used or in what part of the country the building was located, except in those cases where a temporary or very utilitarian roof was needed.

Shingle fabrication was revolutionized in the early 19th century by steam-powered saw mills. Shingle mills made possible the production of uniform shingles in mass quantities. The sawn shingle of uniform taper and smooth surface eliminated the need to hand dress. The supply of wooden shingles was therefore no longer limited by local factors. These changes coincided with (and in turn increased) the popularity of architectural styles such as Carpenter Gothic and Queen Anne that used shingles to great effect.

Handsplit shingles continued to be used in many places well after the introduction of machine sawn shingles. There were, of course, other popular roofing materials, and some regions rich in slate had fewer examples of wooden shingle roofs. Some western "boom" towns used sheet metal because it was light and easily shipped. Slate, terneplate, and clay tile were used on ornate buildings and in cities that limited the use of flammable wooden shingles. Wooden shingles, however, were never abandoned. Even in the 20th century, architectural styles such as the Colonial Revival and Tudor Revival, used wooden shingles.

Modern wooden shingles, both sawn and split, continue to be made, but it is important to understand how these new products differ from the historic ones and to know how they can be modified for use on historic buildings. Modern commercially available shakes are generally thicker than the historic handsplit counterpart and are usually left "undressed" with a rough, corrugated surface. The rough surface shake, furthermore, is often promoted

as suitable for historic preservation projects because of its rustic appearance. It is an erroneous assumption that the more irregular the shingle, the more authentic or "historic" it will appear.

Historic Detailing and Installation Techniques. While the size, shape and finish of the shingle determine the roof's texture and scale, the installation patterns and details give the roof its unique character. Many details reflect the craft practices of the builders and the architectural style prevalent at the time of construction. Other details had specific purposes for reducing moisture penetration to the structure. In addition to the most visible aspects of a shingle roof, the details at the rake boards, eaves, ridges, hips, dormers, cupolas, gables, and chimneys should not be overlooked.

The long, biaxially tapered handsplit shingles are overlapped both vertically and horizontally. Photo: NPS files.

The way the shingles were laid was often based on functional and practical needs. Because a roof is the most vulnerable element of a building, many of the roofing details that have become distinctive features were first developed simply to keep water out. Roof combs on the windward side of a roof protect the ridge line. Wedges, or cant strips, at dormer cheeks roll the water away from the vertical wall. Swept valleys and fanned hips keep the grain of the wood in the shingle parallel to the angle of the building joint to aid water runoff. The slight projection of the shingles at the eaves directs the water runoff either into a gutter or off the roof away from the exterior wall. These details varied from region to region and from style to style. They can be duplicated even with the added protection of modern flashing.

In order to have a weathertight roof, it was important to have adequate coverage, proper spacing of shingles, and straight grain shingles. Many roofs were laid on open shingle lath or open sheathing boards. Roofers typically laid three layers of shingles with approximately 1/3 of each shingle exposed to the weather. Spaces between shingles (1/8"1/2" depending on wood type) allowed the shingles to expand when wet. It was important to stagger each overlapping shingle by a minimum of 11/2" to avoid a direct path for moisture to penetrate a joint. Doubling or tripling the starter course at the eave gave added protection to this exposed surface. In order for the roof to lay as flat as possible, the thickness, taper and surface of the shingles was relatively uniform; any unevenness on handsplit shingles had already been smoothed away with a draw-knife. To keep shingles from curling or cupping, the shingle width was generally limited to less than 10".

Not all shingles were laid in evenly spaced, overlapping, horizontal rows. In various regions of the country, there were distinct installation patterns; for example, the biaxially-tapered long shingles occasionally found in areas settled by the Germans. These long shingles were overlapped on the side as well as on top. This formed a ventilation channel under the shingles that aided drying. Because ventilation of the shingles can prolong their life, roofers paid attention to these details.

Early roofers believed that applied coatings would protect the wood and prolong the life of the roof. In many cases they did; but in many cases, the shingles were left to weather naturally and they, too, had a long life. Eighteenth-century coatings included a pine pitch

coating not unlike turpentine, and boiled linseed oil or fish oil mixed with oxides, red lead, brick dust, or other minerals to produce colors such as yellow, Venetian red, Spanish brown, and slate grey. In the 19th century, in addition to the earlier colors, shingles were stained or painted to complement the building colors: Indian red, chocolate brown, or brown-green. During the Greek Revival and later in the 20th century with other revival styles, green was also used. Untreated shingles age to a silver-grey or soft brown depending on the wood species.

The craft traditions of the builders often played an important role in the final appearance of the building. These elements, different on each building, should be preserved in a re-roofing project.

Replacing Deteriorated Roofs: Matching the Historic Appearance

Historic wooden roofs using straight edge-grain heartwood shingles have been known to last over sixty years. Fifteen to thirty years, however, is a more realistic lifespan for most premium modern wooden shingle roofs.

These weathered historic 19th-century handsplit and dressed shingles were found in place under a later altered roof. See also, below. Photo: John Ingle.

Contributing factors to deterioration include the thinness of the shingle, the durability of the wood species used, the exposure to the sun, the slope of the roof, the presence of lichens or moss growing on the shingle, poor ventilation levels under the shingle or in the roof, the presence of overhanging tree limbs, pollutants in the air, the original installation method, and the history of the roof maintenance. Erosion of the softer wood within the growth rings is caused by rainwater, wind, grit, fungus and the breakdown of cells by ultraviolet rays in sunlight. If the shingles cannot adequately dry between rains, if moss and lichens are allowed to grow, or if debris is not removed from the roof, moisture will be held in the wood and accelerate deterioration. Moisture trapped under the shingle, condensation, or poorly ventilated attics will also accelerate deterioration.

In addition to the eventual deterioration of wooden shingles, impact from falling branches and workmen walking on the roof can cause localized damage. If, however, over 20% of the shingles on any one surface appear eroded, cracked, cupped or split, or if there is evidence of pervasive moisture damage in the attic, replacement should be considered. If only a few shingles are missing or damaged, selective replacement may be possible. For limited replacement, the old shingle is removed and a new shingle can be inserted and held in place with a thin metal tab, or "babbie." This reduces disturbance to the sound shingles above. In instances where a few shingles have been cracked or the joint of overlapping shingles is aligned and thus forms a passage for water penetration, a metal flashing piece slipped under the shingle can stop moisture temporarily. If moisture is getting into the attic, repairs must be made quickly to prevent deterioration of the roof structural framing members.

When damage is extensive, replacement of the shingles will be necessary, but the historic sheathing or shingle lath under the shingles may be in satisfactory condition. Often, the historic sheathing or shingle laths, by their size, placement, location of early nail holes, and water stain marks, can give important information regarding the early shingles used. Before specifying a replacement roof, it is important to establish the original shingle material, configuration, detailing and installation. If the historic shingles are still in place, it is best to remove several to determine the size, shape, exposure length, and special features from the unweathered portions. If there are already replacement shingles on the roof, it may be necessary to verify through photographic or other research whether the shingles currently on the roof were an accurate replacement of the historic shingles.

The following information is needed in order to develop accurate specifications for a replacement shingle:

Original wood type (White Oak, Cypress, Eastern White Pine, Western, Red Cedar, etc.)

Size of shingle (length, width, butt thickness, taper)

Exposure length and nailing pattern (amount of exposure, placement and type of nails)

Type of fabrication (sawn, handsplit, dressed, beveled, etc.)

Distinctive details (hips, ridges, valleys, dormers, etc.)

The replacement shingles matched the historic shingles and were of such high quality that little hand dressing was needed at the site. Photo: John Ingle.

Decorative elements (trimmed butts, variety of pattern, applied color coatings, exposed nails)

Type of substrate (open shingle lath or sheathing, closed sheathing, insulated attics, sleepers, etc.)

Replacement roofs must comply with local codes which may require, for example, the use of shingles treated with chemicals or pressure-impregnated salts to retard fire. These requirements can usually be met without long-term visual effects on the appearance of the replacement roof.

The accurate duplication of a wooden shingle roof will help ensure the preservation of the building's architectural integrity. Unfortunately, the choice of an inappropriate shingle or poor installation can severely detract from the building's historic appearance. There are a number of commercially available wooden roofing products as well as custom roofers who can supply specially-made shingles for historic preservation projects. Unless restoration or reconstruction is being undertaken, shingles that match the visual appearance of the historic roof without replicating every aspect of the original shingles will normally suffice. For example, if the historic wood species is no longer readily available, Western Red Cedar or Eastern White Pine may be acceptable. Or, if the shingles are located high on a roof, sawn shingles or commercially available shakes with the rustic faces factory-sawn off may adequately reproduce the appearance of an historic handsplit and dressed shingle.

There will always be certain features, however, that are so critical to the building's

character that they should be accurately reproduced. Following is guidance on matching the most important visual elements.

Highest Priority in Replacement Shingles:

* best quality wood with a similar surface texture

* matching size and shape: thickness, width, length

* matching installation pattern: exposure length, overlap, hips, ridges, valleys, etc.

