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Fort Leonard Wood Maintenance and Repair Manual

Building 1320, Storehouse

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Maintenance and Repair Manual
Building 1320—Storehouse

FINAL

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Prepared by

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Preface

This study was conducted for the U.S. Army Garrison Fort Leonard Wood, Directorate of Public Works/Environmental Division/Natural Resources Branch, Fort Leonard Wood, MO under project number CNC-Q093, "Cultural Resources Management Activities, M & R Manuals." Funding was provided by Military Interdepartmental Purchase Request 21/2020/220/A/MIPR3CERL07DE/PO, dated 30 April 2004. The Fort Leonard Wood technical monitor was Stephanie Nutt, Historic Archeologist.

The work was performed by the Land and Heritage Conservation Branch (CN-C) of the Installations Division (CN), Construction Engineering Research Laboratory (CERL). The CERL Project Manager was Adam Smith. Dr. Lucy A. Whalley is Chief, CN-C, and Mike Golish is Acting Chief, CN. The Acting Director of CERL is Dr. Ilker R. Adiguzel.

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1.0 MAINTENANCE RECORD

The Cultural Resources POC, DPW will review all proposed work, in addition these guidelines must be reviewed and followed by all personnel prior to performing this procedure.

This is a record of all of the maintenance proposed for the Fort Leonard Wood buildings. For a more detailed record, please consult the individual element's sections as well as the maintenance and management guidelines and procedures, which follow for site, masonry, metal, wood, roofing, doors and windows, and furnishings. Preservation and rehabilitation should be undertaken as sensitively as possible strictly following recommendations for treatment for particular zones correcting all deficiencies of the element. Recommendations for maintenance and management of each particular element should be strictly followed, and work should be logged in the back of this manual (date, weather conditions, supervisor signature, contractor information, work performed, and problems).

Site:

- A 3" minimum gap should be created between the bottom of the skirting and the gravel/soil to prevent deterioration to the wood because of their contact. Note this should only occur where the pier foundation exists.
- NR Rating: 211

Concrete- Foundation:

- Foundation needs to be reinforced with materials like in appearance and mechanical properties to those existing. See concrete section for detailed repair recommendations.
- NR Rating: 212

Metal -Flashing:

- Rusting metal
- Replace missing elements, repair, and repaint metal flashing in order to preserve the surrounding elements.
- Clean rusty portions and replace if beyond surface cleaning.
- NR Rating: 216

Metal- Hardware:

- Rusty door and window hardware
- Clean rusty hardware and replace if beyond surface cleaning.
- NR Rating: 212

Metal-Ventilation Stack:

- Rusting metal
- Clean rusty portions and replace if beyond surface cleaning.
- Painting is an option as long as it is financially viable and will be maintained strictly.
- NR Rating: 212

Metal- Gutter:

- Metal gutter on the east facade should be removed as it is causing excessive deterioration to surrounding elements as a result of improper drainage.
- NR Rating: 215

Electrical-Light Fixtures:

- Rusting metal
- Clean rusty hardware and replace if beyond surface cleaning.
- NR Rating: 211

Wood Decking:

- Wood should be cleaned, scraped, primed, and repainted without neglecting the endgrain.

NR Rating: 212

Wood-Fascia:

- Wood should be cleaned, scraped, primed, and repainted without neglecting the endgrain.
- NR Rating: 212

Wood-Rafters:

- Wood should be cleaned, scraped, primed, and repainted without neglecting the end grain.
- NR Rating: 212

Wood-End cap:

- Wood should be cleaned, scraped, primed, and repainted without neglecting the end grain.
- Repair damaged wood on entire building as detailed in the wood chapter of this maintenance manual, and replace any element that is beyond repair or missing.
- NR Rating: 212

Wood-Rake Trim:

- Wood should be cleaned, scraped, primed, and repainted without neglecting the end grain.
- NR Rating: 213

Wood-Coal Storage Container:

- Wood should be cleaned, scraped, primed, and repainted without neglecting the end grain.
- Repair damaged wood as detailed in the wood chapter of this maintenance manual, and replace any element that is beyond repair or missing.
- Wood should be treated for mold growth according to the guidelines set out in the wood chapter of this maintenance manual.
- NR Rating: 213

Wood-Ladder:

- Wood should be cleaned, scraped, primed, and repainted without neglecting the end grain.
- Repair damaged wood as detailed in the wood chapter of this maintenance manual, and replace any element that is beyond repair or missing.
- NR Rating: 212

Wood-Drop-lap Siding:

- Wood should be cleaned, scraped, primed, and repainted without neglecting the end grain.
- Wood should be reattached where separating from the building.
- Missing wood should be replaced in kind.

Wood-Drop-lap Siding (cont.):

- Repair damaged wood on entire building as detailed in the wood chapter of this maintenance manual, and replace any element that is beyond repair or missing.
- NR Rating: 211

Roof-Asphalt Shingles:

- Inspect yearly for signs of wear and localized failure.
- NR Rating: 214

Windows:

- Wood should be cleaned, scraped, primed, and repainted without neglecting the end grain.
- Wood should be treated for mold growth according to the guidelines set out in the wood chapter of this maintenance manual.
- Warped frames should be repaired or replaced if they are beyond repair.
- Reglaze where necessary.
- Clean excess putty from joint undersides and repoint to create a weather tight seal.
- NR Rating: 212

Doors:

- Wood should be cleaned, scraped, primed, and repainted without neglecting the end grain.
- Repair threshold or if it is beyond repair, it should be replaced in kind.
- Remove excess hardware and patch doors where previous hardware systems have been removed.
- Reglaze where necessary.
- NR Rating: 212

2.0 STAGE I—GENERAL INFORMATION

2.1 Background

The Fort Leonard Wood (FLW) historic building maintenance and repair program is based on three successive steps with each step providing a foundation for the next level. The first step is the identification and documentation of the historic building and classification of each building so that it may be compared to others. Steps two and three provide additional levels of documentation within each building. Step two allows the identification and prioritization of significant interior and exterior areas, or zones. Step three allows the identification and rating of the significant architectural elements of each zone, as well as providing maintenance and repair instructions, where deficiencies exist.

The building data is gathered through field inspections conducted by teams of architects and/or related professionals. This data is then gathered into three stages described below. The stages are:

> Stage I is the general identification information, including the background material necessary to establish a "frame of reference" for the building. It includes data on location, identification, size, codes, and related programs.
>
> Stage II allows the organization of the building into one or more zones, or areas of varying importance for historical and architectural reasons. Stage II contains descriptive information plus photographs and drawings to identify the areas.
>
> Stage III contains the identification, evaluation, and description of individual architectural features or elements within each zone established in Stage II. Stage III also identifies deficient elements and allows work recommendations and cost estimates to correct these deficiencies. The elements are organized into several divisions, such as Exterior, Interior, or Electrical. It is the data in Stage III, which is most applicable to the maintenance, repair, and rehabilitation of the building.

The data collected by the FLW historic building maintenance and repair program is reported in a maintenance and repair manual. It is organized into two parts: graphic documentation and written information. The graphic portion consists of photographs and floor plans of the building as it existed at the time of the inspection, plus the zoned building plans. The written portion consists of the various elements of the building and potential repair/replacement options guided by the Secretary of the Interior Standards.

NR RATING - The objective of Stage I is the classification of all historic properties. The purpose of the classification is to establish a ranking of architectural and/or historical significance. NR Rating, therefore, is a number from 1 to 8, which represents this classification. The definitions are as follows:

> CLASS 1 - A building, which is highly distinctive or unique. A National Historic Landmark or National Register building of national significance.
>
> CLASS 2 - A building on, or eligible for, the National Register at the National significance level. A typical example of a recognized architectural style, having all the primary features and details intact.
>
> CLASS 3 - A building on, or eligible for, the National Register at the State or Local significance level.
>
> CLASS 4 - A building, which is potentially eligible for the National Register because it appears to meet the criteria, but which has not been listed or evaluated.
>
> CLASS 5 - A building 50 years old or older, which has not been evaluated for National Register eligibility.

CLASS 6 - 45-50 - Pending. A building 45 to 50 years old which is not eligible for the National Register, but with the passing of time may become eligible and needs re-evaluation.

CLASS 7 - A building, which has been determined to be ineligible for the National Register.

CLASS 8 - Non-Historic.

2.2 General Information

LOCATION: Historic District, Westside of Nebraska Avenue, Fort Leonard Wood, Pulaski County, Missouri

USGS Big Piney, Missouri, United States Quadrangle,

Universal Transverse Mercator Coordinates: Zone 15

Northing 4177370

Easting 578322

PRESENT OWNER: Department of Defense

Department of the Army

Fort Leonard Wood

ORIGINAL USE: Storehouse

PRESENT USE: Museum Display and Storage

DATE OF CONSTRUCTION: October 1941

SIGNIFICANCE:

Though more than one company headquarters and storehouse were built at Fort Leonard Wood during the World War II mobilization, Building 1320 is one with its integrity intact in its context of mobilization buildings. As a storage/administration building, it served a critical function within the regimental grouping.

BUILDING NUMBER - 1320

NR - Eligible

HABS/HAER - MA – 1290 – B (Camp Edwards Building # T – 1222) Type SA-2, Plan # 700 – 376 (HABS is for type SA-1, which is an SA-2 with an extra room)

NR RATING - CLASS 2

DESCRIPTION:

Building 1320 is a one-story building constructed out of wood using a platform frame with a mat foundation. Siding consists of wood drop-lap butt-ended into corner caps. The roof is a front-gabled form. The rafters are exposed with a close rake. The door is paneled with a four-pane window on the top half of the door, the windows are six-over-six double-hung, and the roof has three stacks and two vents located along the ridge.

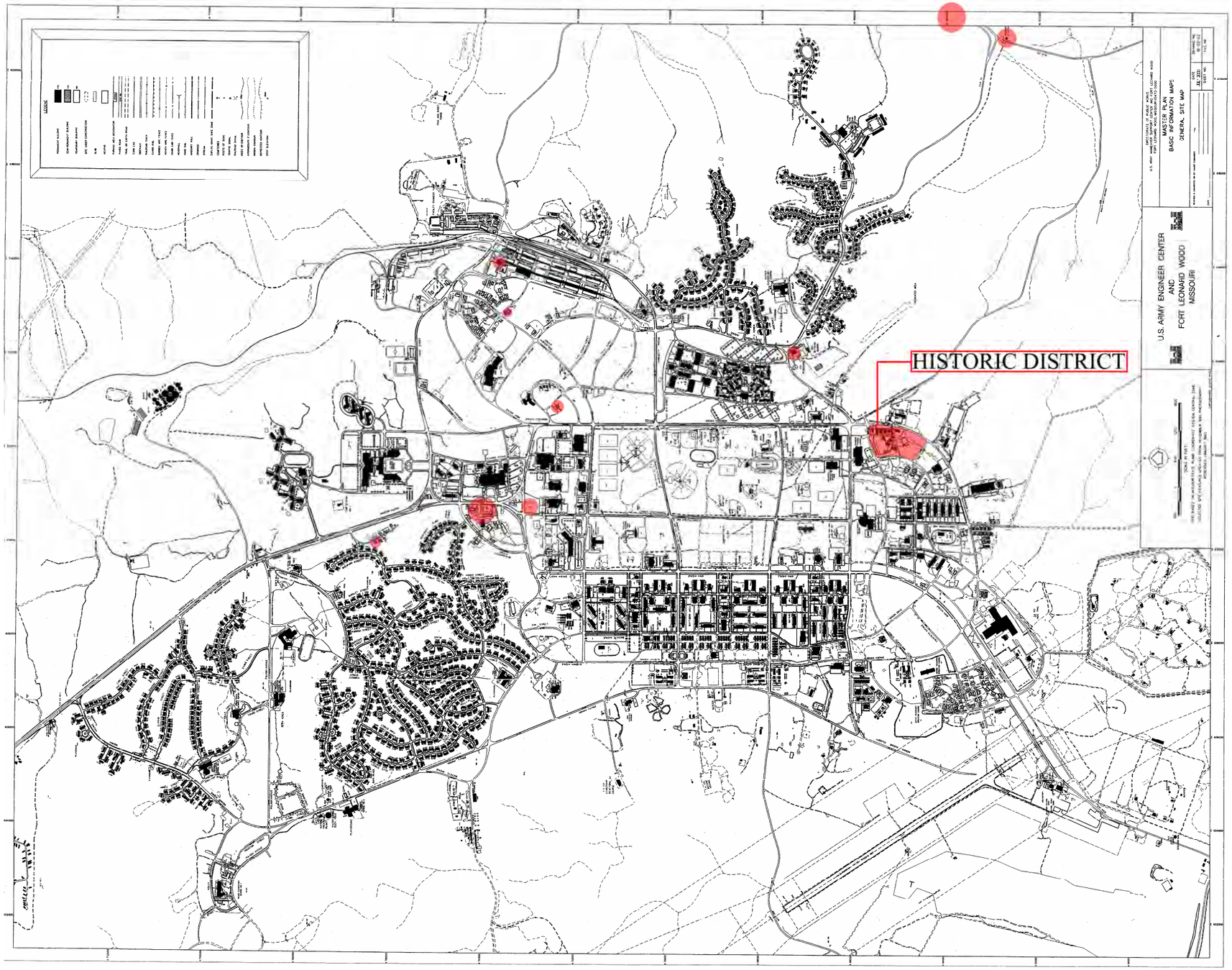


Figure 1: Fort Leonard Wood Cantonment Map with historic buildings located in red.

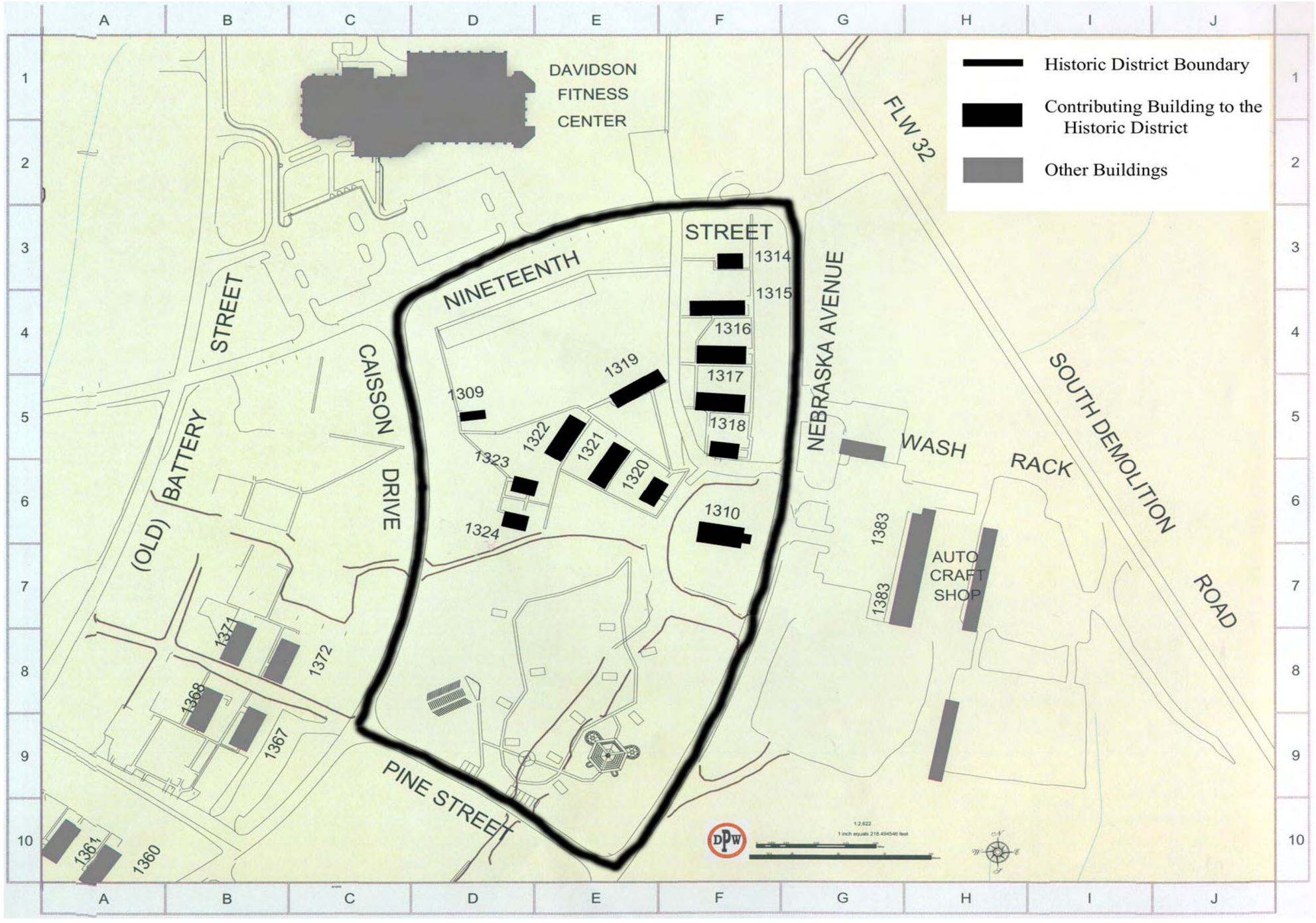


Figure 2: World War II Temporary Building Historic District Map

3.0 STAGE II – BUILDING ZONES

Building zones establish the framework for planning for the operation, maintenance, and rehabilitation of an individual building by dividing the building into logical areas consistent with their use, original design, public access, and integrity. The concept of zoning, while establishing a logical framework, is also consistent with techniques of original architectural programming, design, and construction.

The zoning of the building seeks to identify the differences between more and less significant interior and exterior building areas and assigns a numerical rating, or level, to each zone. The zone ratings establish management and treatment requirements for each zone, i.e., highly significant public spaces may be in a "preservation zone" where maintenance is tightly controlled and replacements are restricted. At the other end of the spectrum, larger, more private work areas may be subject to normal maintenance and open to a much broader range of architectural modification. The treatment guidelines for each level convey the general principles of preservation to be applied within the zone.