* matching decorative features: fancy butts, color, exposed nails

Areas of Acceptable Differences:

* species of wood

* method of fabrication of shingle, if visual appearance matches

* use of fire retardants, or preservative treatments, if visual impact is minimal

* use of modern flashing, if sensitively installed

* use of small sleepers for ventilation, if the visual impact is minimal and rake boards are sensitively treated

* method of nailing, if the visual pattern matches

Treatments and Materials to Avoid:

* highly textured wood surfaces and irregular butt ends, unless documented

* standardized details (prefab hips, ridges, panels, etc.) unless documented

* too wide shingles or those with flat grain (which may curl), unless documented

What is Currently Available

Types of Wood: Western Red Cedar, Eastern White Pine, and White Oak are most readily available today. For custom orders, cypress, red oak, and a number of other historically used woods may still be available. Some experiments using nontraditional woods (such as yellow pine and hemlock) treated with preservative chemicals are being tested for the new construction market, but are generally too thick, curl too easily, or have too pronounced a grain for use on historic buildings.

Method of manufacture: Commercially available modern shingles and shakes are for the most part machine-made. While commercially available shakes are promoted by the industry as handsplit, most are split by machine (this reduces the high cost of hand labor). True handsplit shingles, made the traditional way with a froe and mallet, are substantially more expensive, but are more authentic in appearance than the rough, highly textured machine-split shakes. An experienced shingler can control the thickness of the handsplit shingle and keep the shingle surface grain relatively even. To have an even roof installation, it is important to have handsplit shingles of uniform taper and to have less

than 1/8th variation across the surface of the shingle. For that reason, it is important to dress the shingles or to specify uniform butt thickness, taper, and surfaces. Commercially available shakes are shipped with a range of butt sizes within a bundle (e.g., «", 5/8", 3/4" as a mix) unless otherwise specified. Commercially available shakes with the irregular surfaces sawn off are also available. In many cases, except for the residual circular saw marks, these products appear not unlike a dressed handsplit shingle.

Sawn shingles are still made much the same way as they were historically--using a circular saw. The circular saw marks are usually evident on the surface of most sawn shingles. There are a number of grooved, striated, or steamed shingles of the type used in the 20th century to effect a rustic or thatched appearance. Custom sawn shingles with fancy butts or of a specified thickness are still available through mill shops. In fact, shingles can be fabricated to the weathered thickness in order to be integrated into an existing historic roof. If sawn shingles are being used as a substitute for dressed handsplit shingles, it may be desirable to belt sand the surface of the sawn shingles to reduce the prominence of the circular saw marks.

As seen from the Shingle and Shake chart, few of the commercially available shakes can be used without some modification or careful specification. Some, such as heavy shakes with a corrugated face, should be avoided altogether. While length, width, and butt configuration can be specified, it is more difficult to ensure that the thickness and the texture will be correct. For that reason, whatever shingle or shake is desired, it is important to view samples, preferably an entire bundle, before specifying or ordering. If shingles are to be trimmed at the site for special conditions, such as fanned hips or swept valleys, additional shingles should be ordered.

Coatings and Treatments: Shingles are treated to obtain a fire-retardant rating; to add a fungicide preservative (generally toxic); to revitalize the wood with a penetrating stain (oil as well as water based); and to give color.

While shingles can be left untreated, local codes may require that only fire-retardant shingles be used. In those circumstances, there are several methods of obtaining rated shingles (generally class "B" or "C"). The most effective and longest lasting treatment is to have treated salts pressure-impregnated into the wood cells after the shingles have been cut. Another method (which must be periodically renewed) is to apply chemicals to the surface of the shingles. If treated shingles need trimming at the site, it is important to check with the manufacturer to ensure that the fire-retardant qualities will not be lost. Pressure-impregnated shingles, however, may usually be trimmed without loss of fire-retardant properties.

The life of a shingle roof can be drastically shortened if moss, lichens, fungi or bacterial spores grow on the wood. Fungicides (such as chromated copper arsenate, CCA) have been found to be effective in inhibiting such fungal growth, but most are toxic. Red cedar has a natural fungicide in the wood cells and unless the shingles are used in unusually warm, moist environments, or where certain strains of spores are found, an applied fungicide is usually not needed. For most woods, the Forest Products Laboratory of the U.S. Department of Agriculture has found that fungicides do extend the life of the shingles by inhibiting growth on or in the wood. There are a variety available. Care should be taken in applying these chemicals and meeting local code requirements for proper handling.

Penetrating stains and water repellent sealers are sometimes recommended to revitalize wood shingles subject to damage by ultraviolet rays. Some treatments are oil-borne, some

are waterborne, and some are combined with a fungicide or a water repellent. If any of these treatments is to be used, they should be identified as part of the specifications. Manufacturers should be consulted regarding the toxicity or other potential complications arising from the use of a product or of several in combination. It is also important not to coat the shingles with vapor impermeable solutions that will trap moisture within the shingle and cause rotting from beneath.

Specifications for the Replacement Roof

New rounded butt sawn shingles, with a smooth finish and red oxide stain, were used to replace the deteriorated shingles. The varying widths, between 4" and 7" will keep them from curling and cupping. Exposure length was determined from historic nail patterns on the historic spaced sheathing below. Photo: NPS files.

Specifications and roofing details should be developed for each project. Standard specifications may be used as a basic format, but they should be modified to reflect the conditions of each job. Custom shingles can still be ordered that accurately replicate a historic roof, and if the roof is simple, an experienced shingler could install it without complicated instructions. Most rehabilitation projects will involve competitive bidding, and each contractor should be given very specific information as to what type of shingles are required and what the installation details should be. For that reason, both written specifications and detailed drawings should be part of the construction documents.

For particularly complex jobs, it may be appropriate to indicate that only roofing contractors with experience in historic preservation projects be considered. By prequalifying the bidders, there is greater assurance that a proper job will be done. For smaller jobs, it is always recommended that the owner or architect find a roofing contractor who has recently completed a similar project and that the roofers are similarly experienced.

Specifications identify exactly what is to be received from the supplier, including the wooden shingles, nails, flashing, and applied coatings. The specifications also include instructions on removing the old roofing (sometimes two or more earlier roofs), and on preparing the surface for the new shingles, such as repairing damage to the lath or sheathing boards. If there are to be modifications to a standard product, such as cutting beveled butts, planing off residual surface circular saw marks, or controlling the mixture of acceptable widths (3"8"), these too should be specified. Every instruction for modifying the shingles themselves should be written into the specifications or they may be overlooked.

The specifications and drawn details should describe special features important to the roof. Swept valleys, combed ridges, or wedged dormer cheek runoffs should each be detailed not only with the patterning of the shingles, but also with the placement of flashing or other unseen reinforcements. There are some modern products that appear to be useful. For example, paper coated and reinforced metal laminated flashing is easy to use and, in combination with other flashing, gives added protection over eaves and other vulnerable areas; adhesives give a stronger attachment at projecting roofing combs that could blow away in heavy wind storms. Clear or light colored sealants may be less obvious than dark

mastic often used in conjunction with flashing or repairs. These modern treatments should not be overlooked if they can prolong the life of the roof without changing its appearance.

Roofing Practices to Avoid

Certain common roofing practices for modern installations should be avoided in re-roofing a historic building unless specifically approved in advance by the architect. These practices interfere with the proper drying of the shingles or result in a sloppy installation that will accelerate deterioration. They include improper coverage and spacing of shingles, use of staples to hold shingles, inadequate ventilation, particularly for heavily insulated attics, use of heavy building felts as an underlayment, improper application of surface coatings causing stress in the wood surfaces, and use of inferior flashing that will fail while the shingles are still in good condition.

These commercially available roofing products with rustic split faces are not appropriate for historic preservation projects. Photo: NPS files.

Avoid skimpy shingle coverage and heavy building papers. It has become a common modern practice to lay impregnated roofing felts under new wooden shingle roofs. The practice is especially prevalent in roofs that do not achieve a full triple layering of shingles. Historically, approximately one third of each single was exposed, thus making a three-ply or three-layered roof. This assured adequate coverage. Due to the expense of wooden shingles today, some roofers expose more of the shingle if the pitch of the roof allows, and compensate for less than three layers of shingles by using building felts interwoven at the top of each row of shingles. This absorptive material can hold moisture on the underside of the shingles and accelerate deterioration. If a shingle roof has proper coverage and proper flashing, such felts are unnecessary as a general rule. However, the selective use of such felts or other reinforcements at ridges, hips and valleys does appear to be beneficial.

Beware of heavily insulated attic rafters. Historically, the longest lasting shingle roofs were generally the ones with the best roof ventilation. Roofs with shingling set directly on solid sheathing and where there is insulation packed tightly between the wooden rafters without adequate ventilation run the risk of condensation-related moisture damage to wooden roofing components. This is particularly true for air-conditioned structures. For that reason, if insulation must be used, it is best to provide ventilation channels between the rafters and the roof decking, to avoid heavy felt building papers, to consider the use of vapor barriers, and perhaps to raise the shingles slightly by using "sleepers" over the roof deck. This practice was popular in the 1920s in what the industry called a "Hollywood" installation, and examples of roofs lasting 60 years are partly due to this undershingle ventilation.

Avoid staples and inferior flashing. The common practice of using pneumatic staple guns to affix shingles can result in shooting staples through the shingles, in crushing the wood fibers, or in cracking the shingle. Instead, corrosion resistant nails, generally with barked or deformed shanks long enough to extend about 3/4" into the roof decking, should be specified. Many good roofers have found that the pneumatic nail guns, fitted with the proper nails and set at the correct pressure with the nails just at the shingle surface, have worked well and reduced the stress on shingles from missed hammer blows. If red cedar is

used, copper nails should not be specified because a chemical reaction between the wood and the copper will reduce the life of the roof. Hot-dipped, zinc-coated, aluminum, or stainless steel nails should be used. In addition, copper flashing and gutters generally should not be used with red cedar shingles as staining will occur, although there are some historic examples where very heavy gauge copper was used which outlasted the roof shingles. Heavier weight flashing (2() oz.) holds up better than lighter flashing, which may deteriorate faster than the shingles. Some metals may react with salts or chemicals used to treat the shingles. This should be kept in mind when writing specifications. Terne-coated stainless steel and lead-coated copper are generally the top of the line if copper is not appropriate.

Avoid patching deteriorated roof lath or sheathing with plywood or composite materials. Full size lumber may have to be custom ordered to match the size and configuration of the original sheathing in order to provide an even surface for the new shingles. It is best to avoid plywood or other modern composition boards that may deteriorate or delaminate in the future if there is undetected moisture or leakage. If large quantities of shingle lath or sheathing must be removed and replaced, the work should be done in sections to avoid possible shifting or collapse of the roof structure.

Avoid spray painting raw shingles on a roof after installation. Rapidly drying solvent in the paint will tend to warp the exposed surface of the shingles. Instead, it is best to dip new shingles prior to installation to keep all of the wood fibers in the same tension. Once the entire shingle has been treated, however, later coats can be limited to the exposed surface.

Maintenance

The purpose of regular or routine maintenance is to extend the life of the roof. The roof must be kept clean and inspected for damage both to the shingles and to the flashing, sheathing, and gutters. If the roof is to be walked on, rubber soled shoes should be worn. If there is a simple ridge, a ladder can be hooked over the roof ridge to support and distribute the weight of the inspector.

Keeping the roof free of debris is important. This may involve only sweeping off pine needles, leaves and branches as needed. It may involve trimming overhanging branches. Other aspects of maintenance, such as removal of moss and lichen buildup, are more difficult. While they may impart a certain charm to roofs, these moisture-trapping organisms will rot the shingles and shorten the life of the roof. Buildups may need scraping and the residue removed with diluted bleaching solutions (chlorine), although caution should be used for surrounding materials and plants. Some roofers recommend power washing the roofs periodically to remove the dead wood cells and accumulated debris. While this makes the roof look relatively new, it can put a lot of water under shingles, and the high pressure may crack or otherwise damage them. The added water may also leach out applied coatings.

If the roof has been treated with a fungicide, stain, or revitalizing oil, it will need to be re-coated every few years (usually every 4-5). The manufacturer should be consulted as to the effective life of the coating. With the expense associated with installation of wood shingles, it is best to extend the life of the roof as long as possible. One practical method is to order enough shingles in the beginning to use for periodic repairs.

Periodic maintenance inspections of the roof may reveal loose or damaged shingles that

can be selectively replaced before serious moisture damage occurs. Keeping the wooden shingles in good condition and repairing the roof, flashing and guttering, as needed, can add years of life to the roof.

Conclusion

A combination of careful research to determine the historic appearance of the roof, good specifications, and installation details designed to match the historic roof, and long-term maintenance, will make it possible to have not only a historically authentic roof, but a cost-effective one. It is important that professionals be part of the team from the beginning. A preservation architect should specify materials and construction techniques that will best preserve the roof's historic appearance. The shingle supplier must ensure that the best product is delivered and must stand behind the guarantee if the shipment is not correct. The roofer must be knowledgeable about traditional craft practices. Once the new shingle roof is in place, it must be properly maintained to give years of service.

NOTE *(1)* Preservation Brief 4: Roofing for Historic Buildings discusses research methods, analysis of deterioration, and the general significance of historic roofs.

Further Reading

Bucher, Robert C. "The Long Shingle." *Pennsylvania Folklife*, Vol. XVIII, No. 4, Summer 1969.

Cox, Richard E. "Wooden Shingles from the Fortress of Louisbourg." *Bulletin* of the Association for Preservation Technology, Vol. II, Nos. 12 1970 p.p.65.

Engle, Reed. "Restoring a Roofing." *CRM Bulletin*, a publication of the National Park Service, Vol. 8, No. 6 Dec. 1985.

Kidder, F.E. *Building Construction and Superintendence*, Part II. New York: William T. Comstock, 1902.

LeVan, Susan. "FireRetardant Treatments for Wood Shingles." *Techline*, Madison, Wisconsin: U.S.D.A. Forest Service, 1988.

Niemiec, S.S. and T.D. Brown. "Care and Maintenance of Wood Shingle and Shake Roofs. " Oregon State University Extension Service, September 1988. Publication #EC 1271.

The Old House Journal, Vol. XI, No. 3, April 1983. Special Roof Issue.

Peterson, Charles E. (editor). *Building Early America.* Radnor, Pennsylvania: Chilton Book Co. 1976.

Stevens, John. "Shingles." *Bulletin* of the Association for Preservation Technology, Vol. II, Nos. 12 1970, pp. 74.

Sweetser, Sarah M. *Preservation Briefs 4: Roofing for Historic Buildings*. Washington, D.C.: Technical Preservation Services Division, National Park Service, U.S. Department of the Interior, 1978.

Tollesten, Kristin. "Shingles and Shingled Roofs." *No Future Without the Past.* Rome, Italy:

ICOMOS, 1981. pp. 347360.

Acknowledgements

The author gratefully acknowledges the invaluable assistance of co-worker Michael Auer in preparing this brief for publication. In addition, the following individuals are to be thanked for their contribution to this manuscript: Reed Engle, Historical Architect, NPS; John Ingle, Historical Architect, NPS; Martin Obando, Eastern District Manager, Red Cedar Shingle & Handsplit Shake Bureau; and Peter Sandbeck, North Carolina Division of Archives and History. Appreciation is extended to: the staff of Technical Preservation Services Branch and NPS regional offices; Michael Lynch of the Office of Parks, Recreation and Historic Preservation in Albany, New York; and to Penelope H. Batcheler and William Brookover, Historical Architects, Independence National Historic Park, for their review of this manuscript and constructive comments. Special thanks are given to Kaye Ellen Simonson for the illustrations in the charts.

Washington, D.C. September, 1989

Home page logo: Appropriate re-roofing work in progress. Photo: NPS files.

This publication has been prepared pursuant to the National Historic Preservation Act of 1966, as amended, which directs the Secretary of the Interior to develop and make available information concerning historic properties. Technical Preservation Services (TPS), Heritage Preservation Services Division, National Park Service prepares standards, guidelines, and other educational materials on responsible historic preservation treatments for a broad public.

Questions

26 Preservation Briefs

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

The Preservation and Repair of Historic Log Buildings

Bruce D. Bomberger

»Historical Background
»Traditional Log Construction

»Historical Evaluation and Damage Assessment
»Preservation Treatments
»Log Repair
»Preserving Log Buildings in Their Historic Settings
»Summary
»Selected Reading

A NOTE TO OUR USERS: The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

The intent of this Brief is to present a concise history and description of the diversity of American log buildings and to provide basic guidance regarding their preservation and maintenance. A log building is defined as a building whose structural walls are composed of horizontally laid or vertically positioned logs. While this Brief will focus upon horizontally-laid, corner-notched log construction, and, in particular, houses as a building type, the basic approach to preservation presented here, as well as many of the physical treatments, can be applied to virtually any kind of log structure.

Rustic log structures were a popular choice for vacation cabins in the 20th century. Photo: Courtesy, HABS Collection, NPS.

Log buildings, because of their distinct material, physical structure, and sometimes their architectural design, can develop their own unique deterioration problems. The information presented here is intended to convey the range of appropriate preservation techniques available. It does not, however, detail how to perform these treatments; this work should be left to professionals experienced in the preservation of historic log buildings.

Despite the publication since the 1930s of a number of books and articles on the history of log construction in America, some misconceptions persist about log buildings. Log

cabins were not the first type of shelter built by all American colonists. The term "log cabin" today is often loosely applied to any type of log house, regardless of its form and the historic context of its setting. "Log cabin" or "log house" often conjures up associations with colonial American history and rough frontier life. While unaltered colonial era buildings in general are rare, historic log buildings as a group are neither as old nor as rare as generally believed. One and two-story log houses were built in towns and settlements across the country until about the middle of the 19th century, and in many areas, particularly in the West, as well as the Midwest and southern mountain regions, log continued to be a basic building material despite the introduction of wooden balloon frame construction. By the early 20th century, the popularity of "rustic" architecture had revived log construction throughout the country, and in many areas where it had not been used for decades.

A distinction should be drawn between the traditional meanings of "log cabin" and "log house." "Log cabin" generally denotes a simple one, or one-and-one-half story structure, somewhat impermanent, and less finished or less architecturally sophisticated. A "log cabin" was usually constructed with round rather than hewn, or hand-worked, logs, and it was the first generation homestead erected quickly for frontier shelter. "Log house" historically denotes a more permanent, hewn-log dwelling, either one or two stories, of more complex design, often built as a second generation replacement. Many of the earliest 18th and early 19th century log houses were traditionally clad, sooner or later, with wood siding or stucco.

Unlike western log cabins, 18th and 19th century log houses in the eastern part of the U.S. were almost always covered with siding or stucco. Photo: NPS files.