3.1 SUMMARY OF ZONES

Level 1 - Preservation Zone (Red)

Level 2 - Preservation Zone (Yellow)

Level 3 - Rehabilitation Zone (Green)

Level 4 - Free Zone (White)

Level 5 - Hazardous Zone (Black Outline)

Level 6 - Impact Zone (Red Stripes)

The Storehouse, Building 1320, has one zone:

3.1.1 LEVEL 1 - PRESERVATION ZONE

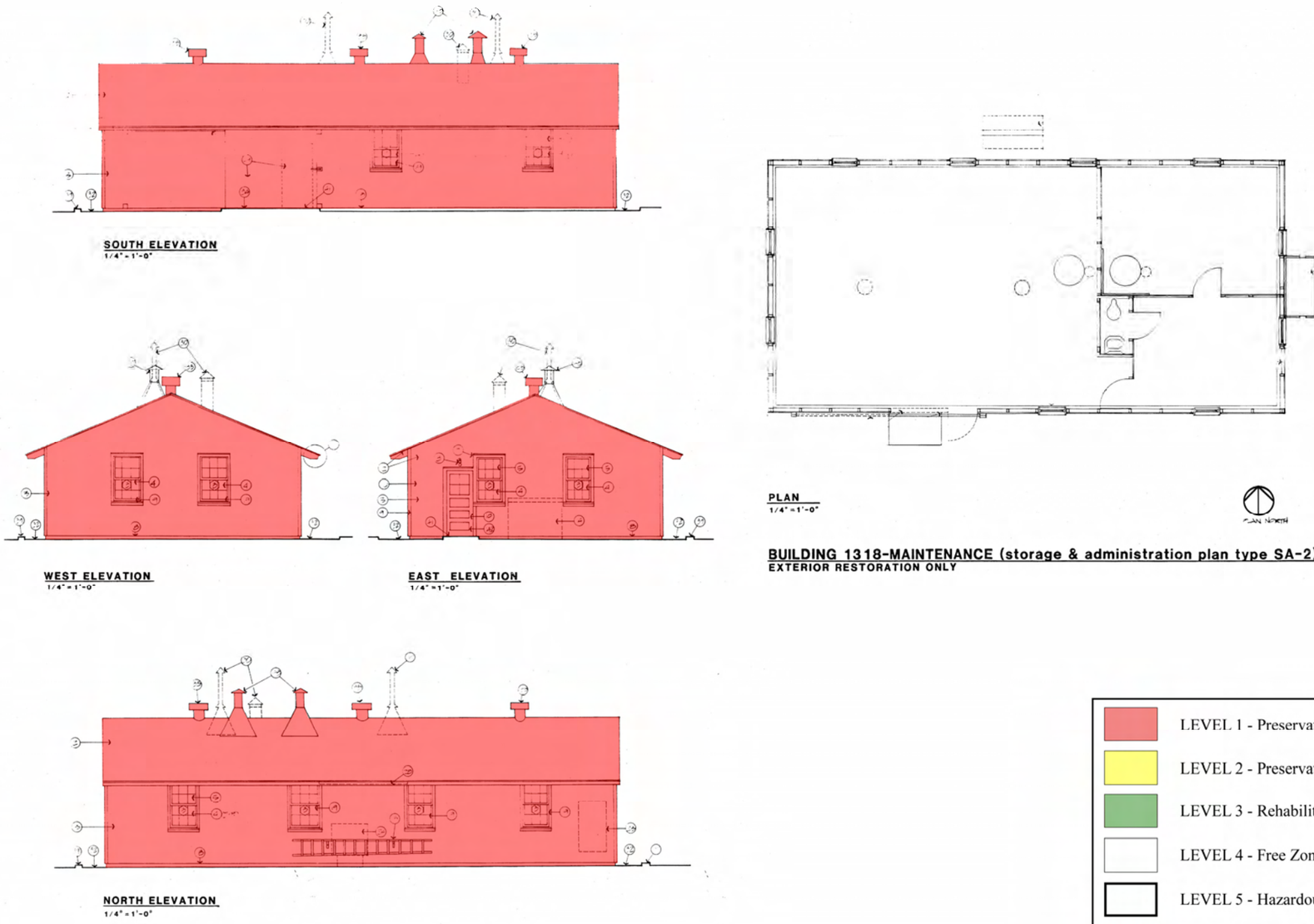
Areas, both in plan and elevation, that exhibits unique or distinctive qualities, original materials or elements, or representing examples of skilled craftsmanship, or work of a known architect or builder, or associated with a person or event of preeminent importance. Level 1 areas may be distinguished from Level 2 areas by concentrations of detailing or "richness" of finish material and detail.

EXAMPLE: Spaces or areas of a building representing the highest degree of detailing and finish level such as the main lobby or public spaces as might be found in an office building or public building, the foyer and parlors of an historic residence, the offices of the most "important" tenants within a building or space, assembly spaces such as courtroom or a library reading room, parlor etc., or the primary building facade(s), i.e., that facade which is the most visible to the public.

The building facades are generally in good shape, though there the wood needs to be scraped, primed, and repainted over the entire building. The paint has deteriorated due to age and has allowed water to penetrate in areas. This has sped up the deterioration of the paint and is promoting the deterioration of the wood. Water was able to penetrate the end grain of a good portion of the wood as a result of improper sealing. Areas which need attention are, but not limited to, the water table, end caps, skirting, siding, porch, railings, ladder, doors and window trim, and the doors themselves. Areas which will need more attention are the areas where the electrical wires connect to the building, as the connections seem to be missing a vulcanized rubber membrane which is leading to extensive damage of the surrounding elements. These areas are marked in red on the floor plan.

GUIDELINE: Every effort should be made to maintain and preserve the character and qualities of this zone. This includes but is not limited to the use of the same type of wood used for the original construction of these structures.

Figure 3: Building 1320 Building Zone Diagram



4.0 STAGE III – ELEMENT REPORT

4.1 GENERAL ASSESSMENT

There are specific trouble areas for the Fort Leonard Wood buildings, which should be more closely inspected, and more rigidly maintained.

The overall elements conditions for Fort Leonard Wood are good, except where identified in the individual reports for each structure. These areas tend to allow water infiltration, which then is leading to the rapid deterioration of those elements that are in direct contact with the area. Some areas, which should be regularly checked on all of the structures, include but are not limited to the skirt roofs, roof connections, and paint. These areas should be maintained strictly and checked regularly. When problems arise, the elements should be repaired as per preservation standards laid out in this manual. The areas and general problems of particular concern are:

4.1.1 GABLE-ENDED HIP ROOF

Corners:

The corners of the roof seem to be allowing water to penetrate, thereby causing the deterioration of the roof deck, rafters, and siding in these areas.

4.1.2 ROOF CONNECTIONS

Chimney and Electrical Connections:

These connections seem to have been improperly built up. They may be missing a vulcanized rubber membrane which should have been included in the original construction, but does not appear to be. This would allow for better water drainage and protection of the wood in these areas, but instead, water is being allowed to infiltrate, swelling the wood and allowing rapid deterioration of all elements in the vicinity.

4.1.3 WOOD COAL BIN

Mold growth

The coal storage bin rests directly on the ground and is as a result suffering from mold growth due to excess moisture. The historic appearance does not allow for the bin to be lifted off of the ground so, the wood will have to be periodically treated for mold growth. Painting yearly or every two years will help prevent this problem given that the entire storage bin is painted including all end grains and the base.

4.1.4 PAINT

All Elements:

Paint deterioration is a problem all buildings are experiencing at Fort Leonard Wood. The paint is alligatoring and peeling; which are caused by the natural aging of paint, or by the presence of excess moisture in the wall. These seem to be the culprits for the advanced deterioration. It is especially prominent in areas where the end grains of the wood have not been painted. This leaves the wood vulnerable to the elements, and causes premature deterioration. Paint should be reapplied generally every 3-5 years in an effort to protect the structure. **Please refer to paint and painting guidelines for wood in the wood portion of this manual.**

4.2 GENERAL INFORMATION

Preservation: Defined as the act or process of applying measures to sustain the existing form, integrity, and material of a building or structure.

The Element Report is the first part of the inventory and condition assessment and provides an inventory of the materials, components, and systems found within the building. The inventory and condition assessment is organized into seven categories or divisions. These include site, exterior, interior, foundation, furnishings, utilities/systems, and fire/life/health safety. An element may be an architectural feature, structural component, engineering system, or functional requirement. For each element found within the building a number of aspects are reported:

> DESCRIPTION - The description of the element provides information beyond the already descriptive name/title of the element. This can include the location on or within a building, unique characteristics, color, texture, design aspects, or whether or not the element is original.
>
> NR RATING - This three-digit number is in reality a three component rating system. The left digit is the NR Rating as defined above in Stage I. The middle digit indicates the level of the zone within which the element can be found defined above in Stage II. The right digit is a number from 1 to 6, which rates each individual element found within the building. It is also known as the element's TREATMENT RATING.

Maintenance personnel should be particularly concerned with the specific treatments associated with each numerical value, i.e., that a #1 rated element must be preserved, or that a #3 rated element should be preserved if at all possible, but if it must be replaced, modern materials are acceptable when used in a manner sympathetic to the historic character of the building. The classification levels and corresponding treatment standards are intentionally general at the building level. Their purpose is to heighten awareness, guide management, prevent unnecessary (potentially irreversible) damage, and to promote sensitive management and maintenance. The treatment ratings for individual elements are as follows:

4.3 SITE

4.3.1 Site Element

4.3.1.1 Site -- Grounds and Walking Paths

NR Rating: 211

Description:

Building 1320—the storehouse is located in the central protion of the block formed by Caisson Drive, East 19th Street, Nebraska Avenue, and Pine Street. It is in the eastern portion of the 1300 Regimental Company Area. It was originally the storehouse for this regimental grouping.

The ground around Building 1320 is the same level and no stairs are needed to gain access to the building. The grounds consist of grass with concrete sidewalks leading to the other portions of the 1300 regimental grouping.

The grounds are well maintained and should be cared for regularly.

Treatment Rating 1: PRESERVE.

Statement of Importance:

- The site is associated with those qualities for which the property was designated historic and dates to the World War II period of significance.

Condition: ***Good – Preserve***

Fair to good - Preserve

Poor - Replace

Inventory Quantity and Condition

The site is evaluated as Good when:

- gravel, debris, and soil should be cleared from the edge of the building as they are promoting the decay of building elements with which they are in direct contact, and
- trees should be cut back from the facade of the building in order to allow proper air circulation. Currently they are allowing the building facade to retain excess moisture, and
- the grounds are well maintained, and
- the front and side concrete walks are generally in good condition, and
- the sidewalks are clear of overgrown plantings, and
- large gravel supports proper soil drainage,and

Minor deficiency of an element exists where:

- Trees and bushes should be cut back so that they are not in direct contact with the building, and
- debris should be kept clear of the edges of the building because it could lead to further deterioration to the wood due to prolonged moisture exposure, and
- a minimum 3" gap should be maintained between the gravel and the skirting in the areas where the foundation is a pier foundation, and
- all walks should be kept clear of debris and overgrown plantings, and
- standard preventive maintenance practices and building conservation methods have not been followed, and/or
- there is a reduced life expectancy of affected or related building materials and/or systems, and/or
- there is a condition with long-term impact beyond 5 years.

4.3.2 Maintenance / Management Guidelines for Site

According to *The Secretary of Interior's Standards for Rehabilitation*, the proper procedure is to respect the significance of the original materials and features, repair and retain them wherever possible, and replace them only when absolutely necessary.

The following recommendations for care of the historic site are to be thoroughly read and understood before a treatment is specified. *The Secretary of the Interior's Standards for Rehabilitation* should also be consulted to determine the appropriateness of any treatment.

The following is an excerpt from *The Secretary of the Interior's Standards for Rehabilitation*. Full documentation can be found at http://www2.cr.nps.gov/tps/tax/rhb/stand.htm

4.3.2.1 Identify, Retain, and Preserve

Recommended…

- Identifying, retaining, and preserving buildings and their features as well as features of the site that are important in defining its overall historic character.
- Site features may include circulation systems such as walks, paths, roads, or parking; vegetation such as trees, shrubs, fields, or herbaceous plant material; landforms such as terracing, berms or grading; and furnishings such as lights, fences, or benches; decorative elements such as sculpture, statuary or monuments; water features including fountains, streams, pools, or lakes; and subsurface archeological features which are important in defining the history of the site.
- Retaining the historic relationship between buildings and the landscape.

Not Recommended…

- Removing or radically changing buildings and their features or site features, which are important in defining the overall historic character of the property so that, as a result, the character is diminished.
- Removing or relocating buildings or landscape features thus destroying the historic relationship between buildings and the landscape.
- Removing or relocating historic buildings on a site or in a complex of related historic structures--such as a mill complex or farm--thus diminishing the historic character of the site or complex.
- Moving buildings onto the site, thus creating a false historical appearance.
- Radically changing the grade on the property, or adjacent to a building. For example, changing the grade adjacent to a building to permit development of a formerly below-grade area that would drastically change the historic relationship of the building to its site.

4.3.2.2 Protect and Maintain

Recommended…

- Protecting and maintaining the building and building site by providing proper drainage to assure that water does not erode foundation walls; drain toward the building; nor damage or erode the landscape.
- Minimizing disturbance of terrain around buildings or elsewhere on the site, thus reducing the possibility of destroying or damaging important landscape features or archeological resources.
- Surveying and documenting areas where the terrain will be altered to determine the potential impact to important landscape features or archeological resources.
- Protecting, e.g., preserving in place important archeological resources.
- Planning and carrying out any necessary investigation using professional archeologists and modern archeological methods when preservation in place is not feasible.
- Preserving important landscape features, including ongoing maintenance of historic plant material.
- Protecting the building and landscape features against arson and vandalism before rehabilitation work begin, i.e., erecting protective fencing and installing alarm systems that are keyed into local protection agencies.

- Providing continued protection of masonry, wood, and architectural metals that comprise the building and site features through appropriate cleaning, rust removal, limited paint removal, and re-application of protective coating systems.
- Evaluating the overall condition of the materials and features of the property to determine whether more than protection and maintenance are required, that is, if repairs to building and site features will be necessary.

Not Recommended…

- Failing to maintain adequate site drainage so that buildings and site features are damaged or destroyed; or alternatively, changing the site grading so that water no longer drains properly.
- Introducing heavy machinery into areas where they may disturb or damage important landscape features or archeological resources.
- Failing to survey the building site prior to the beginning of rehabilitation work that results in damage to, or destruction of, important landscape features or archeological resources.
- Leaving known archeological material unprotected so that it is damaged during rehabilitation work.
- Permitting unqualified personnel to perform data recovery on archeological resources so that improper methodology results in the loss of important archeological material.
- Allowing important landscape features to be lost or damaged due to a lack of maintenance.
- Permitting the property to remain unprotected so that the building and landscape features or archeological resources are damaged or destroyed.
- Removing or destroying features from the buildings or site such as wood siding, iron fencing, masonry balustrades, or plant material.
- Failing to provide adequate protection of materials on cyclical basis so that deterioration of building and site feature results.
- Failing to undertake adequate measures to assure the protection of building and site features.

4.3.2.3 Repair

Recommended…

- Repairing features of the building and site by reinforcing historic materials.

Not Recommended…

- Replacing an entire feature of the building or site such as a fence, walkway, or driveway when repair of materials and limited compatible replacement of deteriorated or missing parts are appropriate.
- Using a substitute material for the replacement part that does not convey the visual appearance of the surviving parts of the building or site feature or that is physically or chemically incompatible.

4.3.2.4 Replace

Recommended…

- Replacing in kind an entire feature of the building or site that is too deteriorated to repair if the overall form and detailing are still evident. Physical evidence from the deteriorated feature should be used as a model to guide the new work. This could include an entrance or porch, walkway, or fountain. If using the same kind of material is not technically or economically feasible, then a compatible substitute material may be considered.
- Replacing deteriorated or damaged landscape features in kind.

Not Recommended…

- Removing a feature of the building or site that unrepairable and not replacing it; or replacing it with a new feature that does not convey the same visual appearance.
- Adding conjectural landscape features to the site such as period reproduction lamps, fences, fountains, or vegetation that is historically inappropriate, thus creating a false sense of historic development.

4.4 CONCRETE

4.4.1 Concrete Element

4.4.1.1 Concrete—Foundation System

NR Rating: 212

Description:

Building 1320 is a one-story building with an on grade concrete mat foundation. The foundation appears to be in good condition. Any repairs should be handled with caution repalacing or repairing with materials that are like in both appearance and mechanical properties.

The foundation should be maintained and repaired as necessary with materials that are like in appearance and mechanical properties.

Treatment Rating 2: PRESERVE WHEREVER POSSIBLE

IF TOO DETERIORATED TO SAVE, ELEMENT MUST BE REPLACED IN KIND.

Statement of Importance:

- The foundation system dates to the World War II period of historic significance of the building and represents a substantial amount of historic fabric, and
- the foundation wall system makes a significant contribution both to the property's historic appearance and as an integral part of the buildings historic construction.

Condition: ***Good – Preserve***

Fair to good - Preserve

Poor - Replace

Inventory Quantity and Condition

The foundation is evaluated as Good when:

- the foundation mat is structurally and architecturally intact, and
- maintenance and cleaning of the foundation system is all that is needed for it to continue to function as it was designed.

Minor deficiency of the foundation system may exist where:

- Clear debris and soil from edge of building in an effort to prevent excessive deterioration as a result of water penetration, and
- replace flashing where deteriorated as it is allowing for direct contact between the foundation and the wood siding above, and
- repair any cracks in concrete by sealing with specification-approved sealant, and
- patch damaged sections with in kind material finished to match existing, and
- repair damaged concrete too deteriorated to patch by cutting damaged material back to remove the source of deterioration (often corrosion of metal reinforcement bars), and
- new patch must be applied with in kind material finished to match existing, and
- replace sections too deteriorated to repair using materials compatible with the original materials, and
- standard preventive maintenance practices and building conservation methods have not been followed, and/or
- there is a reduced life expectancy of affected or related building materials and/or systems, and/or
- there is a condition with long-term impact beyond 5 years.

4.4.2 Maintenance / Management Guidelines for Concrete

According to *The Secretary of Interior's Standards for Rehabilitation*, the proper procedure is to respect the significance of the original materials and features, repair and retain them wherever possible, replace them only when absolutely necessary.

The following recommendations for care of historic concrete are to be thoroughly read and understood before a treatment is specified. *The Secretary of the Interior's Standards for Rehabilitation* should also be consulted to determine the appropriateness of any treatment.

The following is an excerpt from *The Secretary of the Interior's Standards for Rehabilitation*. Full documentation can be found at http://www2.cr.nps.gov/tps/tax/rhb/stand.htm

4.4.2.1 Protect and Maintain

Recommended…

- Provide proper drainage so water does not stand or accumulate.
- Clean walls only when necessary to halt deterioration or remove heavy soiling. Chemical cleaning, if utilized, should be conducted by experienced professionals.

- Tests should be conducted to determine the gentlest effective cleaning method possible; e.g., hand washing or low- to medium-pressure water cleaning. Tests should be observed over a sufficient period so that both the immediate and the long-range effects are known.

Not Recommended…

- Applying non-specified paint or other coatings such as stucco or insulation.
- Cleaning surfaces not heavily soiled.
- Cleaning without testing or without sufficient time for testing results to be of value.
- Sandblasting using dry or wet grit or other abrasive agent, high-pressure water-blasting or caustic solutions. These methods of cleaning or paint removal may permanently erode wall surface and accelerate deterioration.
- Wet cleaning when there is any possibility of freezing temperatures.

4.4.2.2 Repair

Recommended…

- Repair any cracks in concrete by sealing with specification-approved sealant.
- Patch damaged sections with in kind material finished to match existing.

Not Recommended…

- Replacing or rebuilding a major portion of foundation wall that could be repaired.
- Patching concrete without removing the source of deterioration.
- Patching with substitute material that is physically or chemically incompatible with the original concrete.

4.4.2.3 Replace

Recommended…

- Repair damaged concrete too deteriorated to patch by cutting damaged material back to remove the source of deterioration (often corrosion of metal reinforcement bars).
- New patch must be applied with in kind material finished to match existing.
- Replace sections too deteriorated to repair using materials compatible with the original materials.

TYPES OF CRACKS IN CONCRETE AND TYPICAL CAUSES[1]

U.S. General Services Administration
Historic Preservation Technical Procedures

03732-02

The Cultural Resources POC, DPW will review all proposed work; in addition, these guidelines must be reviewed and followed by all personnel prior to performing this procedure.

Cracks can be broadly classified as either active or dormant. If they are active, they show some movement in direction, width, or depth over a measured period. If the cracks are dormant, they remain unchanged. Some dormant cracks are of no danger, but if left unrepaired, cracks provide channels for moisture penetration, which can lead to future damage. For guidance on patching dormant cracks, see 03732-01-R "Repairing Cracks in Concrete by Injecting Epoxy Resin."

Cracks can be more specifically classified based on three factors:

1. direction
2. width
3. depth of the crack

They may be longitudinal, transverse, vertical, diagonal, or random. They may range in size from less than 1 mm (fine) to between 1 and 2 mm (medium) to over 2 mm (wide). The following are some crack classifications and a brief description.

- Pattern Cracking: Fine openings in regular pattern usually due to inconsistent volume of concrete, which is lower, near the surface.
- Checking: Shallow openings, closely and irregularly spaced.
- Hairline Cracking: Small cracks, randomly placed, in exposed areas.
- D-Cracking: Fine cracks at close intervals in a progressive random pattern.