Historical Background

No other architectural form has so captured the imagination of the American people than the log cabin. Political supporters of 1840 presidential candidate William Henry Harrison appropriated the log cabin as a campaign symbol. The log cabin was birthplace and home for young Abe Lincoln, as well as other national figures, and assumed by many 19th century historians to be the very first type of house constructed by English colonists. In 1893 Frederick Jackson Turner in his influential paper, "The Significance of the Frontier in American History" suggested that European colonists had adopted this means of shelter from the Indians.

More recent 20th century scholarship has demonstrated that horizontal log buildings were not the first form of shelter erected by all colonists in America. Nor was log construction technology invented here, but brought by Northern and Central European colonists. Finnish and Swedish settlers are credited with first introducing horizontal log building in the colony of New Sweden (now Pennsylvania) on the upper shores of Delaware Bay in 1638, who later passed on their tradition of log construction to the Welsh settlers in Pennsylvania.

During the 17th and 18th centuries, new waves of Eastern and Central Europeans, including Swiss and Germans, came to America bringing their knowledge of log construction. Even the Scotch-Irish, who did not possess a log building tradition of their own, adapted the form of the stone houses of their native country to log construction, and contributed to spreading it across the frontier. In the Mississippi Valley, Colonial French fur

traders and settlers had introduced vertical log construction in the 17th century.

This lodge constructed of logs in the 1880s is an example of the Adirondack style of rustic camp architecture. Photo: NPS files.

Through the late 18th and early 19th centuries, frontier settlers erected log cabins as they cleared land, winding their way south in and along the Appalachian valleys through the back country areas of Maryland, Virginia, the Carolinas and Georgia. They moved westward across the Appalachian Mountain barrier into the Ohio and Mississippi River valleys transporting their indispensable logcraft with them, into Kentucky and Tennessee, and as far to the southwest as eastern Texas. Log buildings are known to have been constructed as temporary shelters by soldiers during the Revolutionary War, and across the country, Americans used logs not only to build houses, but also commercial structures, schools, churches, gristmills, barns, corncribs and a variety of outbuildings.

Around the mid-19th century, successive generations of fur traders, metal prospectors, and settlers that included farmers and ranchers began to construct log buildings in the Rocky Mountains, the Northwest, California, and Alaska. In California and Alaska, Americans encountered log buildings that had been erected by Russian traders and colonists in the late 18th and early 19th centuries. Scandinavian and Finnish immigrants who settled in the Upper Midwest later in the 19th century also brought their own log building techniques with them. And, many log structures in the Southwest, particularly in New Mexico, show Hispanic influences of its early settlers.

The entrance door centered in the gable end in this late-19th century log building is a typical feature of the Rocky Mountain Cabin style. Photo: NPS files.

While many parts of the country never stopped building with logs, wooden balloon frame construction had made it obsolete in some of the more populous parts of the country by about the mid-19th century. However, later in the century, log construction was employed in new ways. In the 1870s, wealthy Americans initiated the Great Camp Movement for rustic vacation retreats in the Adirondack Mountains of upstate New York. Developers such as William Durant, who used natural materials, including wood shingles, stone, and log--often with its bark retained to emphasize the Rustic style--designed comfortable summer houses and lodges that blended with the natural setting. Durant and other creators of the Rustic style drew upon Swiss chalets, traditional Japanese design, and other sources for simple compositions harmonious with nature.

The Adirondack or Rustic style was balanced in the West with construction of the Old Faithful Inn at Yellowstone National Park in Wyoming, designed by Robert C. Reamer, and begun in 1903. This popular resort was tremendously influential in its use of locally-available natural materials, especially log, and gave impetus to Rustic as a true national style. From the turn of the century through the 1920s, Gustav Stickley and other leaders of the Craftsman Movement promoted exposed log construction. During the 1930s and 40s, the Civilian Conservation Corps (CCC) used log construction extensively in many of

Old Faithful Inn, Yellowstone National Park, Wyoming brought the Rustic style to the West in 1903 in an original design, and a scale befitting its setting. Photo: Courtesy, Historic American Buildings Survey, NPS.

the country's Federal and State parks to build cabins, lean-tos, visitor centers, and maintenance and support buildings that are still in service.

Traditional Log Construction

Plan and Form

When settlers took the craft of log construction with them onto the frontier, they successfully adapted it to regional materials, climates and terrains. One of the most notable characteristics of the earliest 18th and 19th century log houses is the plan and form. The plan can sometimes provide clues to the ethnic origin or route of migration of the original inhabitant or builder. But in the absence of corroborating documentary evidence, it is important not to infer too much about the ethnic craft traditions of a particular log house.

Historians have identified a number of traditional house plans and forms as prototypes. They were often repeated with simple variations. The basic unit of each of these types is the one room enclosure formed by four log walls joined at their corners, called a single "pen" or "crib." The single pen was improved upon by installing interior partitions or by adding another log pen. Some variations of historic log house plans include: the typically mid-Atlantic "continental" plan, consisting of a single-pen of three rooms organized around a central hearth; the "saddlebag" or double-pen plan, composed of two contiguous log pens; and the "dogtrot" plan, formed by two pens separated by an open passage space (sometimes enclosed later), all covered by a continuous roof. The continental plan originated in central and eastern Europe and is attributed to 18th century German immigrants to Pennsylvania. Non-log interior partition walls form the multi-room plan within the exterior log walls. The saddlebag plan consists of two adjoining log pens that share a central chimney. A saddlebag is often the evolution of a single pen with an end chimney, expanded by adding a second pen onto the chimney endwall. The saddlebag was built in a number of different regions across the country. The dogtrot plan may be seen with variation in many parts of the country, although it is sometimes, perhaps erroneously, considered the most typically southern, because its covered passageway provided both air circulation and shelter from the heat. All these plan types were typically built in the form of one or one-and-one-half story settlement cabins.

A somewhat different form evolved in the West around the middle of the 19th century which became especially distinctive of the Rocky Mountain cabin. While the entrance doorway to most earlier log houses was generally placed beneath the eaves, as a means of adapting to the greater snowfall in the Rockies, here the entrance was placed in the gable end, and sometimes protected from roof slides by a porch supported by two corner posts created by an extension of the roof beyond the gable wall.

From the late 18th through the mid-19th centuries, Americans also built many substantial two-story log houses in towns throughout the eastern half of the country. In rural areas two-story log houses were sometimes built to replace earlier, first-generation settlement

cabins, but just as often the early hewn-log house was retained and enlarged. A second story was added by removing the roof and gables, constructing a second floor, laying additional courses of logs, and building a new roof, or reassembling the old one. Each generation of owners might expand an early log core building by adding on new log pens, or masonry or wood frame extensions. The addition of a rear ell, or infill construction to link a formerly freestanding outbuilding, such as a kitchen to the log main house was particularly common. Such a layering of alterations is part of the evolution of many log buildings.

Corner Notching and Other Fastening Techniques

A log to replace the deteriorated sill is being hewn in the traditional manner with a broad axe. Photo: NPS files.

Corner notching is another of the characteristic features of log construction. Most notching methods provide structural integrity, by locking the log ends in place, and give the pen rigidity and stability. Like the floor plan, the type of corner notching can sometimes be a clue to the ethnic craft origin of a log building, but it is important not to draw conclusions based only on notching details. Numerous corner notching techniques have been identified throughout the country. They range from the simple "saddle" notching, which demands minimal time and hewing skill, to the very common "V" notching or "steeple" notching, to "full dovetail" notching, one of the tightest but most time-consuming to accomplish, "half-dovetail" notching which is probably one of the most common, and "square" notching secured with pegs or spikes.

The notching method on some of the earliest eastern cabins and most 19th century western cabins, particularly saddle notching, left an extended log end or "crown." Crowns are especially pronounced or exaggerated in Rustic style structures, and sometimes they are cut shorter as the wall rises, creating a buttress effect at the corners of the building.

Another method of securing log ends consists of fastening logs that are laid without notching ("false notching") with tenons into vertical corner posts, or using spikes or pegs to attach them to vertical corner planks. Vertically positioned logs were secured at their top and bottom ends, usually into roof and sill plate timbers.

Selecting Logs and Assembling the Building

Although wood selection was most likely to be determined by availability, chestnut, white oak, cedar, and fir were preferred because these trees could provide long, straight, rot-resistant logs. Pine, which also provided long straight logs, was also used in areas where it was plentiful. Woods were often mixed, utilizing harder, heavier rot-resistant wood such as white oak for the foundation,"sill log", and lighter, more easily hewn wood such as yellow poplar for the upper log courses.

One of the principal advantages of log construction was the economy of tools required to complete a structure. A felling axe was the traditional tool for bringing down the tree and cutting the logs to length. For many frontier and western structures the round logs were

debarked or used in their original form with the bark left on, or one or more sides of the logs were hewn flat with a broadaxe, or more finely finished with an adze as smooth thick planks. Notching was done with an axe, hatchet or saw; openings for doors and windows were usually cut after the logs were set into place, and door and window frames, particularly jambs, were put in place during construction to help hold the logs in place. Roof framing members and floor joists were either hewn from logs or of milled lumber. A log cabin could be raised and largely completed with as few as two to four different tools, including a felling axe, a broad axe, and a hand saw or crosscut saw.

The upper gable walls were completed with logs if the roof was constructed with purlins, which is more typical of Scandinavian or Finnish construction, and western and 20th century Rustic styles. However, vertical or horizontal weatherboard sheathing was commonly used throughout the country to cover wood-framed gables.