Cracks can occur in hardened or unhardened concrete and may because by some of the following conditions:

- Shrinkage cracking: A crack that occurs only in unhardened concrete. It is often seen as relatively straight lines running parallel with the span of the floor.
- Plastic cracking: A type of shrinkage crack that also only occurs in unhardened concrete. It is seen as diagonal lines in the top of a slab. It is often caused by rapid drying of the surface due to delays in applying the curing membrane.
- Settlement cracking: Caused by local restraining of unhardened concrete around reinforcement or some other obstruction.
- Structural cracking: Usually a result of corrosion of the reinforcing steel or structural over stressing.
- Tension cracking: Only occurs in reinforced concrete and is caused by elongation of the reinforcement in tension zones. It is sometimes seen around columns in flat slabs and on beam soffits near the middle of a span.
- Rust cracking: The most common and most serious cause of structural cracking caused by inadequate reinforcement cover. It gradually develops at varying rates over time depending upon the degree of protection offered by the concrete cover.
- Thermally induced cracking: Results from stresses produced by temperature changes.

END OF SECTION

[1] The following excerpt is from the U.S. General Services Administration (GSA) Technical Procedures. Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf

PATCHING SPALLED CONCRETE[2]

U.S. General Services Administration
Historic Preservation Technical Procedures

03732-04

The Cultural Resources POC, DPW will review all proposed work; in addition, these guidelines must be reviewed and followed by all personnel prior to performing this procedure.

PART 1---GENERAL

1.01 SUMMARY

A. This procedure includes guidance on patching spalls and holes in concrete with a cementitious patching material.

B. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:
   1. Safety Precautions
   2. Historic Structures Precautions
   3. Submittals
   4. Quality Assurance
   5. Delivery, Storage, and Handling
   6. Project/Site Conditions
   7. Sequencing and Scheduling
   8. General Protection (Surface and Surrounding)

1.02 QUALITY ASSURANCE

A. Masonry and Concrete Repair: Prepare sample panels of size indicated for each type of masonry material indicated to be patched, rebuilt, or replaced.

PART 2---PRODUCTS

2.01 MANUFACTURERS

A. Sika Corporation
   201 Polito Ave.
   Lyndhurst, NJ 07071
   201/933-8800

B. General Polymers

C. Master Builders

[2] The following excerpt is from the U.S. General Services Administration (GSA) Technical Procedures. Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf

2.02 MATERIALS

A. Concrete Patching Material: One component, early strength, cementitious patching material "SikeTop 222 or 223" (Sika Corporation); "TPM 723" (General Polymers); "Vertipatch" (Master Builders), or approved equal.

B. Water: Clean, free of oils, acids, alkalis, and organic matter.

2.03 EQUIPMENT

A. Trowels

B. Chisels

C. Stiff bristle brushes (non-metallic)

PART 3---EXECUTION

3.01 PREPARATION

A. Protection:

1. Protect persons, motor vehicles, surrounding surfaces of building whose masonry surfaces are being restored, building site, and surrounding buildings from injury resulting from masonry restoration work.
2. Erect temporary protection covers over pedestrian walkways and at points of entrance and exit for persons and vehicles, which must remain in operation during course of masonry restoration work.
3. Contractor shall test those areaway drains, window well drains, etc., which will be used to assure that drains are functioning properly prior to performing masonry restoration operations in those areas. The Contractor shall report immediately to the Construction Engineer the location of drains, which are found to be stopped up, or blocked.
4. Prevent grout or mortar used in repointing and repair work from staining face of surrounding masonry and other surfaces. Remove immediately grout and mortar in contact with exposed masonry and other surfaces.
5. Protect sills, ledges, windows, and projections from patching material droppings.

3.02 ERECTION, INSTALLATION, APPLICATION

A. Remove deteriorated concrete at spalls to sound material. Grind, chisel, or saw cut deep undercut around perimeter of patch. Clean with compressed air. Thoroughly remove any concrete showing traces of oils or grease.

B. Thoroughly wet patched area prior to casting concrete patching material. If cement patching material manufacturer recommends a different procedure, such procedure is to be followed and executed in accordance with published instructions and in accordance with approved test patch.

C. Install cement-patching material in strict accordance with manufacturer's published instructions.

D. Finish surface to match surface being patched, by grinding, troweling, sacking, or brushing.

3.03 ADJUSTING/CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter using stiff nylon or bristle brushes and clean water, spray applied at low pressure.

B. Use of metal scrapers or brushes will not be permitted.

C. Use of acid or alkali cleaning agents will not be permitted.

END OF SECTION

REMOVING SURFACE DIRT FROM CONCRETE[3]

U.S. General Services Administration
Historic Preservation Technical Procedures

03710-15

The Cultural Resources POC, DPW will review all proposed work; in addition, these guidelines must be reviewed and followed by all personnel prior to performing this procedure.

THE CLEANING OR REMOVAL OF STAINS FROM CONCRETE MAY INVOLVE THE USE OF LIQUIDS, DETERGENTS OR SOLVENTS WHICH MAY RUN OFF ON ADJACENT MATERIAL, DISCOLOR THE CONCRETE OR DRIVE THE STAINS DEEPER INTO POROUS CONCRETE. USE THE PRODUCTS AND TECHNIQUES DESCRIBED HERE ONLY FOR THE COMBINATIONS OF DIRT/STAIN AND CONCRETE SPECIFIED.

PART 1---GENERAL

1.01 SUMMARY

A. This procedure includes guidance on removing dirt from concrete using a detergent, chemical solvent or steam.

B. Dirt encompasses deposits of almost any material in a location where it is not wanted, but it usually includes fine, dark-colored solid particles, often surrounded by some kind of oily film. It is particularly troublesome on architectural and decorative concrete, including exposed aggregate surfaces.

C. Safety Precautions:
   1. DO NOT save unused portions of stain-removal materials.
   2. DO NOT store any chemicals in unmarked containers.
   3. EXCELLENT VENTILATION MUST BE PROVIDED WHEREVER ANY SOLVENT IS USED. USE RESPIRATORS WITH SOLVENT FILTERS.
   4. Whenever acid is used, the surface should be thoroughly rinsed with water as soon as its action has been adequate. Otherwise, it will continue etching the concrete even though the stain is gone.
   5. Provide adequate clothing and protective gear where the chemicals are indicated to be dangerous.
   6. Have available antidote and accident treatment chemicals where noted.

D. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:
   1. Safety Precautions
   2. Historic Structures Precautions
   3. Submittals
   4. Quality Assurance
   5. Delivery, Storage, and Handling
   6. Project/Site Conditions
   7. Sequencing and Scheduling
   8. General Protection (Surface and Surrounding)

[3] The following excerpt is from the U.S. General Services Administration (GSA) Technical Procedures. Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf

PART 2---PRODUCTS

2.01 MATERIALS
NOTE: Chemical products are sometimes sold under a common name. This usually means that the substance is not as pure as the same chemical sold under its chemical name. The grade of purity of common name substances however, is usually adequate for stain removal work, and these products should be purchased when available, as they tend to be less expensive. Common names are indicated below by an asterisk (*).

A. Hydrochloric Acid:
   1. A strong corrosive irritating acid.
   2. Other chemical or common names include Chlorhydric acid; Hydrogen chloride; Muriatic acid*; Marine acid*; Spirit of salt*; Spirit of sea salt*.
   3. Available from chemical supply house, drugstore, hardware store.

B. Detergent:

CAUTION: SOME DETERGENTS CONTAIN AMMONIA AND MAY REACT VIGOROUSLY WITH HYDROCHLORIC ACID.

C. Clean, potable water

D. Clean white cloths or towels

2.02 EQUIPMENT
A. Steam cleaning equipment

B. Stiff bristle brushes (non-metallic)

PART 3---EXECUTION

3.01 PREPARATION
A. Protection:
   1. Provide adequate wash solutions (i.e. water, soap, and towels) before starting the job.
   2. Whenever acid is used, the surface should be thoroughly rinsed with water as soon as its action has been adequate. Otherwise, it will continue etching the concrete even though the stain is gone.

3.02 ERECTION, INSTALLATION, APPLICATION

NOTE: Do not try more than one treatment on a given area unless the chemicals used from prior treatment have been washed away.

A. Brush affected area with water and strong detergent.

B. Rinse the area thoroughly with clean, clear water and blot the surface dry with clean towels.

C. Repeat the treatment as necessary until the desired level of cleanliness is achieved.

-OR-

A. Mix 1 part hydrochloric acid in 19 parts water.

B. Scrub the concrete surface with this solution.

NOTE: This is a strong method and may roughen the concrete.

C. Rinse the area thoroughly with clean, clear water; blot the surface dry with clean towels.

D. Repeat the treatment as necessary until the desired level of cleanliness is achieved.

-OR-

A. Steam cleaning is generally effective and may be used in combination with proprietary materials, such as detergents for dirt removal.

B. If there is oil present in the dirt, follow the procedure described for removing lubricating oil, see 03710-31-R "Poulticing Lubricating and Petroleum Oil Stains from Concrete."

END OF SECTION

REPAIRING CRACKS IN CONCRETE BY INJECTING EPOXY RESIN[4]

U.S. General Services Administration
Historic Preservation Technical Procedures

03732-01
The Cultural Resources POC, DPW will review all proposed work; in addition, these guidelines must be reviewed and followed by all personnel prior to performing this procedure.

PART 1---GENERAL

1.01 SUMMARY

A. This procedure includes guidance on patching cracks in concrete by injecting an epoxy adhesive.

B. Epoxy Injection should be used for DORMANT CRACKS - cracks that remain unchanged. Dormant cracks generally pose little danger. However, if left unrepaired, they will provide channels for moisture penetration.

C. The calculated maximum crack width for concrete should not exceed 0.3 mm. Consult a professional to determine the cause for cracking and its source, as superficial repairs can aggravate the problem.

D. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:
   1. Safety Precautions
   2. Historic Structures Precautions
   3. Submittals
   4. Quality Assurance
   5. Delivery, Storage, and Handling
   6. Project/Site Conditions
   7. Sequencing and Scheduling
   8. General Protection (Surface and Surrounding)

E. For guidance in monitoring cracks, see 04200-02-S.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM),
   100 Barr Drive
   West Conshohocken, PA 19428
   (610) 832-9585
   or FAX (610) 832-9555.

PART 2---PRODUCTS

2.01 MANUFACTURERS

A. Abatron, Inc.
   5501 95th Ave.
   Kenosha, WI 53144
   800/445-1754 or 414/653-2000

[4] The following excerpt is from the U.S. General Services Administration (GSA) Technical Procedures. Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf

B. Sika Corporation
201 Polito Ave.
Lyndhurst, NJ 07071
201/933-8800

2.02 MATERIALS

A. Epoxy Resin (Abatron, Inc., Sika Corp.), or approved equal.
1. For Fine Cracks:
a. Epoxy shall be a two-part type, low viscosity epoxy adhesive material containing 100% solids and shall meet or exceed the following characteristics when tested in accordance with the standards specified.

b. Characteristics of Components:
1) Component A - shall be a blend of modified epoxy resins.
2) Component B - shall be a blend of modified amine curing agents.

c. Test Method Requirements:
1) Component A - Brookfield RVT, 700 maximum; Viscosity @ 77 +/- 3ºF., cps; Spindle No. 2 @ 20 rpm.
2) Component B - Brookfield RVT, 240 maximum; Viscosity @ 77 +/- 3ºF, cps; Spindle No. 2.

d. Properties of Combined Components: When mixed in the ratio of two parts Component A to one part Component B by volume, or 100 parts Component A to 44 parts Component B by weight, shall be:
1) Potlife, 60g @ 77 +/- 3ºF., minutes; 25 minutes maximum.

e. Properties of the Cured Adhesive: When cured for seven days @ 77 +/- 3ºF., unless otherwise specified, shall be:
1) Ultimate Tensile Strength: ASTM D638; 8000 minimum.
2) Compressive Yield Strength, psi: ASTM D695*; 15,000 minimum.
3) Heat Deflection Temperature: ASTM D648*; 130 F. minimum.

NOTE: Test specimens must be cured in a manner such that the peak exothermic temperature of the adhesive does not exceed 77ºF.

2. For Wide Cracks:
a. Epoxy shall be a two-part gel epoxy adhesive material containing 100% solids and shall meet or exceed the following characteristics when tested in accordance with the standards specified.

b. Properties of Combined Components: When mixed in the ratio of two parts Component A to one part Component B by volume, or 100 parts Component A to 34 parts Component B by weight shall be:
1) Potlife, 200g @ 77ºF. +/- 3ºF., minutes.

c. Properties of the Cured Adhesive: When cured for seven days @ 77 degrees F. +/- 3 ºF., unless otherwise specified, shall be:
1) Ultimate Tensile Strength: ASTM D638; 1,500 psi minimum.
2) Compressive Yield Strength: ASTM D695; 6,000 psi minimum.
3) Heat Deflection Temperature: ASTM D648; 105 F. minimum.

B. Surface Seal: (Epoxy Mortar or Oil-free Clay)
1. Description: The surface seal material is that material used to confine the injection adhesive in the joints or cracks during injection and cure.

2. Properties: The surface seal material shall have adequate strength to hold injection fittings firmly in place and to resist injection pressures adequately to prevent leakage during injection. The material shall not leave a residue upon removal.

NOTE: Provide adhesive crack fillers and other related materials that are compatible with one another and with substrates under conditions of severe weather, demonstrated by sealant manufacturer based on testing and field experience.

2.03 EQUIPMENT

A. Equipment for Injection:
   1. Type: The equipment used to meter and mix the two injection adhesive components and inject the mixed adhesive into the crack shall be portable, positive displacement type pumps with interlock to provide positive ratio control of exact proportions of the two components at the nozzle. The pumps shall be electric or air powered and shall provide in-line metering and mixing.
   2. Discharge Pressure: The injection equipment shall have automatic pressure control capable of discharging the mixed adhesive at any pre-set pressure up to 200 psi + 5 psi and shall be equipped with a manual pressure control override. For injection of the gel epoxy, the equipment shall be equipped with the above features and be able to pump at up to 5,000 psi.
   3. Ratio Tolerance: The equipment shall have the capability of maintaining the volume ratio for the injection adhesive prescribed by the manufacturer of the adhesive within a tolerance of + 5% by volume at any discharge pressure up to 200 psi. For gel epoxies, the ratio will be checked by weight at up to 5,000 psi.
   4. Automatic Shut-Off Control: The injection equipment shall be equipped with sensors on both the Component A and B reservoirs that will automatically stop the machine when only one component is being pumped to the mixing head.
   5. The manufacturer of the injection equipment and the manufacturer of the epoxy resin adhesive for injection shall be the same.

PART 3---EXECUTION

3.01 EXAMINATION

A. Examine the nature and severity of the crack:
   1. What direction are the cracks going and where are they the widest?
   2. Note sloped floors, bulging walls and doors that do not fit.

B. Determine the probable cause:
   1. Foundation erosion
   2. Decay of materials
   3. Structural failure
   4. Change in materials or geometry
   5. Thermal and moisture changes

C. Determine possible consequences if left unrepaired.

D. Evaluate alternative methods of repair.

E. For cracks associated with thermal movement, look for:
   1. Horizontal or diagonal cracks near the ground at piers in long walls due to horizontal shearing stresses between the upper wall and the wall where it enters the ground.
   2. Vertical cracks near the ends of walls.
   3. Vertical cracks near the top and ends of the facade.
   4. Cracks around stone sills or lintels: due to expansion of the masonry against both ends of the tight fitting stone piece that cannot be compressed.

3.02 PREPARATION

A. Surface Preparation:
   1. Substrate Conditions: Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from joint substrates.
   2. Surfaces adjacent to joints or other areas of application shall be cleaned of dirt, dust, grease, oil, or other foreign matter detrimental to bond of epoxy injection surface seal system.
   3. Entry ports shall be provided along the crack at intervals of not less than the thickness of the concrete member at that location.
   4. Surface seal material shall be applied to the face of the crack or end. For through cracks, surface seal shall be applied to both faces.
   5. Enough time for the surface seal material to gain adequate strength shall pass before proceeding with the injection.

3.03 ERECTION, INSTALLATION, APPLICATION

A. If, before repairs are made, the crack is still damp, be sure to use an epoxy appropriate for damp conditions.

B. Seal both sides of cracks with an epoxy mortar or oil-free clay, leaving small holes through which epoxy resin will be injected. 1/8" to 1/4" diameter tubing can be used to form holes. Holes should be 2"-4" long, roughly 8" apart.

C. Inject 2-component epoxy using device as provided by manufacturer.

D. Injection of epoxy adhesive shall begin at lower entry port and continue until there is an appearance of epoxy adhesive at the next entry port adjacent to the entry port being pumped.

E. When epoxy adhesive travel is indicated by appearance at the next adjacent port, injection shall be discontinued on the entry port being pumped, and epoxy injection shall be transferred to next adjacent port where epoxy adhesive has appeared.

F. Perform epoxy adhesive injection continuously until cracks are completely filled.

G. If port-to-port travel of epoxy adhesive is not indicated, the work shall immediately be stopped and the engineer notified.

H. When cracks or joints are completely filled, epoxy adhesive shall be cured for sufficient time to allow removal of injection or port sealing devices.

I. The outermost quarter inch of the crack shall be filled with a colored epoxy material of the installers' choice subject to prior approval of the Cultural Resources POC. The colored epoxy filler shall match the existing material, which it is filling and shall not be discernible from a distance of 15 feet.

3.04 ADJUSTING/CLEANING

A. Upon completion of work, remove all seal material and other residue from site. Remove and clean exposed surfaces of residue or staining resulting from this work.

END OF SECTION

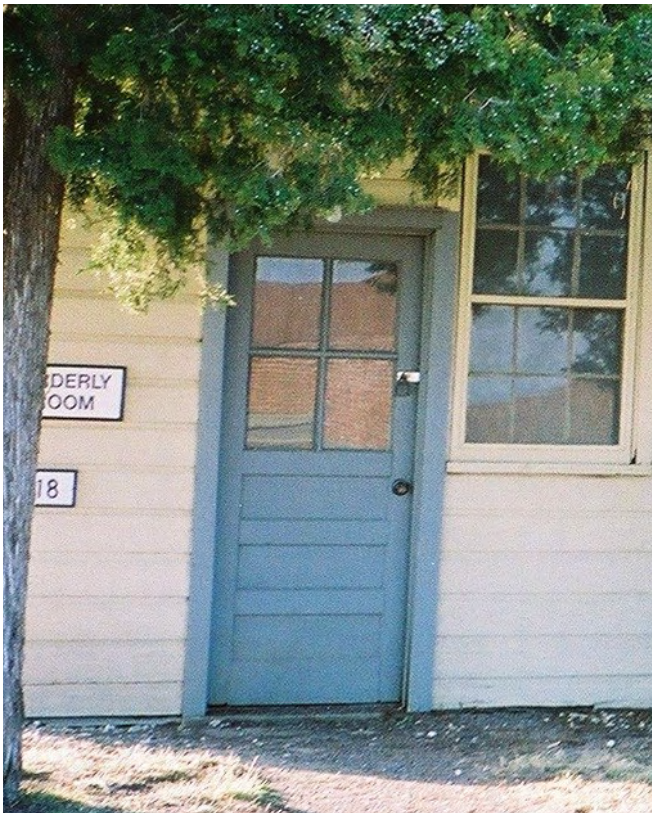
4.5 METAL

4.5.1 Metal Element

4.5.1.1 Metal—Hardware

Description:

Metal hardware includes operation handles for windows, door knobs, and locks for both window and doors. It also includes the metal fasteners which attach the ladder to the building. Over time, the door hardware has been altered or replaced and in some instances holes remain.



Door and window hardware are in good condition and should be maintained in order to protect the metal from premature wear.

Treatment Rating 2: PRESERVE WHEREVER POSSIBLE

IF TOO DETERIORATED TO SAVE, ORIGINAL HARDWARE MUST BE REPLACED IN KIND. HARDWARE TOO DETERIORATED TO SAVE WHICH IS NOT ORIGINAL TO THE STRUCTURE MUST BE REPLACED WITH A DESIGN AND MATERIAL IN KIND TO THE ORIGINAL.

Statement of Importance:

- The hardware has acquired significance in its own right or makes an important contribution to World War II period levels of significance identified for the property, and
- the hardware makes a significant contribution to the property's historic appearance and as an integral part of the building's historic construction, and
- the original hardware meets level "1" criteria, but what has been replaced does not.

Condition: ***Good – Preserve***

Fair to good - Preserve

Poor - Replace

Inventory Quantity and Condition

The hardware is evaluated as Good when:

- the hardware is intact, structurally sound and performing its intended purpose, and
- there are few or no cosmetic imperfections, and
- the hardware needs no repair and only minor or routine maintenance, and
- the hardware on the doors and windows is intact and operable, and
- the hardware shows signs of daily use and wear as the finishes are wearing, and
- the hardware needs to be maintained on a yearly basis in order to insure that it will continue to function properly.

Minor deficiency of the hardware exists where:

- Clean rusty hinges, connectors, and door hardware, and
- replace hardware that is beyond surface cleaning, and
- maintain hardware so that it remains in correct working condition, and
- standard preventive maintenance practices and building conservation methods have not been followed, and/or
- there is a reduced life expectancy of affected or related building materials and/or systems, and/or
- there is a condition with long-term impact beyond 5 years.

4.5.1.2 Metal—Flashing

NR Rating: 216

Description:

Metal flashing is a thin metal strip that runs along the perimeter of the building, windows, roof, and doors in order to prevent water penetration and/or provide water drainage. Generally the flashing is in poor condition along the entire perimeter of the building. Its contact with the ground is promoting its decay prematurely.

Flashing should be cleaned and repaired to ensure it continues to function, and missing elements and any elements beyond repair should be replaced as laid out later in this chapter.

Treatment Rating 6: SPECIFIED TREATMENT IS NOT REQUIRED

IF ANY WORK IS DONE ON THIS ELEMENT, IT SHOULD BE SYMPATHETIC TO THE SIGNIFICANT QUALITIES OF THE HISTORIC PROPERTY.

Statement of Importance:

- The flashing has no historic value, but is a later sensitive repair.

Condition: ***Good – Preserve***

Fair to good - Preserve

Poor - Replace

Inventory Quantity and Condition

The flashing is evaluated as Good when:

- the paint is cracking and peeling, and
- there are early signs of wear, failure, or deterioration, though the element is generally structurally sound and performing its intended purpose, and
- check to ensure all flashing is draining properly in order to prevent future damage, and
- damaged surfaces should be cleaned, and
- a new paint coat should be applied, and

- there is failure of a sub-component of the element, and
- the flashing needs to be maintained on a yearly basis in order to insure that it will continue to function properly, and
- replacement of up to 25% of the element or replacement of a defective subcomponent may be required.

Minor deficiency of the flashing exists where:

- Repair deteriorated or damaged flashing using recognized preservation methods, and
- any repairs to the flashing should be made after cleaning the surface gently if necessary, and
- missing elements should be replaced in kind, and
- clean and replace any flashing that is beyond surface cleaning, and
- the flashing should be repainted using a compatible paint in order to prevent future damage, and
- maintain flashing so that it remains in correct working condition, and
- standard preventive maintenance practices and building conservation methods have not been followed, and/or
- there is a reduced life expectancy of affected or related building materials and/or systems, and/or
- there is a condition with long-term impact beyond 5 years.

Minor deficiencies can include, but are not limited to: paint deterioration.

4.5.1.3 Metal—Vent Stack

NR Rating: 212

Description:

There are three metal ventilation stack located symmetrically along the roof ridge as well as two asymmetrically placed vents toward the west protion of the roof. They appear to function correctly, but should be cleaned thoroughly and their connections to the roof inspected carefully to ensure they are properly built up.

The chimnies show signs of wear and rust, and therefore should be cleaned and if it is beyond surface cleaning should be replaced as per preservation standards.

Treatment Rating 2: PRESERVE WHEREVER POSSIBLE

IF TOO DETERIORATED TO SAVE, ELEMENT MUST BE REPLACED IN-KIND.

Statement of Importance:

- The metal ventilation stacks contribute to the significance of Building 1320 as a building from the World War II period, and
- the metal ventilation stacks make a significant contribution to the property's historic appearance and as an integral part of the buildings historic construction, and
- the ventilation stacks meet level "1" criteria except that preservation is not feasible.

Condition: ***Fair – Preserve***

Fair to good - Preserve

Poor - Replace

Inventory Quantity and Condition

The metal ventilation stacks are evaluated as Fair when:

- the stacks are severely rusting in areas and as a result are promoting the deterioration of surrounding elements , and
- there are early signs of wear, failure, and deterioration, though the stacks appear to be structurally sound and performing their intended purpose, and
- damaged surfaces should be cleaned and replaced if it is beyond surface cleaning, and
- there is failure of a sub-component of the element, and
- the stacks need to be maintained on a yearly basis in order to insure they will continue to function properly, and

Minor deficiency of the ventilation stacks extists where:

- Clean rusty portions, and
- paint if economically viable, and
- replace portions that are beyond surface cleaning, and
- maintain stack so that they remain in correct working condition, and
- check for properly built-up connections through the roof, and
- standard preventive maintenance practices and building conservation methods have not been followed, and/or
- there is a reduced life expectancy of affected or related building materials and/or systems, and/or
- there is a condition with long-term impact beyond 5 years.

Minor deficiencies can include, but are not limited to: rusting surfaces and wearing finishes.

4.5.1.4 Metal—Gutter

NR Rating: 215

Description:

On the east elevation, a gutter has been installed just over the sliding door. This is not historically relevant to the structure and should be removed.

The gutters should be removed as they are not original to the structures and are promoting the advanced derteroiration of the surrounding elements.

Treatment Rating 5: REMOVE/ALTER/REPLACE

UNDERTAKE ALL NEW WORK AS SENSITIVELY AS POSSIBLE.

Statement of Importance:

- the metal gutter is not significant and through design or condition detracts from the historic appearance of the building, or

Example: An inappropriate or other insensitive design modification.

Condition: ***Fair – Remove***

Fair to good - Remove

Poor - Remove

Inventory Quantity and Condition

The gutter is evaluated as Fair when:

- the element is intact, structurally sound, and performing its intended purpose, and
- there is increased deterioration to surrounding elements as a result of increased water flow from drainage, and
- the element provides no true benefit to the user and should be promptly removed, and
- the gutter shows signs of wear as the finishes are wearing.

Minor deficiency of the gutter exists where:

- The gutter system promotes deterioration to the areas on either side of the entrance due to increased water volume in these areas during rain showers, and
- the element provides no real benefit to the building. It does not substantially reduce or protect the user from rain or drainage from the roof, therefore should be removed, and
- the element, though does not detract from the appearance of the building, as it blends in, does not present any historic value therefore should be removed, and
- standard preventive maintenance practices and building conservation methods have not been followed, and/or
- there is a reduced life expectancy of affected or related building materials and/or systems, and/or
- there is a condition with long-term impact beyond 5 years.

Minor deficiencies can include, but are not limited to: rusting surfaces, wearing finishes, and provides no historic relevance and should be removed.

4.5.2 Maintenance / Management Guidelines for Metal

According to *The Secretary of Interior's Standards for Rehabilitation*, the proper procedure is to respect the significance of the original materials and features, repair and retain them wherever possible, and replace them only when absolutely necessary.

The following recommendations for care of the historic metal are to be thoroughly read and understood before a treatment is specified. *The Secretary of the Interior's Standards for Rehabilitation* should also be consulted to determine the appropriateness of any treatment.

The following is an excerpt from *The Secretary of the Interior's Standards for Rehabilitation*. Full documentation can be found at http://www2.cr.nps.gov/tps/tax/rhb/stand.htm

4.5.2.1 Identify, Retain, and Preserve

Recommended…

- Identifying, retaining, and preserving architectural metal features such as columns, capitals, window hoods, or stairways that are important in defining the overall historic character of the building; and their finishes and colors. Identification is also critical to differentiate between metals prior to work. Each metal has unique properties and thus requires different treatments.

Not Recommended…

- Removing or radically changing architectural metal features that are important in defining the overall historic character of the building so that, as a result, the character is diminished.
- Removing a major portion of the historic architectural metal from a facade instead of repairing or replacing only the deteriorated metal, then reconstructing the facade with new material in order to create a uniform or "improved" appearance.
- Radically changing the type of finish or its historic color or accent scheme.

4.5.2.2 Protect and Maintain

Recommended…

- Protecting and maintaining architectural metals from corrosion by providing proper drainage so that water does not stand on flat, horizontal surfaces or accumulate in curved, decorative features.
- Cleaning architectural metals, when appropriate, to remove corrosion prior to repainting or applying other appropriate protective coatings.
- Identifying the particular type of metal prior to any cleaning procedure and then testing to assure that the gentlest cleaning method possible is selected or determining that cleaning is inappropriate for the particular metal.
- Cleaning soft metals such as lead, tin, copper, terneplate, and zinc with appropriate chemical methods because their finishes can be easily abraded by blasting methods.
- Using the gentlest cleaning methods for cast iron, wrought iron, and steel--hard metals--in order to remove paint build-up and corrosion. If hand scraping and wire brushing have proven ineffective, low pressure grit blasting may be used as long as it does not abrade or damage the surface.
- Applying appropriate paint or other coating systems after cleaning in order to decrease the corrosion rate of metals or alloys.
- Repainting with colors that are appropriate to the historic building or district.
- Applying an appropriate protective coating, such as lacquer to an architectural metal feature, such as a bronze door, which is subject to heavy pedestrian use.
- Evaluating the overall condition of the architectural metals to determine whether more than protection and maintenance are required, that is, if repairs to features will be necessary.

Not Recommended…

- Failing to identify, evaluate, and treat the causes of corrosion, such as moisture from leaking roofs or gutters.
- Placing incompatible metals together without providing a reliable separation material. Such incompatibility can result in galvanic corrosion of the less noble metal, e.g., copper will corrode cast iron, steel, tin, and aluminum.
- Exposing metals that were intended to be protected from the environment.
- Applying paint or other coatings to metals such as copper, bronze, or stainless steel that were meant to be exposed.
- Removing the patina of historic metal. The patina may be a protective coating on some metals, such as bronze or copper, as well as a significant historic finish.

- Cleaning soft metals such as lead, tin, copper, terneplate, and zinc with grit blasting which will abrade the surface of the metal.
- Using cleaning methods which alter or damage the historic color, texture, and finish of the metal; or cleaning when it is inappropriate for the metal.
- Failing to employ gentler methods prior to abrasively cleaning cast iron, wrought iron or steel; or using high pressure grit blasting.
- Failing to re-apply protective coating systems to metals or alloys that require them after cleaning so that accelerated corrosion occurs.
- Using new colors that are inappropriate to the historic building or district.
- Failing to assess pedestrian use or new access patterns so that architectural metal features are subject to damage by use or inappropriate maintenance such as salting adjacent sidewalks.
- Failing to undertake adequate measures to assure the protection of architectural metal features.

4.5.2.3 Repair

Recommended…

- Repairing architectural metal features by patching, splicing, or otherwise reinforcing the metal following recognized preservation methods.
- Repairs may also include the limited replacement in-kind--or with a compatible substitute material--of those extensively deteriorated or missing parts of features when there are surviving prototypes such as porch balusters, column capitals or bases; or porch cresting.

Not Recommended…

- Replacing an entire architectural metal feature such as a column or a balustrade when repair of the metal and limited replacement of deteriorated or missing parts are appropriate.
- Using a substitute material for the replacement part that does not convey the visual appearance of the surviving parts of the architectural metal feature or that is physically or chemically incompatible.

4.5.2.4 Replace

Recommended…

- Replacing in-kind an entire architectural metal feature that is too deteriorated to repair--if the overall form and detailing are still evident--using the physical evidence as a model to reproduce the feature.
- Examples could include cast iron porch steps or steel sash windows.
- If using the same kind of material is not technically or economically feasible, then a compatible substitute material may be considered.

Not Recommended…

- Removing an architectural metal feature that is unrepairable and not replacing it; or replacing it with a new architectural metal feature that does not convey the same visual appearance.

PRIMERS AND PAINTS FOR WROUGHT IRON, CAST IRON, AND STEEL[5]

U.S. General Services Administration
Historic Preservation Technical Procedures

05010-13

The Cultural Resources POC, DPW will review all proposed work; in addition, these guidelines must be reviewed and followed by all personnel prior to performing this procedure.

This standard includes general information on primers and paints to be used on interior and exterior wrought iron, cast iron, and steel surfaces.

THE SELECTION OF A SUITABLE PRIMER AND PAINT FOR METALS DEPENDS ON MANY FACTORS INCLUDING THE TYPE OF METAL TO BE COATED, THE TYPE OF SURFACE PREPARATION TO BE USED, ENVIRONMENTAL AND SURFACE CONDITIONS, DESIRED APPEARANCE, AND PERFORMANCE REQUIREMENTS, METHOD OF APPLICATION, AND TYPE AND LEVEL OF EXPOSURE. CONSULT A PAINT MANUFACTURER ALONG WITH THE DIRECTORATE OF ENVIRONMENTAL COMPLIANCE AND MANAGEMENT BEFORE MAKING THE FINAL SELECTION.

The primary purpose of paint is to protect the metal from deterioration. To do so, paint manufacturers have developed paint systems, which are made to work together to protect the metal substrate. These systems include primers and appropriate, compatible topcoats, which can vary depending on the substrate, environmental conditions, and can, vary between manufacturers. As a result, appropriate primers and compatible topcoats, both from the same manufacturer should be used.

For information on paint removal from metal, surface preparation, and application procedures see the following:

For guidance on paint removal from iron and steel, see:
- 05010-05-R "Cleaning/Removing Paint From Wrought Iron, Cast Iron and Steel Using Mechanical/Abrasive Methods
- 05010-16-R "Removing Paint From Wrought Iron, Cast Iron and Steel Using Thermal Methods"
- 05010-17-R "Removing Paint From Wrought Iron, Cast Iron and Steel Using Chemical Methods"

For additional information on the history, properties and uses of paint, see 09900-01-S. See 09900-07-S for general guidelines on painting interior and exterior surfaces.

PRIMERS FOR WROUGHT IRON, CAST IRON, AND STEEL

Characteristics

- Primary function is adhesion.
- Must bond well to substrate and intermediate coat. Should have enough chemical and weather resistance to protect the substrate before application of next coat.

[5] The following excerpt is from the U.S. General Services Administration (GSA). Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf

- Should be compatible with intermediate and topcoats.
- Should be compatible with paint/rust removal methods.

Types

A. Oil/Alkyd Primers:

Advantages:

1. Bond well to most surfaces even if surface preparation is substandard; and
2. Compatible with oil finish coats.

Limitations:

1. NOT compatible with finish coats of vinyl, epoxy or other synthetic polymer. Solvents in these systems attack and soften these primers; and
2. Limited corrosion resistance

B. Mixed Resin Primers:

Advantages:

1. Bond well to most surfaces, though adequate surface preparation is important; nd
2. Compatible with most finish coats; and
3. Good alkali resistance; and
4. Some corrosion resistance.

Limitations:

1. It is only compatible with a specific range of topcoats.

C. Resin Same as Topcoats:

Advantages:

1. Effective when surface is properly prepared; and
2. Some corrosion resistance.

D. Inorganic Zinc:

Advantages:

1. Outstanding bonding characteristics when surface is cleaned and roughened; and
2. Compatible with most finish coats; and
3. Effectively resists disbanding; and
4. Excellent resistance to underfilm corrosion; and
5. Effective in protecting the metal without the help of a finish coat.

Limitations:

1. It is NOT acid or alkali-resistant.

E. Wash Primers: Suitable for use on steel, aluminum, zinc, cadmium, chromium, tinplate, and terneplate.

Advantages:

1. Provides a smooth, durable, uniform base for finish coat application; and
2. Compatible with the following topcoats: vinyl, phenolics, alkyds, nitrocellulose, and oil-type products.

Limitations:

1. It is NOT recommended for surfaces subject to temperatures above 150 degrees F (66 degrees C).

F. Conversion Coatings: Oxidizing solution Used on zinc, iron, aluminum, and magnesium (formulation will vary depending on type of metal). This type of coating is usually factory-applied.

Advantages:

1. Excellent corrosion resistance; and
2. Good adhesion to subsequent paint coats.

Limitations:
1. It is subject to deterioration if overheated.

G. Zinc Chromate: Used on aluminum, magnesium, and ferrous metals.
Advantages:
1. It has good corrosion resistance.

Limitations:
1. It is not suited to highly acidic environments.

H. Zinc-rich Coatings:
Advantages:
1. It has good corrosion resistance.

PAINTS FOR WROUGHT IRON, CAST IRON, AND STEEL

Characteristics
Should be compatible with primer
- Intermediate coat should uniformly bond the primer with the topcoat.
- Intermediate coat should have enough chemical and weather resistance to protect the primer and substrate.

Types
A. Oil-based/Alkyd Enamel:
Advantages:
1. For normal to severe weather conditions, provides good abrasion and dirt resistance; and
2. Suitable for both exterior and interior uses; and
3. Good bonding characteristics.

Limitations:
1. Alkyds are not good in a continuously damp or chemically corrosive environment, nor are they solvent resistant; and
2. Limited alkali resistance.

B. Baked Phenolic:
Advantages:
1. Excellent resistance to acidic environments; and
2. Excellent resistance to water; and
3. Excellent resistance to strong solvents; and
4. Low material cost.

Limitations:
1. Low alkali resistance; and
2. High labor cost for application.

C. Epoxies:
Advantages:
1. Good adhesion, and
2. Good chemical resistance, and
3. Good abrasion resistance, and
4. Good alkali resistance.

Limitations:
1. Sensitive to chalking under exterior exposure, and
2. Sensitive to color fading, and
3. Weak in acid.

D. Acrylics: (thermoplastic and thermosetting coatings)
Advantages:
1. Moderate cost; and
2. Good resistance to degradation from ultraviolet light; and
3. Suitable for both interior and exterior use.

E. Vinyl: Used primarily as intermediate coats
Advantages:
1. Good alkali and acid resistance, and
2. Excellent water resistance, and
3. Low chalking rate.

Limitations
1. Limited solvent and heat resistance, and
2. Inferior to alkyd and epoxy coatings - lower adhesive strength, and
3. Sensitive to intercoat contamination.

F. Inorganic Zinc:
Advantages:
1. Excellent weather and solvent resistance, and
2. Excellent resistance to underfilm corrosion, and
3. Resistant to petroleum products.

Limitations:
1. Limited chemical resistance, and
2. Not suitable for strong acid or strong alkali environments.

G. Organic Zinc:
Advantages:
1. It protects against corrosion.

H. Furan:
Advantages:
1. It is one of the most versatile and resistant of organic films.

Limitations:
1. Poor adhesion to steel and any primed surface; and
2. The film gets very hard after curing, making it extremely difficult to maintain them.

I. Urethanes:
Advantages:
1. Excellent gloss and color retention; and
2. Preferable to epoxy protective coatings or primers; and
3. Available in a wide variety of formulations for different surface types and conditions.

Limitations:
1. Comparable to epoxies and vinyl in resistance to corrosion; and
2. Some tend to yellow when exposed to sunlight; and
3. It is expensive.

J. Silicones:
Advantages:
1. Excellent heat resistance; and
2. Excellent color and gloss retention; and
3. Available in pure or modified form (a mixture of 2 coating types).

Limitations:
1. It is expensive.

END OF SECTION

4.6 WOOD

4.6.1 Wood Element

4.6.1.1 Wood—Coal Storage Bin

NR Rating: 213

Description:

The storage bin is located on the north side of the building. As a result of resting directly on the ground, there is considerable mold damage. The storage bin needs to be cleaned and scraped and the mold should be addressed as per preservation standards detailed later in this chapter. All debris should be cleared from the base of the container to help prevent moisture problems. At this point the wood should be sealed once the mold is removed to prevent future deterioration of both the paint and the wood.

Coal Storage Bin should be scraped and repainted and all debris should be cleared from the base in order to prevent future deterioration.

Treatment Rating 3: PRESERVE WHEREVER POSSIBLE

IF TOO DETERIORATED TO SAVE, ELEMENT MUST BE REPLACED WITH COMPATIBLE MATERIAL AND DESIGN.