Chinking and Daubing

Stone or wood strips served to fill in the chinking areas over which the daubing was applied. Photo: NPS files.

The horizontal spaces or joints between logs are usually filled with a combination of materials that together is known as "chinking" and "daubing." Chinking and daubing completed the exterior walls of the log pen by sealing them against driving wind and snow, helping them to shed rain, and blocking the entry of vermin. In addition, chinking and daubing could compensate for a minimal amount of hewing and save time if immediate shelter was needed. Not all types of log buildings were chinked. Corncribs, and sometimes portions of barns where ventilation was needed were not chinked. While more typical of Swedish or Finnish techniques, and not as common in American log construction, tight-fitting plank-hewn or scribed-fit round logs have little or no need for chinking and daubing.

A variety of materials were used for chinking and daubing, including whatever was most conveniently at hand. Generally though, it is a three-part system applied in several steps. The chinking consists of two parts: first, a dry, bulky, rigid blocking, such as wood slabs or stones is inserted into the joint, followed by a soft packing filler such as oakum, moss, clay, or dried animal dung. Daubing, which completes the system, is the outer wet-troweled finish layer of varying composition, but often consisting of a mixture of clay and lime or other locally available materials. Instead of daubing, carefully fitted quarter poles or narrow wood strips were sometimes nailed lengthwise across the log joints.

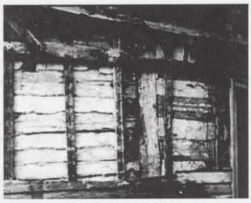
Chinking, especially the daubing, is the least durable part of a log building. It is susceptible to cracking as a result of freeze-thaw action, structural settlement, drying of the logs, and a thermal expansion-contraction rate that differs from that of the logs. Seasonal deterioration of chinking necessitates continual inspection and regular patching or replacement.

Exterior Wall Treatments

Although the exterior logs of cabins in the West, and 20th century Rustic buildings are generally not covered, many 18th and 19th century log houses east of the Mississippi, with

the exception of some of the simpler cabins and houses in remote or poorer areas, were covered with exterior cladding. The exterior of the log walls was covered for both aesthetic and practical reasons either as soon as the building was completed or sometime later.

In some instances, the exterior (and interior) of the logs was whitewashed. This served to discourage insects, and sealed hairline cracks in the daubing and fissures between the daubing and logs. Although the solubility of whitewash allows it to heal some of its own hairline cracks with the wash of rain, like daubing it has to be periodically reapplied. Usually, a more permanent covering such as wood siding or stucco was applied to the walls, which provided better insulation and protection, and reduced the maintenance of the log walls.



Once the siding is gone, the logs may rapidly deteriorate unless another protective treatment is applied. Photo: NPS files.

Sometimes log houses were sided or stuccoed later in an attempt to express a newly-achieved financial or social status. Many log houses were immediately sided and trimmed upon completion to disguise their simple construction beneath Georgian, Federal and later architectural styles. Frequently a log house was covered, or recovered, when a new addition was erected in order to harmonize the whole, especially if the original core and its addition were constructed of different materials such as log and wood frame.

Vertical wood furring strips were generally nailed to the logs prior to applying weatherboarding or stucco. This ensured that the walls would be plumb, and provided a base on which to attach the clapboards, or on which to nail the wood lath for stucco.

Foundations

Log building foundations varied considerably in quality, material, and configuration. In many cases, the foundation consisted of a continuous course of flat stones (with or without mortar), several piers consisting of rubblestone, single stones, brick, short vertical log pilings, or horizontal log "sleepers" set on grade. The two "sill logs," were laid directly upon one of these types of foundations.

Climate and intended permanence of the structure were the primary factors affecting foundation construction. The earliest log cabins, and temporary log dwellings in general, were the most likely to be constructed on log pilings or log sleepers set directly on grade. Where a more permanent log dwelling was intended, or where a warm, humid climate accelerated wood decay, such as in the South, it was sometimes more common to use stone piers which allowed air to circulate beneath the sill logs. Full cellars were not generally included in the original construction of most of the earliest log houses, but root cellars were often dug later.

Roofs

Log buildings were roofed with a variety of different framing systems and covering materials. Like log house plans and corner notching styles, the types of roof framing systems used were often variations on particular ethnic and regional carpentry traditions.

In most cases wood shingles were the first roof covering used on the earliest 18th and 19th century log houses. As wood shingle roofs deteriorated, many were replaced with standing seam metal roofs, many of which continue to provide good service today. Later pioneer log buildings west of the Mississippi were likely to be roofed with metal or roll roofing, or even with sod. Other log buildings have been re-roofed in the 20th century with asphalt shingles. For some rustic log buildings in the West and Great Camps in the Adirondacks, asphalt shingles are the original historic roofing material.

Chimneys

Ethnic tradition and regional adaptation also influenced chimney construction and placement. Chimneys in log houses were usually built of stone or brick, a combination of the two, or even clay-lined, notched logs or smaller sticks. Later log buildings were frequently constructed with only metal stacks to accommodate wood stoves. The chimneys of log buildings erected in cold climates tended to be located entirely inside the house to maximize heat retention. In the South, where winters were less severe the chimney stack was more typically constructed outside the log walls. With the advent of more efficient heating systems, interior chimneys were frequently demolished or relocated and rebuilt to maximize interior space.

Interior Finishes

Logs on the interiors of many of the simpler cabins and Rustic style structures were often given a flattened surface or left exposed. But, in the more finished log houses of the 18th and 19th century, they were more commonly covered for most of the same reasons that the exterior of the logs was covered--improved insulation, ease of maintenance, aesthetics, and keeping out vermin. Covering the interior log walls with planks, lath and plaster, boards pasted with newspaper, fabric such as muslin, or wallpaper increased their resistance to air infiltration and their insulation value. Finished walls could be cleaned and painted more easily, and plastered walls and ceilings obscured the rough log construction and prepared interior surfaces for decorative wood trim in the current styles.

Historical Evaluation and Damage Assessment

Before undertaking preservation work on a historic log building, its history and design should be investigated, and physical condition evaluated. It is always advisable to hire a historical architect or qualified professional experienced in preservation work to supervise the project. In addition, State Historic Preservation Offices, regional offices of the National Park Service, and local historical commissions may also provide technical and procedural advice.

The historical investigation should be carried out in conjunction with a visual inspection of the log building. Physical assessment needs to be systematic and thorough. It should include taking notes, photographs or video recording, and making drawings of existing conditions, including overall and detail views. This will serve as a record of the appearance and condition which can be referred to once work is under way. A physical assessment should also identify causes of deterioration, not just symptoms or manifestations and, in some instances, may need to include a structural investigation.

Foundation Inspection

The foundation of a log building should always be inspected before beginning work because, as in any building, foundation-related problems can transfer structural defects to other components of the building. Settling of the foundation is a typical condition of log buildings. If settlement is not severe and is no longer active, it is not necessarily a problem. If, however, settlement is active or uneven, if it is shifting structural weight to unintended bearing points away from the intended main bearing points of the corner notches and sill log, serious wall deflections may have resulted. Causes of settlement may include foundation or chimney stones or sill logs that have sunk into the ground, decay of log pilings, log sleepers, or of the sill logs themselves.

Log Inspection

Foundation problems usually result in damage to the sill logs and spandrels, which are often the most susceptible to deterioration. Sill logs, along with the corner notching, tend to bear most of the weight of the building, and are closest to vegetation and the ground, which harbors wood-destroying moisture and insects. If the sill log has come into contact with the ground, deterioration is probably underway or likely to begin. It is also important to check the drainage around the building. The building assessment should note the condition of each log and attempt to identify the sources of problems that appear to exist.

Sill log inspection should not necessitate destruction of historic exterior cladding if it exists. Inspection can usually be made in areas where cladding is missing, loose, or deteriorated. Sill log, as well as upper log, deterioration may also be revealed by loose or peeling areas of the cladding. If pieces of cladding must be removed for log inspection, they should be labeled and saved for reinstallation, or as samples for replacement work. Historic cladding generally need not be disturbed unless there are obvious signs of settling or other indications of deterioration.

Other areas of the log walls which are particularly susceptible to deterioration include window and door sills, corner notches, and crowns, and any other areas regularly saturated by rain runoff or backsplash. The characteristic design feature of Adirondack or Rustic style log buildings of leaving log ends or crowns to extend beyond the notched corners of the building positions the crowns beyond the drip-line of the roof edge. This makes them vulnerable to saturation from roof runoff, and a likely spot for deterioration. Saddle notching in which the cut was made out of the top surface of the log and which cups upward, and flat notching, may also be especially susceptible to collecting runoff moisture.

Detection of decay requires thorough inspection. Probing for rot should be done carefully since repair techniques can sometimes save even badly deteriorated logs. Soft areas should be probed with a small knife blade or icepick to determine the depth of decay. Logs should be gently tapped at regular intervals up and down their lengths with the tool handle to detect hollow-sounding areas of possible interior decay. Long cracks which run with the wood grain, called "checks," are not signs of rot, but are characteristic features of the seasoning of the logs. However, a check can admit moisture and fungal decay into a log, especially if it is located on the log's upper surface. Checks should also be probed with a tool blade to determine whether decay is underway inside the log.

Sill log ground contact and relative moisture content also provide ideal conditions for certain types of insect infestation. Wood building members, such as sill logs or

weatherboarding, less than eight inches from th~ ground, should be noted as a potential problem for monitoring or correction. Sighting of insects, or their damage, or telltale signs of their activity, such as mud tunnels, exit holes, or "frass," a sawdust-like powder, should be recorded. Insect infestation is best treated by a professionally licensed exterminator, as the chemicals used to kill wood-destroying insects and deter reinfestation are generally toxic.

rotted sill needing replacement

This rotted sill cannot be repaired and must be replaced. Photo: NPS files.

Roof Inspection

Along with the foundation, the roof is the other most vital component of any building. The roof system consists of, from top to bottom, the covering, usually some form of shingles or metal sheeting and flashing; board sheathing or roof lath strips; the framing structure, such as rafters or purlins; the top log, sometimes referred to as the "roof plate" or "rafter plate;" and, sometimes, but not always, gutters and downspouts.

The roof and gutters should be inspected and checked for leaks both from the exterior, as well as inside if possible. Inspection may reveal evidence of an earlier roof type, or covering, and sometimes remnants of more than one historic covering material. The roof may be the result of a later alteration, or raised when a second story was added, or repaired as the result of storm or fire damage. Often, roof framing may be composed of reused material recycled from earlier buildings. Inspection of the roof framing should note its configuration and condition. Typical problems to look for are framing members that have been dislodged from their sockets in the roof plate, or that are cracked, ridge damage, sagging rafters, broken ties and braces, and decay of exterior exposed rafter or purlin ends, especially common on Rustic style buildings.

Other Features

The rest of the building should also be inspected as part of the overall assessment, including siding, window sash and frames, door frames and leafs, chimneys, porches, and interior walls, trim, and finishes. Any of these features may exhibit deterioration problems, inherent to the material or to a construction detail, or may show the effects of problems transmitted from elsewhere, such as a deformed or mis-shapen window frame resulting from a failed sill log. The inspection should note alterations and repairs made over time, and identify those modifications which have acquired significance and should be preserved. Nothing should be removed or altered before it has been examined and its historical significance noted.

Preservation Treatments

Since excessive moisture promotes and hastens both fungal and insect attack, it should be dealt with immediately. Not only must the roof and gutters be repaired--if none exist, gutters should probably be added--but the foundation grade should be sloped to ensure drainage away from the building. If the distance from the ground to the sill log or exterior sheathing is less than eight inches, the ground should be graded to achieve this minimum distance. Excess vegetation and debris such as firewood, dead leaves, or rubbish should be cleared from the foundation perimeter, and climbing vines whose leaves retain moisture and tendrils erode daubing, should be killed and removed. Moisture problems due to faulty

interior plumbing should also be remedied. Solving or reducing moisture problems may in itself end or halt the progress of rot and wood-destroying insects.

Log Repair

Stabilizing and repairing a log that has been only partially damaged by decay or insects is always preferable to replacing it. Retaining the log, rather than substituting a new one, preserves more of the building's integrity, including historic tool marks and the wood species which may no longer be obtainable in original dimensions. Log repair can generally be done with the log in place at less cost, in less time, and with less damage to building fabric, than by removing, and installing a new hewn and notched replacement log. Log repair is accomplished by two basic methods: traditional methods of splicing in new or old wood, or through the use of epoxies. These treatments are sometimes combined, and may also be used in conjunction with reinforcing members. Historic log repair, whether it involves patching techniques or the use of epoxies, should always be performed only by an experienced craftsperson or architectural conservator.

Wood Splicing

Wood splicing can involve several types of techniques. Also referred to as "piecing-in" or "Dutchman" repair, it involves treating a localized area of deterioration by cutting out the decayed area of the log, and carefully carving and installing a matching, seasoned wood replacement plug or splice. The wood species, if available, and the direction and pattern of the grain should match that of adjacent original wood. The location and depth of decay should determine the splicing technique to be used. In a case where decay runs deep within a log, a full-depth segment containing the affected area can be cut out, severing the log completely, and a new segment of log spliced in, using angled "scarf" joints or square-cut "half-lap" joints. The splice is secured to the severed log by angling lag screws or bolts through the upper and lower surfaces that will be concealed by daubing.

Splicing can also be performed using epoxy as an adhesive. A log with shallow decay on its outer face can be cut back to sound depth, and a half-log face spliced on, adhered with epoxy, screws or bolts. A technique for the repair of badly deteriorated log crowns involves cutting them back to sound wood, and into the notching joint if necessary, and installing new crowns cut to match. Fiberglass or aluminum reinforcement rods are inserted into holes drilled into the new crowns, and into corresponding holes drilled in the ends of the original cutoff logs. Epoxy is used as an adhesive to attach and hold the new crowns in place. Long lag screws can be angled up through the underside of the crown into the log above to provide additional support for the repair.

Epoxy Consolidation and Repair

In some instances, epoxies may be used by themselves to consolidate and fill the voids left by deteriorated wood. Epoxies are versatile in performance, relatively easy to use by experts, and, after curing, may be shaped with woodworking tools. Their use requires that sufficient sound wood survives for the epoxy to adhere. But they can be used to stabilize rotted wood, return full or greater than original strength to decayed structure-bearing members, and to reconstitute the shape of decayed log ends. Epoxies resist decay and insects, and while epoxy itself is resistant to moisture, epoxy tends to cause adjacent wood to retain moisture rather than dry out, and if not used in the right location, can actually further a continuing cycle of wood decay. Hence, epoxy repairs are most

successful in areas where they are protected from moisture. Epoxies, of which there are a variety of commercially-available products on the market, are prepared in essentially two forms: a liquid consolidant and a flexible putty filler.Each consists of a resin and a hardener which must be mixed prior to use.

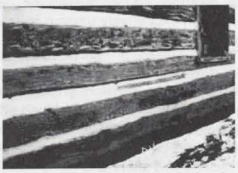
The technique of treating, for an example, a decayed log crown with epoxies is begun by removing loose decayed wood, and drying the area if necessary. The rot-affected cavity and surface of the log end is then saturated with liquid epoxy by repeated brushing, or by soaking it in a plastic bag filled with epoxy that is attached to the log. The porous condition of the rot-damaged wood will draw up the epoxy like a lamp wick. Once the liquid epoxy has saturated the log end and cured, the log end has been consolidated, and is ready for the application of an epoxy putty filler. The filler resin and hardener must also be mixed, pigments must be mixed with the filler epoxy to color the patch, and more importantly to protect it from ultraviolet sunlight. The filler can be applied with a putty knife, pressing it into the irregularities of the cavity. The cured patch can be worked like wood and painted with an opaque stain or a dull finish paint to help it blend with surrounding wood, although epoxy repairs can be difficult to disguise on natural, unpainted wood.

Epoxies can be used to consolidate and repair other areas of a log, including rotted internal areas which have not yet progressed to damage the log's outer surface. Saturation of small internal areas can be accomplished by drilling several random holes into the log through an area that will be concealed by daubing, and then pouring in liquid epoxy. If a pure resin is used, it should be a casting resin to minimize shrinkage, and it is best to fill voids with a resin that contains aggregates such as sand, or micro-balloons. Epoxy is frequently used by architectural conservators to strengthen deteriorated structural members. The damaged log can be strengthened by removing the deteriorated wood, and filling the void by imbedding a reinforcing bar in epoxy filler, making sure the void is properly sealed to contain the epoxy before using it. Sometimes larger decayed internal areas of a log can be more easily accessed and repaired from the interior of a structure. This may be a useful technique if it can be accomplished without causing undue damage to the interior finishes in the log building. However, despite its many advantages, epoxy may not be an appropriate treatment for all log repairs, and it should not be used in an attempt to conceal checking, or extensive log surface patching that is exposed to view, or logs that are substantially decayed or collapsed.

Log Replacement

Repairing or replacing only a segment of a log is not always possible. Replacement of an entire log may be the only solution if it has been substantially lost to decay and collapsed under the weight of logs above it. Log replacement, which should be carried out only by experienced craftspersons, is begun by temporarily supporting the logs above, and then jacking them up just enough to insert the new log. Potential danger to the structure may include creating inadequate temporary bearing points, and crushing chinking and interior finishes which may have settled slowly into non-original positions that cannot withstand jacking.

To begin the process of log replacement, the entire length of the log must be inspected from the exterior and the interior of the structure to determine whether it supports any structural members or features, and how their load can be taken up by bracing during jacking and removal. On the exterior, sheathing such as weatherboard, and adjacent chinking, must be removed along the length of the log to perform this inspection. Likewise,



The new sill matches the original and is a compatible replacment. Photo: NPS files.

on the interior, abutting partition walls and plaster may also need to be removed around the log to determine what, if any, features are supported by or tied into the log to be removed.

A replacement log should be obtained to match the wood species of the original being removed. If it is a hewn log, then the replacement must be hewn to replicate the dimensions and tool marks of the original. If the same wood species cannot be obtained in the original dimensions, a substitute species may have to be used, and may even be preferable in some instances if a more durable wood can be found than the original wood species. It should, however, be chosen to match the visual characteristics of the original species as closely as possible.