Statement of Importance:

- The coal storage bin contributes to the significance and historic appearance of the commander's quarters as a building from the World War II period, and
- the coal bin represents later, sensitive repair or replacement work.

Condition: ***Fair – Preserve***

Fair to good - Preserve

Poor – Replace

Inventory Quantity and Condition

The coal storage bin is evaluated as Fair when:

- the paint should be scraped and reapplied including the end grain, and
- the mold, especially near the base of the bin, should be addressed as detailed in this chapter, and
- there are early signs of wear, failure, or deterioration, though the coal container is generally structurally sound and performing its intended purpose, and
- the paint is peeling and cracked, and
- the wood on the lid of the storage bin is rotting due to improper seal and water drainage inherent in the design, and
- damaged surfaces should be cleaned, and
- there is failure of a sub-component of the element, and
- replacement of up to 25% of the element or replacement of a defective subcomponent may be required.

Minor deficiency of the coal storage bin exists where:

- Wood should be scraped and repainted, including the end grain, which is most susceptible to water intake, causing future paint failure, and
- any repairs to the wood should be made after cleaning the surface gently and treating the mold growth, and
- if wood is beyond repair, it should be replaced in kind as detailed at the end of this chapter, and
- mold should be addressed as per preservation standards detailed later in this chapter, and
- standard preventive maintenance practices and building conservation methods have not been followed, or
- there is a reduced life expectancy of affected or related building materials and/or systems, or
- there is a condition with long-term impact beyond 5 years.

Minor deficiencies can include, but are not limited to: rotting wood, paint deterioration, and mold growth.

4.6.1.2 Wood—End Cap

NR Rating: 212

Description:

The wood end cap finishes the corners of the building hiding the joint between the siding from one face of the building and that of the adjacent face. The end caps are generally in fair condition. There are definite signs of age and water infiltration.

The end caps are pulling away from the building, alligatoring and delaminating.

Treatment Rating 2: PRESERVE WHEREVER POSSIBLE

IF TOO DETERIORATED TO SAVE, ELEMENT MUST BE REPLACED IN-KIND.

Statement of Importance:

- The wood end cap contributes to the historic appearance, being an integral part of the original construction of the building, and
- contributes to the significance of Building 1320 as a building from the World War II period.

Condition: ***Fair – Preserve***

Fair to good - Preserve

Poor - Replace

Inventory Quantity and Condition

The wooden endcap is evaluated as Fair when:

- the endcaps on all sides of the building are allowing water to infiltrate and as a result are rotting upwards from the watertable, and
- the endcaps are rotting from the ground up on the north facade, and
- there are early signs of wear, failure, or deterioration, though the element is generally structurally sound, and
- the paint is peeling and cracked, and

- damaged surfaces should be cleaned, and
- a new paint coat should be applied without neglecting the endgrain, and
- there is failure of a sub-component of the element, and
- replacement of up to 25% of the element or replacement of a defective subcomponent may be required.

Minor deficiency of the wood endcap where:

- Repair deteriorated or damaged wood by carefully patching, piecing-in, or otherwise reinforcing the wood using recognized preservation methods, and
- missing elements should be replaced in kind, and
- any repairs to the wood should be made after cleaning the surface gently if necessary, and
- end caps should be scraped, primed, and repainted, including the end grain, which is most susceptible to water intake, and
- standard preventive maintenance practices and building conservation methods have not been followed, and/or
- there is a reduced life expectancy of affected or related building materials and/or systems, and/or
- there is a condition with long-term impact beyond 5 years.

Minor deficiencies can include, but are not limited to: end cap warping, paint delamination and alligatoring.

4.6.1.3 Wood—Fascia

NR Rating: 212

Description:

The wood fascia closes the exposed raked roof. It is attached to the end of the rafters and serves visually as a capping piece for the rafters. The fascia exists along the entire perimeter of the roof of Building 1320. The fascia is generally in good condition and needs only minor repair and or maintenance.

The wood fascia should be cleaned, scraped, and paint reapplied as needed in order to prevent the wood from deteriorating.

Treatment Rating 2: PRESERVE WHEREVER POSSIBLE

IF TOO DETERIORATED TO SAVE, ELEMENT MUST BE REPLACED IN-KIND.

Statement of Importance:

- The wood end cap contributes to the historic appearance, being an integral part of the original construction of the building, and
- contributes to the significance of Building 1320 as a building from the World War II period.

Condition: ***Good– Preserve***

Fair to good - Preserve

Poor - Replace

Inventory Quantity and Condition

The wood fascia is evaluated as Good when:

- the paint is peeling and cracking on all sides of the fascia, and
- the wood is intact, structurally sound and performing its intended purpose, and

- the wood should be cleaned, and
- the paint will need to be scraped and reapplied including the endgrain, and
- there are few or no cosmetic imperfections, and
- the wood rafters need no repair and only minor or routine maintenance.

Minor deficiency of the wood fascia exists where:

- Replace deteriorated or damaged wood by carefully patching, piecing-in, or otherwise reinforcing the wood using recognized preservation methods, and
- any repairs to the wood should be made after cleaning the surface gently, and
- the surface of the wood should be scraped, cleaned, primed, and repainted as detailed later in this chapter, and
- standard preventive maintenance practices and building conservation methods have not been followed, and/or
- there is a reduced life expectancy of affected or related building materials and/or systems, and/or
- there is a condition with long-term impact beyond 5 years.

Minor deficiencies can include, but are not limited to: paint deterioration and deteriorating wood.

4.6.1.4 Wood—Rake Trim

NR Rating: 213

Description:

The wood rake trim is the capping 1x2 at the gable roof ends, and is attached at the roof lines to the rafters just under the roof flashing. Generally the trim is in good condition, but is becoming separated in many cases in the historic district and therefore should be inspected and maintained.

The wood rake trim should be cleaned, scraped, and paint reapplied as needed in order to prevent the wood from deteriorating.

Treatment Rating 3: PRESERVE WHEREVER POSSIBLE

IF TOO DETERIORATED TO SAVE, ELEMENT MUST BE REPLACED WITH COMPATIBLE MATERIAL AND DESIGN.

Statement of Importance:

- The trim board contributes to the historic appearance of the building and represents later, sensitive repair or replacement work.

Condition: ***Good– Preserve***

Fair to good - Preserve

Poor - Replace

Inventory Quantity and Condition

The wood rake trim is evaluated as Good when:

- the paint is peeling and cracking on all sides of the trim, and
- the wood is intact, structurally sound and performing its intended purpose, and
- the wood should be cleaned, and
- the paint will need to be scraped and reapplied including the endgrain, and
- there are few or no cosmetic imperfections, and
- the wood rafters need no repair and only minor or routine maintenance.

Minor deficiency of the rake trim exists where:

- Any repairs to the wood should be made after cleaning the surface gently, and
- the wood should be repainted, including the endgrain, which is most susceptible to water intake, causing future paint failure, and
- standard preventive maintenance practices and building conservation methods have not been followed, and
- there is a reduced life expectancy of affected or related building materials and/or systems, and
- there is a condition with long-term impact beyond 5 years.

Minor deficiencies can include, but are not limited to: paint deterioration due to age and water infiltration.

4.6.1.5 Wood—Ladder

NR Rating: 212

Description:

The wood ladder was painted then assembled. Notches were cut in vertical pieces to fit the horizontal footstep pieces of the ladder. The ladder is resting on the side of the building on two brackets that are chamfered at the bottom.

Wood ladder is generally in good condition. Ladder should be cleaned, scraped, and repainted in an effort to protect the wood from future deterioration as a result of water infiltration.

Treatment Rating 2: PRESERVE WHEREVER POSSIBLE

IF TOO DETERIORATED TO SAVE, ELEMENT MUST BE REPLACED IN-KIND.

Statement of Importance:

- The wooden ladder contributes to the historic appearance of Building 1320, being an integral part of the historic appearance of the building, and
- contributes to the significance of the mess hall as a building from the World War II period.

Condition: ***Good– Preserve***

Fair to good - Preserve

Poor – Replace

Inventory Quantity and Condition

The ladder is evaluated as good when:

- the wood is intact, structurally sound and performing its intended purpose, and
- the ladder shows paint wear, surface checking of wood, and rusting nails, and
- the wood should be cleaned, scraped, primed and repainted without neglecting the end grain and
- there are few or no cosmetic imperfections, and
- the wood ladder needs no repair and only minor or routine maintenance.

Minor deficiency of the ladder exists where:

- Any repairs to the wood should be made after cleaning the surface gently if necessary, and
- the hardware connections should be cleaned and replaced if they are beyond surface cleaning, and
- the wood should be cleaned, scraped, primed, and repainted, including the end grain, and
- standard preventive maintenance practices and building conservation methods have not been followed, and/or
- there is a reduced life expectancy of affected or related building materials and/or systems, and/or
- there is a condition with long-term impact beyond 5 years.

Minor deficiencies can include, but are not limited to: rusting hardware and paint deterioration

4.6.1.6 Wood—Rafters

NR Rating: 212

Description:

The wood roof rafters are closed 2x4s with a close rake from the exterior face of the building to the edge of the roof. Generally, the damage to these areas is either paint related or structural, both of which are a result of water penetration. The rafters are in good condition, but some areas need more attention than others. The paint is cracking and checking globally on the rafters. The rafters should be repainted, without neglecting the end grain in order to prevent future deterioration.

Wood rafters should be repaired, paint scraped and reapplied including endgrain to prevent future deterioration or paint failure.

Treatment Rating 2: PRESERVE WHEREVER POSSIBLE

IF TOO DETERIORATED TO SAVE, ELEMENT MUST BE REPLACED IN-KIND.

Statement of Importance:

- The wood rafters contribute to the significance and historic appearance of Building 1320 as a building from the World War II period, and
- the wood rafters make a significant contribution to the property's historic appearance and as an integral part of the buildings historic construction.

Condition: ***Good – Preserve***

Fair to good - Preserve

Poor – Replace

Inventory Quantity and Condition

The rafters are evaluated as Good when:

- the paint is peeling and cracking on all sides of the rafters, and
- the wood is intact, structurally sound and performing its intended purpose, and
- the wood should be cleaned, and
- the wood will need to be scraped, primed, and repainted including the end grain, and
- there are few or no cosmetic imperfections, and
- the wood rafters need no repair and only minor or routine maintenance.

Minor deficiency of the rafters exists where:

- Any repairs to the wood should be made after cleaning the surface gently, and
- the wood should be primed, and repainted, including the end grain, which is most susceptible to water intake, causing future paint failure, and
- standard preventive maintenance practices and building conservation methods have not been followed, and
- there is a reduced life expectancy of affected or related building materials and/or systems, and
- there is a condition with long-term impact beyond 5 years.

Minor deficiencies can include, but are not limited to: paint deterioration due to age and water infiltration.

4.6.1.7 Wood—Roof Decking

NR Rating: 212

Description:

The wood roof decking is located on the underside of the roof. It is composed of several wood planks laid one next to another and attached to the top of the roof rafters in order to form the roof membrane. They cover the entire roof and are exposed underneath the overhang. The roof decking should be scraped and repainted in order to prevent further deterioration.

Treatment Rating 2: PRESERVE WHEREVER POSSIBLE

IF TOO DETERIORATED TO SAVE, ELEMENT MUST BE REPLACED IN-KIND.

Statement of Importance:

- The exposed wood decking contributes to the significance and historic appearance of Building 1320 as a building from the World War II period, and
- the wood decking makes a significant contribution to the property's historic appearance and as an integral part of the buildings historic construction.

Condition: ***Good – Preserve***

Fair to good - Preserve

Poor – Replace

Inventory Quantity and Condition

The decking is evaluated as Good when:

- the wood is intact, structurally sound and performing its intended purpose, and
- the paint is peeling and cracking, and
- the wood should be cleaned, and
- the decking will need to be scraped, primed, and repainted including the end grain, and

- there are few or no cosmetic imperfections, and
- the wood decking needs no repair and only minor or routine maintenance.

Minor deficiency of the decking exists where:

- Any repairs to the wood should be made after cleaning the surface gently, and
- the wood should be primed and repainted, including the end grain, which is most susceptible to water intake, and
- standard preventive maintenance practices and building conservation methods have not been followed, and
- there is a reduced life expectancy of affected or related building materials and/or systems, and
- there is a condition with long-term impact beyond 5 years.

Minor deficiencies can include, but are not limited to: paint deterioration due to water infiltration

4.6.1.8 Wood—Drop-lap Siding

NR Rating: 211

Description:

The wood drop-lap siding covers the exterior facade of the entire building. Drop-lap siding paint is deteriorating on all facades of the storehouse, Building 1320. Areas of particular concern are the lower courses of each facade. Water has been allowed to penetrate the wood due to an improper seal and/or excessive exposure to water due to drainage and has led to the deterioration of the drop-lap siding in these areas. The paint is peeling and cracking and there is alligatoring at the lower part of each siding piece. Overall, though, the siding is in fair condition.

Drop-lap siding paint is deteriorating on all facades of the Storehouse, building 1320. Wood should be repaired, scraped, and repainted including endgrain in order to prevent future deterioration.

Treatment Rating 1: PRESERVE.

Statement of Importance:

- The drop-lap siding is associated with those qualities for which the historic district buildings were designated historic and dates from the World War II period, and
- the siding is highly distinctive architecturally due to the irregularity and lack of precision in its machining from the World War II period and it dates to the World War II period, and
- the wood siding contributes to the significance and historic appearance of the mess hall as a building from the World War II period, and
- the level of damage or deterioration is such that it is still feasible to preserve.

Condition: ***Fair – Preserve***

Fair to good - Preserve

Poor – Replace

Inventory Quantity and Condition

The wood drop-lap siding is evaluated as Fair when:

- there are early signs of wear, failure, or deterioration, though the element is generally structurally sound and performing its intended purpose, and
- the paint is cracked parallel to the grain on the north facade above the doors and between the windows, and
- the paint is peeling on the north west side of the north elevation, and
- siding is warped and cracking as a result on the south elevation, and
- the paint on the south elevation is peeling on the first four courses above grade, and
- paint is peeling over 80% of the south facade, and
- the siding is warped above the windows on the south facade, causing the screen frame to detach from the building, and
- the paint is cracking over 20% of the east facade, and
- due to an installation of a makeshift gutter system, deterioration and warping is particularly bad on either side of the sliding door on the east facade where the gutter drains, and
- damaged surfaces should be cleaned and repaired as detailed in this chapter, and
- a new paint coat should be applied including the endgrain, to prevent further deterioration due to moisture, and
- there is failure of a sub-component of the element, and
- replacement of up to 25% of the element or replacement of a defective subcomponent is required.

Minor deficiency of the siding exists where:

- Replace deteriorated or damaged wood by carefully patching, piecing-in, or otherwise reinforcing the wood using recognized preservation methods, and
- any repairs to the wood should be made after cleaning the surface gently, and
- siding should be scraped and repainted, including the endgrain, which is most susceptible to water intake, causing future paint failure, and
- gutter system should be removed to prevent excessive deterioration to the surrounding elements due to improper drainage, and
- standard preventive maintenance practices and building conservation methods have not been followed, and
- there is a reduced life expectancy of affected or related building materials and/or systems, and
- there is a condition with long-term impact beyond 5 years.

Minor deficiencies can include, but are not limited to: wood splitting, warping and/or failure and paint deterioration.

4.6.2 Maintenance / Management Guidelines for Wood

According to *The Secretary of Interior's Standards for Rehabilitation*, the proper procedure is to respect the significance of the original materials and features, repair and retain them wherever possible, replace them only when absolutely necessary.

The following recommendations for care of historic wood are to be thoroughly read and understood before a treatment is specified. *The Secretary of the Interior's Standards for Rehabilitation* should also be consulted to determine the appropriateness of any treatment.

The following is an excerpt from *The Secretary of the Interior's Standards for Rehabilitation*. Full documentation can be found at http://www2.cr.nps.gov/tps/tax/rhb/stand.htm

4.6.2.1 Protect and Maintain

Recommended…

- Remove damaged or deteriorated paint only to the next sound layer using the gentlest means possible (hand scraper wire brush or sand paper), and then repaint. Stripping methods including hot air guns, heat plates, and chemical or dip stripping should be employed with great care, and only as a supplement to hand scraping, brushing and sanding.
- Apply specification-approved primer and paint following proper surface preparation and product instructions.
- Inspect regularly for wood that is excessively or continually moist and for evidence of insect infestation and fungal rot.

Not Recommended…

- Replacing, rebuilding, or altering any original wood features that could be preserved or consolidated.
- Introducing new or non-specific brands of paint, colors, or methods of application.
- Failing to identify, evaluate, and treat the causes of wood deterioration, including insect or fungus infestation.
- Using chemical preservatives (such as creosote), which can change the appearance of wood features.
- Using thermal devices improperly when removing paint so that historic woodwork is scorched or damaged.
- Address evidence of moisture infiltration and infestation as soon as possible.
- Use only hot-dipped, zinc-coated nails, bolts, and hardware for use on treated wood.
- Countersink and putty all new, exposed nails and screws according to general specifications. Failing to neutralize wood thoroughly after using chemicals so the new paint does not adhere.
- Allowing detachable wood features, like doors, to soak too long in a caustic solution so that the wood grain is raised and the surface roughened.

4.6.2.2 Repair

Recommended…

- Fill moderate-sized holes and check cracks with putty or epoxy filler. Repair should be applied as per general specifications.
- Repair fragile original wood using well-tested consolidant when appropriate. Repairs should be physically, visually, and chemically compatible and identifiable upon close inspection.

Not Recommended…

- Removing or replacing original wood that could be stabilized and conserved, or repaired with limited replacement of deteriorated or missing parts.
- Using substitute materials that are physically, visually, or chemically incompatible with the original materials.

4.6.2.3 Replace

Recommended…

- Replace deteriorated or damaged wood by carefully patching, piecing-in, or otherwise reinforcing the wood using recognized preservation methods. Replacement work should be permanently dated in an unobtrusive location.

Not Recommended…

- Removing an original wood feature that is repairable. Removing an original wood feature that is unrepairable and not replacing it, or failing to label the new work.

EXTERIOR PAINT PROBLEMS ON HISTORIC WOODWORK[6]

U.S. General Services Administration
Historic Preservation Technical Procedures and

The Rohm and Haas Paint Quality
Institute Technical Procedures

09910-01

PRESERVATION BRIEFS: 10

The Cultural Resources POC, DPW will review all proposed work; in addition, these guidelines must be reviewed and followed by all personnel prior to performing this procedure.

This standard includes the bulk of information contained in the original Preservation Brief developed by the National Park Service. To obtain a complete copy of this brief, including figures and illustrations, please contact:

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A CAUTIONARY APPROACH TO PAINT REMOVAL IS INCLUDED IN THE GUIDELINES TO "THE SECRETARY OF THE INTERIOR STANDARDS FOR HISTORIC PRESERVATION PROJECTS." REMOVING PAINTS DOWN TO BARE WOOD SURFACES USING HARSH METHODS CAN PERMANENTLY DAMAGE THOSE SURFACES; THEREFORE SUCH METHODS ARE NOT RECOMMENDED. ALSO, TOTAL REMOVAL OBLITERATES EVIDENCE OF THE HISTORICAL PAINTS AND THEIR SEQUENCE AND ARCHITECTURAL CONTEXT.

JUSTIFICATION FOR PAINT REMOVAL

Once conditions warranting removal have been identified, the general approach should be to remove paint to the next sound layer using the gentlest means possible, then to repaint. Practically speaking, paint can adhere just as effectively to existing paint as to bare wood, providing the previous coats of paint are also adhering uniformly and tightly to the wood and the surface is properly prepared for repainting (cleaned of dirt and chalk and dulled by sanding.) On the other hand, if painted exterior wood surfaces display continuous patterns of deep cracks or if they are extensively blistering and peeling so that bare wood is visible, then the old paint should be completely removed before repainting.

[6] The following excerpts are from the U.S. General Services Administration (GSA) Technical Procedures and The Rohm Haas Paint Quality Institute Technical Procedures. Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf and http://www.paintquality.com.