Wood Preservatives

In most instances, the use of chemical wood preservatives is not generally recommended on historic log buildings. Preservatives tend to change the color or appearance of the logs. In addition, many are toxic, they tend to leach out of the wood over time, and like paint, must be periodically reapplied. Many of the late 19th and early 20th century Rustic structures were constructed of logs with the bark left on which may provide protection, while others have been painted. However, some log buildings, and especially log houses that have been inappropriately stripped of historic cladding in an earlier restoration, and now show signs of weathering, such as deep checking, may be exceptions to this guidance. A preservative treatment may be worth considering in these cases. Boiled linseed oil may sometimes be appropriate to use on selected exposures of a building that are particularly vulnerable to weathering, although linseed oil does tend to darken over time. Borate solutions, which do not alter the color or appearance of wood, may be another of the few effective, nonhazardous preservatives available. However, borate solutions do not penetrate dry wood well, and thus the wood must be green or wet. Because borate solutions are water-soluble, after treating, the wood must be coated with a water-repellent coating. In some instances, it may be appropriate to reapply varnish where it was used as the original finish treatment. Pressure-treating, while effective for new wood, is not applicable to in-place log treatment, and is generally not effective for large timbers and logs because it does not penetrate deeply enough.

Foundation Repair

The foundation should have good drainage, be stable, adequately support the building as well as any future floorloads, and keep the sill log sufficiently clear of the ground and moisture to deter decay and insect infestation. Log buildings with cellars are less likely to suffer problems than those built upon the ground or with crawl spaces, as long as the cellar is kept dry and ventilated. Because the foundations of many log buildings were neither dug nor laid below the frost-like, they generally tend to be susceptible to freeze-thaw ground heaving and settlement. Also, as previously noted, some foundations consisted of wooden sleepers or pilings in direct contact with the ground. If a foundation problem is minor, such as the need for repointing or resetting a few stones, work should address only those areas. Loose stones should be reset in their original locations if

possible. A clearly inadequate foundation that has virtually disappeared into the ground, or where large areas of masonry have buckled or sunk, resulting in excessively uneven or active settlement, will need to be rebuilt using modern construction methods but to match the historic appearance.

Chinking Repair

Daubing composed entirely of portland cement is never appropriate to use on a historic log building. Photo: NPS files.

Repair of chinking, whether it is finished on the exterior with wooden strips or with daubing, should not be done until all log repair or replacement, structural jacking and shoring is completed, and all replacement logs have seasoned. Historically, patching and replacing daubing on a routine basis was a seasonal chore. This was because environmental factors--building settlement, seasonal expansion and contraction of logs, and moisture infiltration followed by freeze-thaw action--cracks and loosens daubing. If the exterior log walls are exposed, and the chinking or daubing requires repair, as much of the remaining inner blocking filler and daubing should be retained as possible. A daubing formula and tooled finish that matches the historic daubing, if known, should be used, or based on one of the mixes listed here. For the most part, modern commercially-available chinking products are not suitable for use on historic log buildings, although an exception might be on the interior of a log building where it will be covered by plaster or wood, and will not be visible. These products tend to have a sandy appearance that may be compatible with some historic daubing, but the color, and other visual and physical characteristics are generally incompatible with historic log surfaces.

Sections of wood chinking which are gone or cannot be made weathertight should be replaced with same-sized species saplings or quarter poles cut to fit. Generally, unless bark was used originally, it should be removed before nailing the new wood chinking replacements tightly into place.

Analysis of daubing can be done in much the same way as mortar analysis. If that is not feasible, by crushing a loose piece of daubing its constituent parts can be exposed, which may typically include lime, sand, clay, and, as binders, straw or animal hair. The color imparted by the sand or pigmented constituents should be noted, and any areas of original daubing should be recorded with color film for later reference. Daubing that is loose or is not adhered to the logs must first be cleaned out by hand. Blocking filler should be left intact, refitting only loose pieces. (Sometimes it may be difficult to obtain a good bond in which case it may be necessary to clean out the joint entirely.) If needed, soft filler should be added, such as jute or bits of fiberglass batt, pressed firmly into voids with a stick or blunt tool. Concealed reinforcement may sometimes be used, depending upon the authenticity of the restoration. This can include galvanized nails partially inserted only on the upper side of the log to allow for the daubing to move with the upper log and keep the top joint sealed, or galvanized wire mesh secured with galvanized nails. Like repointing masonry, daubing should not be done in full sun, excessive heat or when freezing temperatures are expected. The daubing materials should be dry-mixed, the chinking rechecked as being tight and secure, and the mix wetted and stirred to a stiff, paste-like consistency. The mix dries quickly, so no more daubing should be prepared at a time than can be applied in about 30 minutes. A test patch of new daubing, either on the building, or

in a mockup elsewhere, will help test the suitability of the formula's color and texture match.

Before applying the daubing, the chinking area, including filler and log surfaces to be covered, should be sprayed with water to prevent the dry filler from too rapidly drawing off the daubing moisture which will result in hairline cracking. A trowel, ground to the width of the daubing, is used to press the daubing into the chinking space, and to smooth the filled areas. Wide or deep chinking spaces or joints may have to be daubed in layers, to prevent sagging and separation from the logs, by applying one or two scratch coats before finishing the surface.

Portland cement was a part of the original daubing used in many late 19th and early 20th century log buildings, and is therefore appropriate to include in repairing buildings of this period. Although a small amount of portland cement may be added to a lime, clay and sand mix for workability, there should not be more than 1 part portland cement to 2 parts of lime in daubing mixes intended for most historic log buildings. Portland cement tends to shrink and develop hairline cracks, and retain moisture, all of which can be potentially damaging to the logs.

Daubing Mixes

parts (volume)	*material*
MIX A	
1/4	cement
1	lime
4	sand
1/8	dry color
	hog bristles or excelsior
MIX B	
6	sand
4	lime
1	cement
MIX C	
1	portland cement
4-8	lime
7-10	sand

Mix A (Donald A. Hutsler, "Log Cabin Restoration: Guidelines for the Historical Society," American Association for State and Local History, Technical Leaflet No. 74, "History News," Vol. 29, No. 5 (May 1974.)

Mix B and C are reprinted from "Log Structures: Preservation and Problem-Solving," by Harrison Goodall and Renee Friedman, Nashville, TN: American Association for State and Local History, 1980.

Interior Treatments

There is no single appropriate way to finish or restore the interior of a historic log house. Each building and its history is unique. The temptation should be resisted to impart an unfinished frontier character by removing plaster to expose interior log walls or joists in the ceiling. Instead, interior treatments should be based on existing evidence, and guided by old photographs, written documentation, and interviews with previous owners. Interior features and finishes that might exist in some 18th and 19th century log houses include wood paneled walls, wood moldings, stairs, and fireplace mantels; where they have survived, these features should be retained. Many of the more rustic log buildings built later in the 19th or early 20th century intentionally featured exposed interior log walls, sometimes with the logs peeled and varnished. If interior plaster is severely damaged or has previously been removed, and evidence such as lath ghosting on the logs exists, walls should be replastered or recovered with gypsum board or dry wall to match the historic appearance.

Preserving Log Buildings in Their Historic Settings

Log buildings are too often viewed as portable resources. Like other historic buildings, moved or relocated log structures can suffer a loss of integrity of materials and of setting. Historic buildings listed in the National Register of Historic Places may be subject to loss of that status if moved. Despite the popularity of dismantling and relocating log buildings, they should be moved only as a last resort, if that is the only way to save them from demolition. If they must be moved, it is preferable that they be moved intact-- that is, in one piece rather than disassembled. Disassembling and moving a log building can result in considerable loss of the historic building materials. While the logs and roof framing members can be numbered for reassembly, dismantling a log building can result in loss of such features as foundation and chimney, chinking and daubing, exterior cladding, and interior finishes. Furthermore, log buildings can rarely be put back together as easily as they were taken apart.

Summary

Historic log buildings regardless of whether they are of horizontal or vertical construction, or whether they are 18th century log houses or early 20th century Rustic style cabins, are unique. Their conservation essentially centers on the preservation and repair of the logs, and appropriate repairs to chinking and daubing, which like repointing of masonry, is necessary to ensure that most log buildings are weathertight. Log building preservation may be accomplished with a variety of techniques including splicing and piecing-in, the use of epoxy, or a combination of patching and epoxy, and often, selected replacement. But, like any historic building, a log structure is a system that functions through the maintenance of the totality of its parts.

The exterior of many of the earliest late 18th and 19th century log buildings, and particularly those east of the Mississippi, were commonly covered with some type of cladding, either horizontal or vertical wood siding, stucco, or sometimes a combination. If extant, this historic cladding, which may be hidden under a later, non-historic artificial siding such as aluminum, vinyl, or asbestos, should be preserved and repaired, or replaced if evidence indicates that it existed, as a significant character-defining feature of the building.

Selected Reading

Briscoe, Frank. "Wood-Destroying Insects." *The Old-House Journal.* Vol. XIX, No. 2 (March/April 1991), pp. 3439.

Caron, Peter. "Jacking Techniques for Log Buildings." Association for Preservation Technology *Bulletin*. Special Issue: Alberta Culture. Vol. XX, No. 4 (1988), pp. 4254.

Cotton, J. Randall. "Log Houses in America." *The Old-House Journal.* Vol. XVIII, No. 1 (January/February 1990), pp. 37-44.

Elbert, Duane E., and Keith A. Sculle. *Log Buildings in Illinois: Their Interpretation and Preservation.* Illinois Preservation Series: Number 3. Springfield, IL: Illinois Department of Conservation, Division of Historic Sites, 1982.