I. CLASS I EXTERIOR SURFACE CONDITIONS GENERALLY REQUIRING NO PAINT REMOVAL:

A. DIRT, SOOT, POLLUTION, COBWEBS, INSECT COCOONS, ETC.:

Cause of Condition:
Environmental "grime" or organic matter that tends to cling to painted exterior surfaces and, in particular, protected surfaces such as eaves, do not constitute a paint problem unless painted over rather than removed prior to repainting. If not removed, the surface deposits can be a barrier to proper adhesion and cause peeling.

Recommended Treatment:
Most surface matter can be loosened by a strong, direct stream of water from the nozzle of a garden hose. Stubborn dirt and soot will need to be scrubbed off using 1/2 cup of household detergent in a gallon of water with a medium soft bristle brush. The cleaned surface should then be rinsed thoroughly, and permitted to dry before further inspection to determine if repainting is necessary. Quite often, cleaning provides a satisfactory enough result to postpone repainting.

B. MILDEW:

Black, gray or brown areas of fungus growth on the surface of paint or caulk.

Cause of Condition:
Mildew is caused by fungi feeding on nutrients contained in the paint film or on dirt adhering to any surface. Because moisture is the single most important factor in its growth, mildew tends to thrive in areas where dampness and lack of sunshine are problems such as window sills, under eaves, around gutters and downspouts, on the north side of buildings, or in shaded areas near shrubbery. It may sometimes be difficult to distinguish mildew from dirt, but there is a simple test to differentiate: if a drop of household bleach is placed on the suspected surface, mildew will immediately turn white whereas dirt will continue to look like dirt. Specific causes of mildew include:

- Forms most often on areas that tend to be damp, and receive little or no direct sunlight (walls with a northerly exposure and the underside of eaves are particularly vulnerable); and
- The use of a lower quality paint, which may have an insufficient amount of mildewcide; and
- Failure to prime bare wood before painting; and
- Painting over a substrate or coating where mildew has not been removed.

Recommended Treatment:
Because mildew can only exist in shady, warm, moist areas, attention should be given to altering the environment that is conducive to fungal growth. The area in question may be shaded by trees which need to be pruned back to allow sunlight to strike the building; or may lack rain gutters or proper drainage at the base of the building. If the shady or moist conditions can be altered, the mildew is less likely to reappear. A recommended solution for removing mildew consists of one cup non-ammoniated detergent, one quart household bleach, and one gallon water. When the surface is scrubbed
with this solution using a medium soft brush, the mildew should disappear; however, for particularly stubborn spots, an additional quart of bleach may be added. After the area is mildew-free, it should then be rinsed with a direct stream of water from the nozzle of a garden hose, and permitted to dry thoroughly. When repainting, use specially formulated exterior latex “mildew-resistant" primer and then a top-of- the-line exterior latex paint.

C. STAINING:

Cause of Condition:
Staining of paint coatings usually results from excess moisture reacting with materials within the wood substrate. There are two common types of staining, neither of which requires paint removal. The most prevalent type of stain is
due to the oxidation or rusting of iron nails or metal (iron, steel, or copper) anchorage devices.

Recommended Treatment:
The source of the stain should first be located and the moisture problem corrected. When stains are caused by rusting of the heads of nails used to attach shingles or siding to an exterior wall or by rusting or oxidizing iron, steel, or copper anchorage devices adjacent to a painted surface, the metal objects themselves should be hand sanded and coated with a rust inhibitive primer followed by two finish coats. (Exposed nail heads should ideally be countersunk, spot primed, and the holes filled with a high quality wood filler except where exposure of the nail head was part of the original construction system or the wood is too fragile to withstand the countersinking procedure.)

Discoloration due to color extractives in replacement wood can usually be cleaned with a solution of equal parts denatured alcohol and water. After the affected area has been rinsed and permitted to dry, a "stain-blocking primer" especially developed for preventing this type of stain should be applied

(two primer coats are recommended for severe cases of bleeding prior to the finish coat). Each primer coat should be allowed to dry at least 48 hours.

II. CLASS II EXTERIOR SURFACE CONDITIONS GENERALLY REQUIRING LIMITED PAINT REMOVAL:

A. CRAZING:

Cause of Condition:

Crazing--fine, jagged interconnected breaks in the top layer of paint--results when paint that is several layers thick becomes excessively hard and brittle with age and is consequently no longer able to expand and contract with the

wood in response to changes in temperature and humidity. As the wood swells, the bond between paint layers is broken and hairline cracks appear. Although somewhat more difficult to detect as opposed to other more obvious paint problems, it is well worth the time to scrutinize all surfaces for crazing.

If not corrected, exterior moisture will enter the crazed surface, resulting in further swelling of the wood and, eventually, deep cracking and alligatoring, a Class III condition which requires total paint removal.

Recommended Treatment:

Crazing can be treated by hand or mechanically sanding the surface, then repainting. Although the hairline cracks may tend to show through the new paint, the surface will be protected against exterior moisture penetration.

B. WRINKLING:

A rough, crinkled paint surface occurring when paint forms a "skin."

Cause of Condition:
Another error in application that can easily be avoided is wrinkling. This occurs when the top layer of paint dries before the layer underneath. The top layer of paint actually moves as the paint underneath (a primer, for example) is drying. Specific causes of wrinkling include:

- Paint applied too thickly (more likely when using alkyd or oil-based paints); and
- Painting a hot surface or in very hot weather (higher than recommended by the manufacturer); and
- Exposure of uncured paint to rain, dew, fog or high humidity levels; and
- Applying topcoat of paint to insufficiently dried first coat; and
- Painting over contaminated surface (e.g., dirt or wax).

Recommended Treatment:
The wrinkled layer can be removed by scraping, followed by hand or mechanical sanding to provide as even a surface as possible. Repaint, applying an even coat of top quality exterior

paint. Make sure the first coat or primer is dry before applying the topcoat. Apply paints at the manufacturer's recommended spread rate (two coats at the recommended spread rate are better than one thick coat). When painting during extremely hot, cool or damp weather, allow extra time for the paint to dry completely.

III. CLASS III EXTERIOR SURFACE CONDITIONS GENERALLY REQUIRING TOTAL PAINT REMOVAL:

If surface conditions are such that the majority of paint will have to be removed prior to repainting, it is suggested that a small sample of intact paint be left in an inconspicuous area either by covering the area with a metal plate, or by marking the area and identifying it in some way. (When repainting does take place, the sample should not be painted over.) This will enable future investigators to have a record of the building's paint history.

A. PEELING:

Loss of paint due to poor adhesion or moisture. Where there is a primer and topcoat, or multiple coats of paint, peeling may involve some or all coats.

Cause of Condition:
Peeling to bare wood is most often caused by excess interior or exterior moisture that collects behind the paint film, thus impairing adhesion. Generally beginning as blisters, cracking and peeling occur as moisture causes the wood to swell, breaking the adhesion of the bottom layer. Common causes of peeling are:

- Seepage of moisture through uncaulked joints, worn caulk or leaks in roof or walls; and
- Excess moisture escaping through the exterior walls (more likely if paint is oil-based; and
- Inadequate surface preparation; and
- Use of lower quality paint; and
- Applying an oil-based paint over a wet surface; and
- Earlier blistering of paint (see Blistering).

Recommended Treatment:
There is no reason for repainting before dealing with the moisture problems because new paint will simply fail. Therefore, the first step in treating peeling is to locate and remove the source or sources of the moisture, not only because moisture will jeopardize the protective coating of paint, but if left unattended, it can ultimately cause permanent damage to the wood. Exterior moisture should be eliminated by correcting the following conditions prior to repainting: faulty flashing; leaking gutters; defective roof shingles; cracks and holes in siding and trim; deteriorated caulking in joints and seams; and shrubbery growing too close to painted wood. After the moisture problems have been resolved, the wood must be permitted to dry out thoroughly. The damaged paint can then be scraped off with a scraper or stiff wire

brush, sand rough edges, and apply appropriate primer. Repaint with a top quality acrylic latex exterior paint for best adhesion and water resistance.

B. CRACKING / ALLIGATORING:

Cracking involves the splitting of a dry paint film through at least one coat, which will lead to complete failure of the paint. Early on, the problem appears as hairline cracks; later, flaking of paint chips occurs.

Alligtatoring is the patterned cracking in the surface of the paint film resembling the regular scales of an alligator.

Cause of Condition:
Cracking and alligatoring are advanced stages of crazing. Once the bond between layers has been broken due to intercoat paint failure, exterior moisture is able to penetrate the surface cracks, causing the wood to swell and deeper cracking to take place. This process continues until cracking, which forms parallel to grain, extends to bare wood. Ultimately, the cracking becomes an overall pattern of horizontal and vertical breaks in the paint layers that looks like reptile skin, hence, "alligatoring." In advanced stages of cracking and alligatoring, the surfaces will also flake badly. Specific causes of alligatoring and cracking include:

- Use of a lower quality paint that has inadequate adhesion and flexibility; and
- Over thinning the paint or spreading it too thin; and
- Poor surface preparation, especially when the paint is applied to bare wood without priming; and
- Painting under cool or windy conditions that make latex paint dry too fast; and
- Application of an extremely hard, rigid coating, like an alkyd enamel, over a more flexible coating, like a latex primer; and
- Application of a topcoat before the undercoat is dry; and
- Natural aging of oil-based paints as temperatures fluctuate. The constant expansion and contraction results in a loss of paint film elasticity.

Recommended Treatment:
If cracking and alligatoring are present only in the top layers they can probably be scraped, hand or mechanically sanded to the next sound layer, then repainted. However, if cracking and/or alligatoring have progressed to bare wood and the paint has begun to flake, it will need to be totally removed. Methods include scraping or paint removal with the electric heat plate, electric heat gun, or chemical strippers, depending on the particular area involved. Bare wood should be primed within 48 hours, then repainted.

It may be possible to correct cracking that does not go down to the substrate by removing the loose or flaking paint with a scraper or wire brush, sanding to feather the edges, priming any bare spots and repainting. If the cracking goes down to the substrate remove all of the paint by scraping, sanding and/or use of a heat gun; then prime and repaint with a quality exterior latex paint.

If the paint is alligatoring, old paint should be completely removed by scraping and sanding the surface; a heat gun can be used to speed work on large surfaces, but take care to avoid igniting paint or substrate. The surface should be primed with high quality latex or oil-based primer, and then painted with a top quality exterior latex paint.

SURFACE PREPARATION FOR PAINT APPLICATION TO WOOD[7]

U.S. General Services Administration
Historic Preservation Technical Procedures and

The Rohm and Haas Paint Quality
Institute Technical Procedures

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WARNING:
DO NOT ATTEMPT TO REMOVE PAINT IF YOU SUSPECT IT CONTAINS LEAD.

This can cause an extreme health hazard. Lead paint was common until 1950, but was not outlawed in the U.S.A. until 1978. It should be generally assumed that because buildings built before 1950 involve one or more layers of lead-base paint, the majority of conditions warranting paint removal will mean dealing with this toxic substance along with the dangers of the paint removal tools and chemical strippers themselves. If you think you may have lead paint, contact the EPA hotline for information: **1-800-424-LEAD** or visit http://www.epa.gov/opptintr/lead/leadinfo.htm

If you suspect the presence of old paint containing lead, do not attempt to scrape, sand, power wash, use heat gun, etc., which might put lead into the environment, but rather contact a contractor qualified for lead assessment and abatement. Lead paint is most likely to be found in buildings that are more than 25 years old.

Sources of Lead Paint: Lead carbonate was used prior to World War II. A white powder, it was used as a primary white pigment in oil-based paints. During the 1940s and early `50s, "white lead" was replaced by titanium dioxide (TiO2), which is more efficient in providing whiteness and hiding. In the early 1970s, the use of lead compounds began to be phased out. In 1978, legislation eliminated them altogether. All interior and exterior house paints and primers are now made without lead. Some buildings, especially those built before this legislation was enacted, may contain lead paint. These paints present potential health hazards, especially for infants, small children, and pregnant women.

Paint performs better in mild conditions; in fact poor painting conditions can greatly compromise the paint job.

1. WEATHER CONDITIONS FOR GOOD ADHESION
   NOT TOO COLD, NOT TOO HOT
   Most latex paints should be applied when the air temperature or the surface being painted is 35 - 50 ˚F – depending on the manufacturer's recommendation (see paint label). Painting in cold weather is more difficult, and it takes longer to dry, leaving the wet paint more susceptible to dirt, insects and pollen.

   If you use a latex paint, wait until the temperature is predicted to remain above the recommended minimum for the next 36 hours.

[7] The following excerpts are from the U.S. General Services Administration (GSA) Technical Procedures and The Rohm Haas Paint Quality Institute Technical Procedures. Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf and http://www.paintquality.com.

If you paint when it is too hot, the paint may not last as long. This is especially true with latex paints. Avoid painting in the following conditions, especially if more than one condition exists: air or surface temperature exceeds 90 degrees; direct sunshine (particularly dark colored paint); gusty winds; low humidity; highly porous surfaces such as old, weathered stucco. For latex paints, these conditions will adversely affect film formation of the latex binder and not provide you optimum properties.

2. SURFACE PREPARATION GUIDELINES

- Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items, or provide surface applied protection; and
- do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film; and
- remove all loose or poorly adhering paint by scraping, or by careful hand wire brushing using a stiff metal wire brush going with the grain of the wood; and
- wear eye protection, work gloves and a dust mask; and
- feather sand rough edges of remaining paint; and
- refresh surface of exposed, weathered wood by sanding with medium grit (#120) garnet paper; and
- treat any mildew; and
- remove dirt, chalk, dust, residual particles of paint, treated mildew by scrubbing with detergent and water, rinse thoroughly.

A. GET RID OF MILDEW

Mildew is a spotty black, gray and brown mold that grows in warm, moist, low-light environments. Before you paint, look for mildew in areas that get little or no sun, like around the trim, under eaves, northern exposures and shaded areas.

IMPORTANT: Do not paint or stain over mildew. The paint or stain may cover it at first, but before long the mildew will grow right through the new coating.

B. PREPARE GLOSSY SURFACES

Glossy areas should be dulled or paint/primer will not adhere well.

- Sand with a medium grit paper such as #100 - #120. Use fine grit paper such as#180 - #220 for critical work such as doors and prominent trim. Then remove any dust with a damp rag.
- Chemical deglossers are available, but require care and caution. Leaving a chemical deglosser on the surface too long can soften and wrinkle the old coating. If you use a chemical deglosser, make sure there is ample ventilation. Open windows, use fans, and follow manufacturer's instructions carefully. Exercise safety precautions – protective goggles, clothing, gloves, and respirator.

C. CHECK ALL CAULKING

Caulk is used to seal areas where there are gaps in materials or where there were openings for pipes, wires, and light fixtures. Caulk keeps out the elements and insects and gives the building a finished look. Chances are, if it is time to repaint, it is also time to re-caulk.

- Check all the caulking and remove any that is old, cracked or pulled away from the surface; and
- Scrape the area and dust before priming if the area is to be painted, and
- Use acrylic or siliconized acrylic caulk for exterior use. For areas where building materials are not to be painted, use a clear acrylic caulk for cosmetic purposes. Silicone caulk is also good for exterior use, but should not be painted over, and
- Apply fresh caulk to all cracks and openings up to 1/2" wide, and
- Allow to dry overnight and re-apply as needed.

REMOVAL PROCEDURES FOR OLD, DAMAGED PAINT OR STAIN[8]

U.S. General Services Administration
Historic Preservation Technical Procedures and

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Institute Technical Procedures

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A few different methods may need to be used to effectively remove deteriorated paint. Review the methods explained here to see which best suit the project. See procedure 06400-09-R "Removing Paint from Wood Features Using Thermal Methods", 06300-02-R "Procedures for Painting Wood Features", and 06400-07-R "Chemically Removing Paint from Wood Features" for additional guidance.

A. SCRAPING

Scraping is most effective on flat surfaces, from smooth masonry and hardboard to wood and ferrous metal. Make sure the scraper is sharp and apply even pressure as you scrape in one direction; then scrape at 90 degrees. Shaped scrapers like triangles and ovals make it easier to get into corners and to scrape rounded profiles. Be sure NOT to apply pressure when scraping hardboard. For the really tough jobs, like hard or metal surfaces, try a two-hand scraper.

When the scraping is done, feather sand rough edges of remaining paint with a medium grit sandpaper such as #100 grit.

Wear goggles or face mask for eye protection. Wear leather or work gloves to protect the skin. Use a protective mask or respirator to limit dust intake.

B. WIRE BRUSHING

Use a stiff metal hand brush on brick, stucco and other masonry and on wood shakes (in a vertical motion). Power wire brushing is for stubborn areas only and must be used with extreme care. Wear goggles or face mask for eye protection. Wear leather or work gloves to protect the skin. Use a protective mask or respirator to limit dust intake.

C. SANDING

Areas that have been scraped should be smoothed with sanding. A power sanding tool like an electric belt sander is an option when the substrate is wood or steel. Do not attempt to power sand masonry, hardboard, aluminum or plastic materials.

D. POWER WASHING

A high-pressure plain water stream held 6" to 8" from the surface will lift old, loose paint. NEVER use harsh cleansers or bleach. Always spray at a horizontal or downward angle. An upward angle can damage siding. Be careful around doors and windows since the spray may have enough force to shatter glass and damage seals. Do not use power washing on soft woods like cedar and redwood. Wear goggles and water-repellant clothing and footwear.

[8] The following excerpts are from the U.S. General Services Administration (GSA) Technical Procedures and The Rohm Haas Paint Quality Institute Technical Procedures. Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf and http://www.paintquality.com.

E. CHEMICAL REMOVAL

Strong solvent-based removers work well on most oil-based and latex paints, primers, stains, and varnishes. Chemical removers should be used only on small face-up areas such as trim and moldings. Make sure to select a chemical remover that is intended for your application. Use with extreme care and follow these directions:

- Before you begin, clear the area of children and pets and extinguish any fire sources; and
- Cover floors and steps and remove plants, rugs and furniture; and
- Apply a heavy coat to a small area (2–3 sq. ft) with a low-end natural bristle paint brush; and
- Allow plenty of time for it to work (see manufacturer's recommendations); and
- Carefully remove the softened coatings using a putty knife or wooden blade and scrape the materials into a cardboard carton; and
- Reapply more stripper if needed; and
- Clean the surface with wadded up paper towels. Do not use steel wool; it can discolor the surface; and
- Dispose of all refuse after the job, carefully following manufacturer's instructions.

IMPORTANT: Wear goggles or face mask and long sleeve shirt and long pants. Use chemical-resistant gloves and a respirator designed for use with chemical solvents. Follow all direction and safety precautions. Some products are highly flammable and all fire sources must be extinguished prior to use.

There are low odor solvent removers, but since they are not as strong, they may take much longer to work.

F. HEAT GUN

A heat gun designed for paint removal – NOT a propane torch or blow torch – can be a good way remove old exterior paint and varnish. Follow these steps for a safe, effective job:

- Place a drop cloth under the entire work area; and
- Keep the drop cloth damp by spraying regularly with a garden hose; and
- Spray a light coating of water on the area where the paint is to be removed; and
- As the old coating bubbles and softens, carefully remove it with a putty knife and place it in a metal container for disposal; and

IMPORTANT: Wear goggles or face mask, long sleeve shirt, and long pants. Use chemical-resistant gloves and a respirator designed for use with a heat gun.

IMPORTANT: Do not remove old paint with a heat gun if you suspect it contains lead! The heat can vaporize the lead and cause a health hazard. Contact the EPA lead paint hotline at 1-800-424-LEAD.

PRIMERS AND PAINTS FOR WOOD[9]

U.S. General Services Administration
Historic Preservation Technical Procedures and

The Rohm and Haas Paint Quality
Institute Technical Procedures

06300-01

PRIMERS AND PAINTS FOR WOOD

The Cultural Resources POC, DPW will review all proposed work; in addition, these guidelines must be reviewed and followed by all personnel prior to performing this procedure.

This standard includes general information on primers and paints to be used on exterior wood surfaces. The primary purpose of paint is to protect wood from deterioration. To do so, paint manufacturers have developed paint systems which are made to work together to protect the wood substrate. These systems include primers and appropriate, compatible topcoats which can vary depending on the substrate and can vary between manufacturers. As a result appropriate primers and compatible topcoats, both from the same manufacturer should be used.

CHARACTERISTICS OF PRIMERS

Primers prevent certain chemical reactions from occurring between the wood and the topcoats. In wood, water soluble extractives are often a natural constituent of many wood species. Stain blocking primers, either oil- or water-based are especially important to use in these situations. They provide a more stable substrate for the new topcoats. They provide a uniform coat allowing more even color coverage of the topcoats. They bind weathered wood fibers, providing a more stable substrate. For areas subject to heavy mildew, mildew resistant primers are also available, making the surface less susceptible to mildew.

Types:

1. Oil / Alkyd Primers:
   - Must be applied to a completely dry surface; and
   - Recommended for use when all of the paint has NOT been removed from the surface. Oil based paint is better able to bind with old, chalky paint layers thereby providing a more stable base for the finish coats; and
   - Recommended for use if the existing paint type is unknown (oil or latex?), or if a switch to latex topcoat is being made; and
   - Appropriate for use on wood surfaces from which all paint has been removed but which are subject to less movement, i.e. a wall surface rather than a fence.

   Advantages:
   Oil / Alkyd primers have excellent stain blocking capabilities, and are suited for wood in which the paint has NOT been removed.

[9] The following excerpts are from the U.S. General Services Administration (GSA) Technical Procedures and The Rohm Haas Paint Quality Institute Technical Procedures. Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf and http://www.paintquality.com.

2. Acrylic Latex Primers:
   - Found to be successful when used on wood surfaces from which all of the paint has been removed and from wood surfaces which are "fresh"; and
   - They are especially good for surfaces which are considered difficult situations i.e. free-standing elements such as fences, columns, balustrades, etc. where wood is constantly moving; and
   - They can be applied to wood that is slightly damp.

   Advantages:
   Acrylic latex primers are more flexible than oil/alkyd paints.

   Limitations:
   As latex paint dries it shrinks more than oil and can literally pull off older, more brittle paint layers as it dries. Therefore, oil/alkyd paints are usually recommended for use on wood surfaces where all of the paint has not been removed.

   Products:
   1. Lucite brand of Forest Products Lab: Found to be the most flexible and is the only acrylic latex primer which has a good stain blocker.
   2. If Lucite is unavailable and the wood being painted contains water soluble extractives (cedar and redwood), then an oil/alkyd primer is recommended.
   3. If in doubt about the stain-blocking capabilities of a selected latex primer, test it.

CHARACTERISTICS OF PAINTS

Made up of three basic ingredients:
1. A binder - oil or water
2. Thinner - mineral spirits, turpentine or water
3. Pigment - organic or inorganic

To these basic ingredients can be added any number of additives to produce specialized paints. The term vehicle, often used in reference to paint, refers to the binder plus the thinner. Binder is key to paint formulation. The type and amount of binder affect everything from stain resistance and gloss, to adhesion and crack resistance.

Latex paints use several polymer types as binders, including 100 percent acrylic, styrene-acrylic, and vinyl acrylic (“PVA” for polyvinyl acetate). Whereas, oil paints use a binder based on a drying oil such as linseed or Soya, or some other type of modified oil (in which case these paints are called alkyds).

In general, latex paints have better exterior durability than do oil-based or alkyd paints. They have better color retention, chalk resistance and resistance to longer-term embrittlement and cracking.

Higher quality latex paints have greater durability and other performance advantages over lower quality latex paints mostly due to the type and amount of acrylic binder used.

Quality paints with 100 percent acrylic binders are especially durable. They adhere to many different surfaces (wood, masonry, aluminum siding, and vinyl siding), and are more durable than latex paints (with vinyl binders) on fresh masonry surfaces. Other paints will show early color loss and film deterioration while 100 percent acrylic latex paints are resistant to the effects of alkaline surfaces.

Pigments are finely ground particles or powders which are dispersed in a paint. “Prime” pigments provide color and opacity. The most common prime pigment is titanium dioxide, which is white. It is

used in latex and oil-based paints. “Extender” pigments provide bulk to the paint at a low cost. These pigments impact on properties like scrub resistance, stain resistance and chalk resistance.

IMPORTANT: Higher quality paints will have higher levels of prime pigment than lower quality paints. Also, better quality paints have less extender pigment in relation to binder level. This makes them more chalk resistant on exterior exposure, providing better color retention and durability. Though all paints will eventually fade, the rate of fading will be much lower with better quality paints.

Additives are performance-enhancing ingredients that are typically added to top quality paints more than to ordinary paints. They provide desirable properties such as ease of application and the appearance of the applied paint. Some also have protective qualities, such as mildewcides.

Mildewcides are a category of additives used in exterior paints to keep mildew in check so that the paint looks fresh. These ingredients are expensive, hence, higher levels are found in higher quality paints. Other additives include Dispersing agents (to help the pigment remain evenly distributed); and preservatives (to prevent spoilage of paint during storage).

Types of Paints:

NOTE: The paint selected must be from the same manufacturer and made to be used with the primer selected. It should also be selected for use in a specific situation where applicable, such as using porch and deck enamel when painting porch floors.

CAUTION: PAINTS CONTAINING ZINC ARE TO BE AVOIDED WHEN PAINTING WOOD, AS ZINC ATTRACTS MOISTURE.

1. Oil / Alkyd Paints:
   - These are opaque coatings which use natural oils, such as linseed oil, or modern alkyds as the binder; and
   - Alkyds are oil modified resins which dry faster and harder than ordinary oils; and
   - They offer the best protection from both liquid and vaporous water but become brittle with age and eventually are unable to move with the substrate and peel, crack, flake, etc.

   Limitations:
   Limitations to using oil / alkyd primers are their longer drying time; they are more difficult to clean up than latex paints; and they can be odorous, volatile and flammable due to the presence of organic solvents.

2. Emulsion or Latex Paints:
   - Also known as water based paints, these paints have a latex binder which has been emulsified or suspended in water; and
   - Acrylic latex resins are particularly durable and favored over polyvinyl acetate and polyvinyl chloride latex resins; and
   - They allow more water vapor to pass through than oil based paints and they are more flexible, even over time. Nevertheless, they will eventually peel, flake, or crack; and
   - For optimal results when using acrylic latex paints, make sure that for at least the first 24 hours after application, a temperature of 50˚F can be maintained.

Advantages:
General advantages to using latex paints are they are easy to clean-up; they may be thinned with water; they are more flexible than oil / alkyd paints; and they provide better resistance to mildew because there is no oil in the paint. The oil of oil/alkyd paints acts as food for mildew. They also have decreased odor, toxicity, and flammability (due to lack of organic solvents and thinners.)

NOTE: THERE HAVE BEEN CASES WHERE MILDEW HAS PROLIFERATED EVEN ON A LATEX PAINT SURFACE; APPARENTLY THE TINT USED TO COLOR THE PAINT PROVIDED THE NECESSARY FOOD SOURCE.

a. Acrylic-based paints:
   - Excellent color and gloss retention
   - Good flexibility and durability

b. Polyvinyl acetate emulsion paints:
   - Low cost
   - Excellent color retention

c. Linseed-oil resin-emulsion systems:
   - Easy to make
   - Low material cost
   - Improves paint durability

Limitations:
General limitations for the use of emulsion paints are that some require the use of a special primer or sealer to seal chalky surfaces and prevent peeling of the new coating.

a. Acrylic-based paints:
   - Sometimes have poor color retention in dark tints.
   - Sometimes combined with alkyd-resins for better adhesion; This increases the potential of mildew growth.

b. Polyvinyl acetate emulsion paints: sentence
   - Moderate durability when used alone; Durability is increased when the vinyl acetate emulsion is blended with other emulsions (i.e. acrylic, Linseed oil, alkyd-resin).

c. Styrene-butadiene paints:
   - Normally not used on exterior.
   - Tend to yellow with age.
   - Not very flexible - grain cracking is a frequent problem when applied to wood.
   - Not readily available today.

Products/Suppliers:
1. Benjamin Moore and Co.
2. Glidden
3. PPG Industries, Pittsburgh Paints
4. Pratt and Lambert
5. The Sherwin-Williams Company

NOTE: There are some paints on the market known as self-cleaning paints. As rainwater runs down the wall the paint is slowly worn away. This is called chalking. Such paints should NOT be used if there is an unpainted surface or contrasting color below the painted surface, such as a red brick foundation wall. The streaking can be unsightly.

SELECTING PRIMERS

As with paints, there are two broad classifications of primers and sealers: latex and water-based products, and alkyd or oil-based products. Both types come in interior and exterior formulations. There are also shellac based primers that have alcohol as their thinner. In most cases, quality latex primers and sealers perform as well as oil-based products, if not better. However, on severely staining wood and on heavily chalked surfaces, oil-based primers do provide better stain blocking and adhesion.

1. Guidelines for Exterior Applications:
   a. New Unpainted Wood:
      If the wood is not severely staining, either quality acrylic latex or an oil-based exterior wood primer is recommended. In the case of severely staining woods, an oil-based stain-blocking primer is best. New wood should be primed within two weeks to keep wood fibers from deteriorating and reducing adhesion.

   b. Weathered and Unpainted Wood:
      Either a quality latex or oil-based primer is recommended. Scrape and sand the wood thoroughly before priming because the deteriorated wood fibers must be removed, or adhesion will be compromised. Also, the primer should be applied shortly after surface preparation.

   c. Previously Painted Wood:
      All loose paint should be scraped off and rough edges feather-sanded. Any bare spots should be sanded thoroughly and dusted off. In addition, as much chalk as possible should be removed before priming. If the old paint is very chalky, and all the chalk cannot be removed, the use of an oil-based primer is recommended. If the old paint is in sound condition and is still adhering well, priming can be beneficial, but is not necessary.

   d. Stucco and Masonry:
      On new masonry, or older surfaces that are very porous, a latex masonry sealer or primer is recommended. In a repaint situation, use a sealer only where the old paint has been removed during surface preparation or through weathering.

   e. Aluminum or Galvanized Iron:
      Remove any white, powdery oxide, using a non-metallic scouring pad or steel wool (be sure all steel particles are washed off). Then apply a corrosion-inhibitive metal primer to all exposed bare metal

   f. Ferrous Metals:
      Remove any rust by wire brushing. Rinse, let dry and then apply a latex or oil-based rust-inhibitive primer. Two coats of primer will provide added protection against future rusting.

2. Primer Selection According to Surface Application:
   a. New Wood:
      Prime with a quality acrylic latex or oil-based wood primer. Be sure the primer is stain-blocking when staining woods such as cedar or redwood; oil-based primers are better for severely staining woods.

   b. Repaint:
      Primer usually not necessary unless paint is glossy or very chalky, or bare substrate

is exposed. Still, priming the entire surface will maximize adhesion and uniformity of appearance.

c. Weathered Wood:
Thoroughly sand weathered or exposed wood, removing all gray fibers; dust off. Apply a wood primer before painting.

d. Masonry:
Apply sealer or latex masonry or general purpose primer if surface is fresh or very porous. In repaint situation, use primer if old paint is porous, stained, or has been removed by scraping or wire brushing.Ferrous Metals:
If rusted, remove as much rust as possible, clean and rinse, and apply acrylic latex or oil-based corrosion-inhibitive primer (two coats are better) before top coating.

e. Aluminum, Galvanized Steel:
Clean the surface. Remove any powdery oxide with non-metallic scouring pad. Apply acrylic latex rust-inhibitive primer, then topcoat. If previously painted, priming not necessary if sound and rust-free.

IMPORTANT: Make sure to choose a primer that is specially formulated for the surface to be painted (wood, masonry, hardboard, metal substrates). Be sure to use an exterior primer for exterior work.
IMPORTANT: Be sure to read and follow all manufacturers' recommendations.

SELECTING PAINT
When doing exterior painting, one of the most important decisions is the quality of paint to be used. According to the Paint Quality Institute, a leading authority on paint performance, TOP QUALITY paints are designed to produce the best-looking and longest-lasting results. And even though quality paints may cost a little more, they can last more than twice as long as ordinary paints — so they are really more economical in the long run. Some of the specific benefits of using top quality paints, compared with using "economy" paint are:

- Superior adhesion, less likely to blister, flake or peel; and
- Better chalk resistance, for excellent color retention; and
- Better dirt resistance, so the paint remains fresh-looking; and
- Better mildew resistance, so paint will not be marred by black or brown blotches; and
- Overall superior durability.

GUIDELINES:
- Use top-of-the-line exterior 100% acrylic latex house paint (see definition below), and
- A flat finish will provide a more uniform appearance; quality satin and semi-gloss finishes will resist mildew more than a flat.

DO NOT apply oil-based paint over latex paint.

IMPORTANT: A can of quality paint will contain a higher volume of solid material (pigment and binder) than do ordinary paints. In the case of top quality latex paints, that means more solids and less water. Therefore, if a top quality paint and an ordinary paint were to be applied at the same spread rate, the top quality paint would dry to a thicker paint film due to its higher solids content. A top quality paint will contain 35 to 45 percent volume solids, while an ordinary paint will contain about 25 to 30 percent.

EPOXY REPAIR FOR DETERIORATION AND DECAY IN WOODEN MEMBERS[10]

U.S. General Services Administration
Historic Preservation Technical Procedures

06300-01

The Cultural Resources POC, DPW will review all proposed work; in addition, these guidelines must be reviewed and followed by all personnel prior to performing this procedure.

PART 1---GENERAL

1.01 SUMMARY
This procedure includes guidance on stabilizing decayed wood members with epoxy consolidant and filler.

A. Deterioration and decay in wood results from moisture infiltration, accompanying fungal growth and insect infestation. Paint, caulk, and sealant failures are also a major cause of wood deterioration.

B. Some sources of moisture may include the original moisture in green wood, rainwater, condensation, ground water, piped water, and water released by water-conducting fungus through the process of decay itself.

C. Epoxy repair may be appropriate if:
   1. the piece to be repaired is historically significant. Epoxy repair makes it possible to retain most of an original component by selectively repairing only the damaged area.
   2. if the piece is decorative and replacement would be too expensive or impossible.

D. Epoxy repair may NOT be appropriate if:
   1. the piece is a structural member. Epoxy has adequate compression strength, but is not the best choice to repair a member in tension. In this case, replacement is usually a better option.
   2. the wood to be repaired is to remain unpainted, as the epoxy is quite different in appearance from wood. In this case, the wood should be selectively replaced.
   3. if the area to be repaired is large, as epoxy repair can be expensive.

E. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:
   1. Safety Precautions
   2. Historic Structures Precautions
   3. Submittals
   4. Quality Assurance
   5. Delivery, Storage and Handling
   6. Project/Site Conditions
   7. Sequencing and Scheduling
   8. General Protection (Surface and Surrounding)

[10] The following excerpt is from the U.S. General Services Administration (GSA) Technical Procedures. Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf

PART 2---PRODUCTS

2.01 MANUFACTURERS

A. Conservation Services
8 Lakeside Trail
Kinnelon, NJ 07405
201/838-6412

B. Abatron, Inc.
5501 95th Ave.
Kenosha, WI 53144
800/445-1754 or 414/653-2000

C. Roux Laboratories
5344 Overmyer Dr.
Jacksonville, FL 32205
904/693-1200

2.02 MATERIALS

A. Epoxy consolidant and epoxy filler, both are multiple part compounds. Purchase by the gallon unless a large amount of epoxying needs to be done. Use one of the following, or approved equal:
   1. "Con Serv (T) Flexible Consolidant 100" (Conservation Services): Cures slowly with a 5 to 7 hour application time to allow deep penetration. Complete hardness is achieved in 3 to 6 days.
   2. "Con Serv (T) Flexible Patch 200" (Conservation Services): A four part putty-like filler; Is not easy to mix in small amounts; Consistency and hardness are easily controlled with this material.

   NOTE: The products of Conservation Services are recommended for treatment of thicker wood such as windowsills. Because of its slower curing time, it allows for deeper penetration into members.

   3. "Liquidwood-1" Consolidant (Abatron): Solidifies in a short period.
   4. "Woodepox-2" Adhesive Paste (Abatron): A two-part paste mix; final hardness is determined by varying the ratio of the two parts. The LiquidWood can be used as a thinner, but this reduces the flexibility of the filler.

   NOTE: These Abatron products are recommended for use on smaller members such as window sashes where deep penetration of consolidant is not required. The quick drying feature is an advantage for small, but repetitive, jobs. Abatron carries twenty different types of wood consolidant with varying degrees of penetration.

B. Oil clay that can be purchased from a hobby store – used to keep consolidant from leaking through cracks.

C. Nitril Rubber Gloves (Abatron)

D. Disposable vinyl gloves: Available from drug store or pharmaceutical supply distributor in 50 count or larger boxes.

2.03 EQUIPMENT

A. Plastic bottles, like those used for hair dye, to apply the consolidant; having many on hand is recommended. Cleaning of the bottles for reuse is possible.

B. Applicator bottles: Available from drug store and sold for hair dye application usually in 8 fl. oz. size; Also available in bulk from Roux Laboratories. Roux Color Applicators lend themselves more easily to cleaning and reuse.

C. Rags of different sizes to wipe up spills before epoxy has a chance to harden, small rags are recommended for quick one-time uses such as wiping off spouts and caps.

D. Thin wooden sticks, approximately 8" long for scooping out paste and mixing consolidant.

E. Goggles and a respirator for protection from fumes

F. Putty knives for application of filler

G. Channel lock pliers for opening stuck caps

H. Allen wrench to clean out cap holes

I. Needle nose pliers to pull out hardened epoxy

J. 1/8"x8"x12" Masonite boards for mixing paste filler

K. Carbon dioxide fire extinguisher: Curing epoxy creates heat that may cause fire.

L. Rotary saw

M. Air compressor

N. Drill

O. Stiff bristle brushes

PART 3---EXECUTION

3.01 EXAMINATION

A. Detect rot using the "Pick Test":
   1. Insert an ice pick into the wood at a slight angle.
   2. Lift the pick out. If the wood splinters in long pieces, the wood is ok. If the wood snaps where the pick is being lifted, the wood is decayed.

B. When rot is discovered:
   1. Determine the source of moisture infiltration and eliminate it.
      a. If rot is only present on the surface, drying is all that is necessary to stop the spread of decay and kill off any growth.
   2. If source of moisture is unknown, treat the wood with a preservative.
      a. Preservatives are caustic chemicals and should be handled with care.
      b. A particularly dangerous wood preserving chemical is pentachlorophenol (a.k.a. penta).

CAUTION: THIS CHEMICAL IS CARCINOGENIC AND ITS USE IS BANNED IN MANY STATES.

   3. Preservatives will eliminate fungal growth, but generally do not restored strength to the deteriorated wood material.

3.02 PREPARATION

A. Surface Preparation:

1. Dry affected wood member completely to arrest further decay. Dry in place if possible -or- remove the member and keep in a cool dry place until dry.

CAUTION: IF THIS PRECAUTION IS NOT TAKEN, THE EPOXY CAN ACTUALLY TRAP MOISTURE IN WOOD FIBERS AND ACCELERATE THE DECAY PROCESS.

2. Have all materials at hand before the mixing process begins.
3. Label all caps and lids so that a cap or lid is not placed on the wrong container or it may remain there permanently.

3.03 ERECTION, INSTALLATION, APPLICATION

CAUTION: AS EPOXIES CURE, HEAT IS PRODUCED. FOR THIS REASON, EPOXIES SHOULD BE USED IN SMALL QUANTITIES TO DETER EXTENSIVE HEAT BUILD-UP. CARE SHOULD BE TAKEN WHEN USING EPOXY ON A HOT DAY.

A. Repair decayed wood using epoxy wood consolidant:

1. Drill 1/4" or 3/16" holes in affected wood to receive epoxy consolidant:
    a. Drill holes at an angle and spaced approximately 2" on center in staggered rows. The top of one hole should line up with the bottom of the next hole.