Goodall, Harrison. "Log Crown Repair and Selective Replacement Using Epoxy and Fiberglass Reinforcing Rebars: Lamar Barn, Yellowstone National Park, Wyoming." *Preservation Tech Notes*, Exterior Woodwork Number 3. Washington, D.C.: Preservation Assistance Division, National Park Service, U.S. Department of the Interior, 1989.

_____, and Renee Friedman. *Log Structures: Preservation and Problem-Solving.* Nashville, TN: American Association for State and Local History, 1980.

Hutslar, Donald A. *The Architecture of Migration: Log Construction in the Ohio Country*, 17501850. Athens, OH: Ohio University Press, 1986.

_____. *Log Cabin Restoration: Guidelines for the Historical Society*. American Association for State and Local History Technical Leaflet 74. History News. Vol. 29, No. 5, May 1974.

Jordan, Terry G. *American Log Buildings: An Old World Heritage.* Chapel Hill, NC: The University of North Carolina Press, 1985.

Kaiser, Harvey H. *Great Camps of the Adirondacks.* Boston: David R. Godine Publisher, Inc., 1986.

Merrill, William. "Wood Deterioration: Causes, Detection and Prevention." American Association for State and Local History Technical Leaflet 77. *History News*. Vol. 29, No. 8, August, 1974.

Rowell, R.M., J.M. Black, L.R. Gjovik, and W.C. Feist. *Protecting Log Cabins from Decay*. U.S.D.A. Forest Service Products Laboratory, General Technical Report, FPL11. Madison, WI: Forest Products Laboratory, Forest Service, U.S. Department of Agriculture, 1977.

St. George, R.A. *Protecting Log Cabins, Rustic Work and Unseasoned Wood from Injurious Insects in the Eastern United States*. Farmer's Bulletin No. 2104, United States Department of Agriculture. Washington, D.C.: Government Printing Office, 1962 (Rev. 1970).

Tweed, William C., Laura E. Soulliere, and Henry G. Law. *National Park Service Rustic Architecture: 1916-1942.* San Francisco, CA: Division of Cultural Resource Management, Western Regional Office, National Park Service, February 1977.

Wilson, Mary. *Log Cabin Studies*. Cultural Resources Report No. 9. Ogden, UT: United States Department of Agriculture, Forest Service, 1984.

Acknowledgements

The author, Curator, Landis Valley Museum, Lancaster, PA, wishes to thank those experts who reviewed and commented upon the draft manuscript: James Caufield; J. Randall Cotton; Harrison Goodall; Donald A. Hutslar; Terry G. Jordan; Bernard Weisgerber; Rodd Wheaton; and National Park Service professional staff. **Anne E. Grimmer** is credited with directing this cooperative publication project and general editorship.

Washington, D.C. September, 1991

Home page logo: The log cabin was used on this 1840 campaign metal to symbolize frontier life and egalitarianism, a platform that successfully elected William Henry Harrison to the presidency. Photo: The State Museum of Pennsylvania, Pennsylvania Historical and Museum Commission.

This publication has been prepared pursuant to the National Historic Preservation Act of 1966, as amended, which directs the Secretary of the Interior to develop and make available information concerning historic properties. Technical Preservation Services (TPS), Heritage Preservation Services Division, National Park Service prepares standards, guidelines, and other educational materials on responsible historic preservation treatments for a broad public.

Questions

Appendix D - Supplemental Photos

By Allen Edwards, October 2011

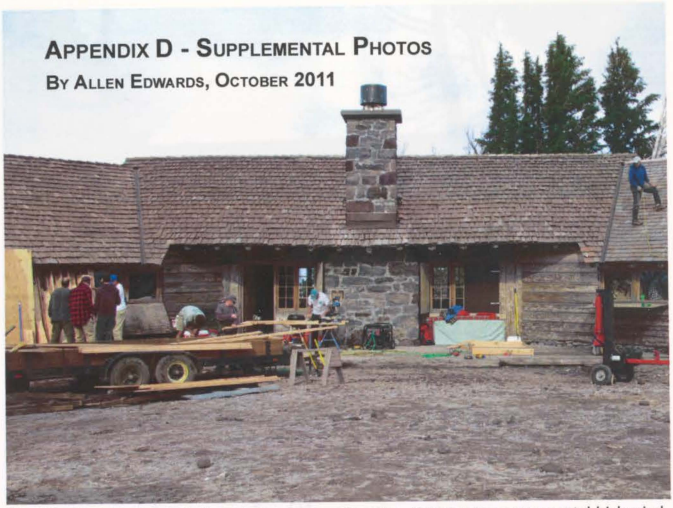


Fig. 1 South side of main hall, end-of-season work party. Note contemporary metal high wind chimney cap.

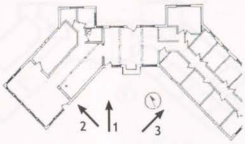


Fig. 2 West wing, bunk construction and shutter repair projects.

Fig. 3 East wing, Crag Rats assess cedar shingle condition.

Fig. 4 North entrance as seen from approach. Note portico on entrance c. 1920.

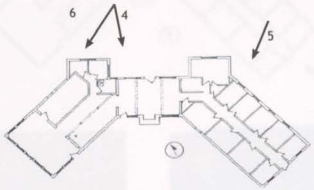


Fig. 5 East wing, east elevation. Note yellow hue of un-weathered Douglas fir logs.

Fig. 6 West pavilion and basement door to wood storage area at foundation level.

Fig. 7 East wing, east elevation. Note log ends protrude from the extension to wing in 1928. This element has been replaced in-kind to interpret the alteration. Shuttered single plan hopper windows.

Fig. 8. East wing, west elevation. Note uniform appearance of cut cedar shingles used on this wing. As split cedar shakes deteriorate, they will be replaced with this historically accurate roofing. Note open hopper window on L.

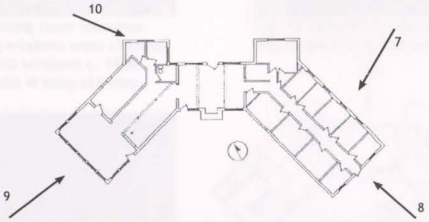


Fig. 10 Wood retaining wall outside basement wood storage area with north deck above.

Fig. 9 West wing 18 pane wood sash casement windows c. 1930 replaced two pairs of 4-over-4 double hung windows. Brick chimney from 1940.

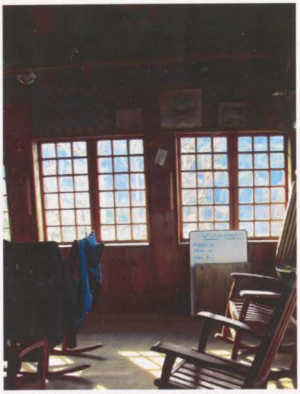


Fig. 11 Original dining room four-over-four double-hung windows were changed to 18-lite casement windows c. 1930 after the loss of the W wing chimney.

Fig. 12 View of CCC era corbeled doorway to west wing hall and bunks.

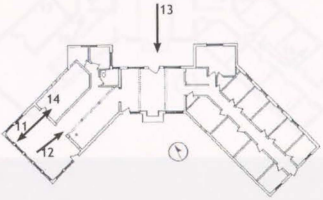


Fig. 14 View of kitchen, relocated to original position in 2000.

Fig. 13 Historic "Cloud Cap Inn" sign covered by portico on main entrance.

Fig. 15. East wing hallway with Douglas fir tongue and groove ceiling, walls, and floor.

Fig. 16 East bedroom. Bedrooms contain historic pencil graffiti. The author's attempts at photographing were unsuccessful in low light with flash glare. Historic graffiti is being preserved.

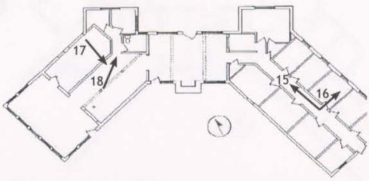


Fig. 18 Bathroom and barrel room in west wing and west pavilion.

Fig. 17 Photo of hatch door to attic space above ceiling of west wing hallway.

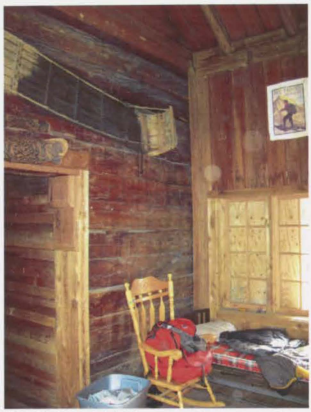


Fig. 19 Central hall, note adz and broad axe tool makings on timber wall. CCC era 8-lite casement windows in central hall were replaced in kind in 1997. Originals were 4-over-4 double-hung wood sash windows.

Fig. 20 Kitchen displaying heavy timber queen post truss system. Note 20-lite casement windows installed behind sink in 2000.

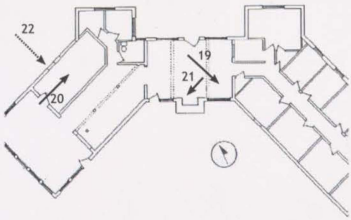


Fig. 22 Log floor joists are visible from wood storage area. The tops are flattened and bottoms notched to fit timber girder.

Fig. 21 Central hall hearth with fire. Ashlar stone work from CCC era replaced original fieldstone.