CAUTION: BE SURE NOT TO DRILL THROUGH THE ENTIRE SURFACE FOR CONSOLIDANT WILL LEAK OUT FROM BEHIND.

    b. Dam any surface cracks with oil clay so that epoxy will not leak.
2. Remove sawdust and dirt from drilled holes using compressed air or stiff bristle brushes.
3. Following manufacturer's instructions, mix a small amount of the consolidant components (resin and hardener) together in an applicator bottle. Stir the mixture thoroughly by hand with a thin stick for 4 minutes or with a bent coat hanger chucked into a drill for 2 minutes.
4. Using a large plastic syringe or squeeze bottle and tube spout, carefully squirt the consolidant into the pre-drilled holes. Completely saturate the wood, moving from hole to hole refilling until the wood can hold no more. More than one application may be needed.
5. Wipe off any excess consolidant or spills and cover the treated area to protect until cured as directed by epoxy manufacturer.
6. If severed pieces need to be re-attached, glue them in place with a mixture of consolidant and filler.

B. When the consolidant has cured, fill the voids in the surface with epoxy filler (wood-epoxy putty):

1. Mix the two part epoxy filler following the same procedures for mixing consolidant in Section 3.03 A.3. above. Mix filler to achieve the consistency of a glazing compound that can be worked with a putty knife.
2. Apply the filler to the surface:
    a. For large voids, apply filler in 1" thick layers. This reduces the possibility of problems associated with heat build-up.
    b. Build up filler layers slightly above the wood surface to allow for planning and sanding smooth after it has cured.
3. When the filler has cured, sand or plane the surface smooth.
4. Apply a wood preservative to surrounding wood surfaces and prime and paint the entire surface.

END OF SECTION

BIENNIAL CLEANING AND STAIN REMOVAL OF WOODWORK[11]

U.S. General Services Administration
Historic Preservation Technical Procedures

06400-02

The Cultural Resources POC, DPW will review all proposed work; in addition, these guidelines must be reviewed and followed by all personnel prior to performing this procedure.

PART 1---GENERAL

1.01 SUMMARY

A. This procedure includes guidance on the routine dusting and cleaning of wood surfaces.

B. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:

1. Safety Precautions
2. Historic Structures Precautions
3. Quality Assurance
4. Delivery, Storage, and Handling
5. Project/Site Conditions
6. Sequencing and Scheduling
7. General Protection (Surface and Surrounding)

1.02 SUBMITTALS

A. Samples:
Submit sample of stain and wood filler for approval by the Cultural Resources POC.

PART 2---PRODUCTS

2.01 MANUFACTURERS

A. Butcher Polish Company
120 Bartlett Street
Marlborough, MA
617/481-5700

2.02 MATERIALS

NOTE: Chemical products are sometimes sold under a common name. This usually means that the substance is not as pure as the same chemical sold under its chemical name. The grade of purity of common name substances, however, is usually adequate for stain removal work, and these products should be purchased when available, as they tend to be less expensive. Common names are indicated below by an asterisk (*).

[11] The following excerpt is from the U.S. General Services Administration (GSA) Technical Procedures. Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf

A. Solvent: Mineral spirits, turpentine, or denatured alcohol.

Mineral Spirits:
A petroleum distillate that is used especially as a paint or varnish thinner.

1. Other chemical or common names include Benzine* (not Benzene); Naphtha*; Petroleum spirits*; Solvent naphtha*.
2. Potential Hazards: TOXIC AND FLAMMABLE.
3. Safety Precautions:
    a. AVOID REPEATED OR PROLONGED SKIN CONTACT.
    b. ALWAYS wear rubber gloves when handling mineral spirits.
    c. If any chemical is splashed onto the skin, wash immediately with soap and water.
    d. Available from construction specialties distributor, hardware store, paint store, or printer's supply distributor.

Turpentine:

1. Typically used as a solvent and thinner.
2. Potential Hazards: TOXIC AND FLAMMABLE.
3. Safety Precautions:
    a. Work in a well ventilated area.
    b. Observe safety rules as turpentine is flammable, and the fumes can trip an ionization smoke detection system.
    c. Store soiled cloths in a metal safety container to guard against spontaneous combustion.
    d. Available from hardware store or paint store.

Denatured Alcohol:

1. Other chemical or common names include Methylated spirit*.
2. Potential hazards: TOXIC AND FLAMMABLE.
3. Available from hardware store, paint store, or printer's supply distributor.
4. Denatured alcohol should be a satisfactory substitute for ethyl alcohol for stain removing purposes.

B. Cloth: Clean cotton rags

C. Sand paper: 3 grades, finest grade 00

D. Wax: Butcher's wax, such as "Butcher's paste Wax (Butcher Polish Company)

E. Bleach: Standard household bleach

1. An unstable salt produced usually in aqueous solution and used as a bleaching and disinfecting agent.
2. Other chemical or common names include Bleaching solution*; Household bleach*; Laundry bleach*; Sodium Hypochlorite; Solution of chlorinated soda*.
3. Potential Hazards: CORROSIVE TO FLESH.
4. Available from chemical supply house, grocery store or supermarket, hardware store or janitorial supply distributor.

F. Oil Stain and Thinner: To achieve a match between stained areas and original wood finish.

G. Shellac burn-in sticks

H. Clean, potable water

PART 3---EXECUTION

3.01 ERECTION, INSTALLATION, APPLICATION

A. Dust with a solvent-treated soft cloth.

B. Dry rub with a soft cloth to maintain the polish, rubbing along the grain of the wood.

C. Stain and Spot Removal: Stains may be cleaned by promptly wiping with cloth dampened in clear water or rubbing with cloth dampened in solvent. Dry the wood with a soft cloth. White spots may be removed by rubbing them with a small amount of linseed oil.

D. Old Stain Removal: If water and solvent fail to remove dark stains, brush full-strength bleach onto stained area and allow to stand one minute. Use clean, cotton rags to keep the bleach from running.

TEST BLEACH IN A SMALL INCONSPICUOUS AREA PRIOR TO USING THE BLEACH ON THE LARGE STAIN TO ENSURE THAT IT WILL NOT DAMAGE THE WOOD.

1. Rinse bleach completely from wood.
2. If area is too light in color, carefully apply a small amount of stain to match original wood finish.
3. Lightly sand area and apply wax following manufacturer's instructions using clean cotton rags, rubbing in direction of wood grain.

E. Biennial Cleaning:
1. Damp-wipe woodwork with a soft cloth dampened in clear water.
2. Promptly dry the wood with a soft cloth, rubbing along the grain.
3. Polish by dry rubbing with a soft cloth.

F. Fill scratches and gouges with shellac burn-in sticks matching color to the wood stain.

G. Apply wax following manufacturer's instructions using clean cotton rags, rubbing in direction of wood grain.

H. See also 06400-01-P and 06400-01-R for guidance on the general cleaning of wood surfaces.

END OF SECTION

PATCHING CRACKS AND HOLES IN WOODWORK[12]

U.S. General Services Administration
Historic Preservation Technical Procedures

06400-16

The Cultural Resources POC, DPW will review all proposed work; in addition, these guidelines must be reviewed and followed by all personnel prior to performing this procedure.

PART 1---GENERAL

1.01 SUMMARY

A. This procedure includes guidance on patching cracks and small holes in woodwork.

B. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:
   1. Safety Precautions
   2. Historic Structures Precautions
   3. Submittals
   4. Quality Assurance
   5. Delivery, Storage and Handling
   6. Project/Site Conditions
   7. Sequencing and Scheduling
   8. General Protection (Surface and Surrounding)

1.02 REFERENCES

A. AWI Quality Standard: Comply with applicable requirements of Architectural Woodwork Quality Standards, Premium Grade, published by the Architectural Woodwork Institute (AWI), except as otherwise indicated.

1.03 SYSTEM DESCRIPTION

A. Performance Requirements: Submit written program for each phase of restoration process including protection of surrounding materials on building during operations. Describe in detail materials, methods, and equipment to be used for each phase of restoration work.

1.04 QUALITY ASSURANCE

A. Mock-Ups: Prior to start of wood restoration work, prepare the following sample panels in building where directed by the **Cultural Resources POC**. Obtain the **Cultural Resources POCs acceptance** of visual qualities before proceeding with the work. Retain acceptable panels in undisturbed condition, suitably marked, during construction as a standard for judging completed work.
   1. Wood Repair: Prepare sample panels for each type of woodwork indicated to be patched, resurfaced, modified, or replaced. Prepare mock-up panels on existing woodwork to demonstrate quality of materials and workmanship.

[12] The following excerpt is from the U.S. General Services Administration (GSA) Technical Procedures. Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf

1.05 PROJECT/SITE CONDITIONS

A. Existing Conditions:
   1. Installer shall advise Contractor of temperature and humidity requirements for woodwork installation areas. Do not install woodwork until required temperature and relative humidity have been stabilized and will be maintained in installation areas.
   2. Maintain temperature and humidity in installation area as required to maintain moisture content of installed woodwork within a 1.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period. The fabricator of woodwork shall determine optimum moisture content and required temperature and humidity conditions.
   3. Determine that surfaces to which finishes are to be applied are even, smooth, sound, clean, dry, and free from defects affecting proper application. Correct or report defective surfaces to Contracting Officer.

PART 2---PRODUCTS

2.01 MATERIALS

A. Patching Materials:
   1. Wood Filler: Standard filler manufactured specifically for restorative patching of woodwork.
      a. Tint filler to match existing woodwork.
   2. Sandpaper: No. 3/0 or No. 5/0 garnet paper.

B. Replacement Wood: Match species, grade, grain pattern, and other special characteristics of existing woodwork.

PART 3---EXECUTION

3.01 ERECTION, INSTALLATION, APPLICATION

A. Remove all minor surface imperfections such as scratches, dents, etc., by rubbing surface with fine grit sandpaper.

B. Patch all holes and cracks in woodwork with wood filler tinted to match existing wood.

C. Carefully hand rub filled area with a fine grit sandpaper to match surface characteristics of adjacent woodwork.

D. Touch-up patch during finishing so that color and other appearance characteristics of filled area match the finish of adjacent woodwork. See 06400-05-R, 06400-06-R, and 06400-10-R for guidance on refinishing.

E. Patch holes and cracks in woodwork including woodwork damaged from hardware changes with wood plugs or wood patches.

F. Rout out hole or crack woodwork to receive plus or patch materials.

G. All repair plugs and patches in wood with a transparent finish shall have grain aligned.

3.02 ADJUSTING/CLEANING

A. Upon completion of this work, all floors, walls, and other adjacent surfaces that are stained, marred, or otherwise damaged by work under this section shall be cleaned and repaired and all work and the adjacent areas shall be left in a clean and perfect condition.

B. All completed work shall be adequately protected from damage by subsequent building operations and effects of weather. Protection shall be by methods recommended by the manufacturer of installed materials and as approved by the **Cultural Resources POC**.

C. Repair damaged and defective woodwork wherever possible to eliminate functional and visual defects. Where it is not possible to repair properly, replace woodwork, and adjust joinery for uniform appearance.

D. Clean woodwork: Dust and damp wipe woodwork with a soft cloth dampened in clean water; dry rub with soft cloth to maintain the polish, rubbing along the grain of the wood.

E. Stain and Spot Removal:
   1. Stains may be cleaned by prompt damp wiping with cloth dampened in clear water or rubbing with cloth dampened in solvent. Dry the wood with a soft cloth.
   2. White spots may be removed by rubbing them with a small amount of linseed oil.

END OF SECTION

REPAIRING WATER-DAMAGED WOODWORK[13]

U.S. General Services Administration
Historic Preservation Technical Procedures

06400-11

The Cultural Resources POC, DPW will review all proposed work; in addition, these guidelines must be reviewed and followed by all personnel prior to performing this procedure.

PART 1---GENERAL

1.01 SUMMARY

A. This procedure includes guidance on repairing woodwork stained from minor water damage.

B. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:
   1. Safety Precautions
   2. Historic Structures Precautions
   3. Submittals
   4. Quality Assurance
   5. Delivery, Storage and Handling
   6. Project/Site Conditions
   7. Sequencing and Scheduling
   8. General Protection (Surface and Surrounding)

PART 2---PRODUCTS

2.01 MATERIALS

A. Wood stain
B. Wood bleach: Solution of sodium perborate, hydrogen peroxide, or proprietary mixture suitable for oak.
C. Wood filler: colored to match wood
D. Sandpaper: Extra fine grit
E. Mild cleaner such as "Murphy's Oil Soap"

PART 3---EXECUTION

3.01 PREPARATION

A. Surface Preparation:
   1. Mask all adjacent surfaces and protect other exposed surfaces in the work area.
   2. Fill any splits in existing wood and sand smooth prior to sealer application.

3.02 ERECTION, INSTALLATION, APPLICATION

A. Select an inconspicuous area on which to test materials and application for each method type required. Test area must be approved by the Contracting Officer.

B. After each test area has been prepared, receive approval from the Contracting Officer before commencing general application.

[13] The following excerpt is from the U.S. General Services Administration (GSA) Technical Procedures. Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf

C. Check area with a moisture meter to verify that wood does not have moisture on surface.

D. Sand stained areas to bare wood.

E. If bare wood is stained, apply wood bleach to remove stain. Minimize flow of bleach onto areas not stained. Allow to dry and sand wood lightly to remove chemical residue.

F. Fill wood if required and apply stain of color to match existing.

3.03 ADJUSTING/CLEANING

A. Wash woodwork with mild detergent and water.
B. Dry immediately with clean cloth.
C. Finish to match historic finish.

END OF SECTION

REPLACING DETERIORATED WOODWORK[14]

U.S. General Services Administration
Historic Preservation Technical Procedures

06400-15

The Cultural Resources POC, DPW will review all proposed work; in addition, these guidelines must be reviewed and followed by all personnel prior to performing this procedure.

PART 1---GENERAL

1.01 SUMMARY

A. This procedure includes guidance on wood restoration work including repairing existing woodwork by removing damaged or deteriorated material and replacing with new to match existing.

B. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:
   1. Safety Precautions
   2. Historic Structures Precautions
   3. Submittals
   4. Quality Assurance
   5. Delivery, Storage and Handling
   6. Project/Site Conditions
   7. Sequencing and Scheduling
   8. General Protection (Surface and Surrounding)

1.02 REFERENCES

A. AWI Quality Standard: Comply with applicable requirements of Architectural Woodwork Quality Standards, Premium Grade, published by the Architectural Woodwork Institute (AWI), except as otherwise indicated.

1.03 SYSTEM DESCRIPTION

A. Performance Requirements: Submit written program for each phase of restoration process including protection of surrounding materials on building during operations. Describe in detail materials, methods, and equipment to be used for each phase of restoration work.

1.04 QUALITY ASSURANCE

A. Mock-Ups: Prior to start of wood restoration work, prepare the following sample panels in building where directed by the **Cultural Resources POC**. Obtain the **Cultural Resources POCs** acceptance of visual qualities before proceeding with the work. Retain acceptable panels in undisturbed condition, suitably marked, during construction as a standard for judging completed work.
   1. Wood Repair: Prepare sample panels for each type of woodwork indicated to be patched, resurfaced, modified, or replaced. Prepare mock-up panels on existing woodwork to demonstrate quality of materials and workmanship.

[14] The following excerpt is from the U.S. General Services Administration (GSA) Technical Procedures. Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf

1.05 PROJECT/SITE CONDITIONS

A. Existing Conditions:
   1. Installer shall advise Contractor of temperature and humidity requirements for woodwork installation areas. Do not install woodwork until required temperature and relative humidity have been stabilized and will be maintained in installation areas.
   2. Maintain temperature and humidity in installation area as required to maintain moisture content of installed woodwork within a 1.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period. The fabricator of woodwork shall determine optimum moisture content and required temperature and humidity conditions.
   3. Determine that surfaces to which finishes are to be applied are even, smooth, sound, clean, dry, and free from defects affecting proper application. Correct or report defective surfaces to Contracting Officer.

PART 2---PRODUCTS

2.01 MATERIALS

A. New or Replacement Materials:
   1. Wood Moisture Content: Provide kiln-dried lumber with an average moisture content range of 6% to 11% for interior work. Maintain temperature and relative humidity during fabrication, storage, and finishing operations so that moisture content values for woodwork at time of installation do not exceed the above range.
   2. Replacement Wood: Match species, grade, grain pattern, and other special characteristics of existing woodwork.

B. Clean, soft cloths

PART 3---EXECUTION

3.01 PREPARATION

A. Surface Preparation:
   1. Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.
   2. Back prime woodwork on all surfaces, which will be concealed with one coat of wood primer. Schedule delivery to allow time for application and drying of back prime coat before installation of woodwork.
   3. Remove miscellaneous hardware, nails, etc., from all existing woodwork as required to provide a first class installation of new or replacement woodwork.
   4. Prior to installation of new architectural woodwork, examine shop fabricated work for completion, and complete work as required, including back priming and removal of packing.

3.02 ERECTION, INSTALLATION, APPLICATION

A. Carefully remove at locations indicated any damaged or deteriorated woodwork. Unless indicated otherwise, replace the entire length of the existing damaged piece to the next butt joint.

B. For partial replacement of existing pieces, use a neat, well-fitted level cut with grain aligned in transparent finished wood.

C. Install new pieces as described below:
   1. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims.
   2. Cut to fit unless specified to be shop-fabricated or shop-cut to exact size. Where woodwork abuts other finished work, scribe, and cut for accurate fit. Before making cutouts, drill pilot holes at corners.

3. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns, miter at corners, and comply with Quality Standards for joinery.
4. Anchor woodwork to anchors or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fasteners heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork, and matching final finish where transparent finish is indicated.

D. Finish replacement woodwork to match adjacent woodwork surfaces. See 06400-05-R and 06400-10-R for guidance.

3.03 ADJUSTING/CLEANING

A. Upon completion of this work, all floors, walls, and other adjacent surfaces that are stained, marred, or otherwise damaged by work under this section shall be cleaned and repaired and all work and the adjacent areas shall be left in a clean and perfect condition.

B. All completed work shall be adequately protected from damage by subsequent building operations and effects of weather. Protection shall be by methods recommended by the manufacturer of installed materials and as approved by the **Cultural Resources POC**.

C. Repair damaged and defective woodwork wherever possible to eliminate functional and visual defects. Where it is not possible to repair properly, replace woodwork, and adjust joinery for uniform appearance.

D. Clean woodwork: Dust and damp wipe woodwork with a soft cloth dampened in clean water; dry rub with soft cloth to maintain the polish, rubbing along the grain of the wood.

E. Stain and Spot Removal:
1. Stains may be cleaned by prompt damp wiping with cloth dampened in clear water or rubbing with cloth dampened in solvent. Dry the wood with a soft cloth.
2. White spots may be removed by rubbing them with a small amount of linseed oil.

END OF SECTION

4.7 ROOFING

4.7.1 Roofing Elements

NR Rating: 214

Description:

The roof shingles are not original to the structure. The roofs on all of the buildings were repaired, and asphalt shingles replaced at some point. The green asphalt shingles cover the entire gable and skirt roofs. They are not distinctive nor do they represent a substantial amount of historic fabric. The asphalt shingles are in fair condition, but begin to show signs of age.

Asphalt shingles should be inspected yearly for wear and localized failure.

Treatment Rating 4: PRESERVE WHERE THERE IS NO COMPELLING REASON FOR REMOVAL

UNDERTAKE ALL NECESSARY ALTERATION WORK AS SENSITIVELY AS POSSIBLE, INCLUDING ANY DEMOLITION WORK.

Statement of Importance:

- The asphalt shingles date to the World War II period; however, they do not represent a substantial amount of historic fabric, are not distinctive, and do not contribute to the significance, or to the original construction system of the storehouse.

Condition: ***Good– Preserve***

Fair to good - Preserve

Poor – Replace

Condition: ***Good– Preserve***

Fair to good - Preserve

Poor – Replace

Inventory Quantity and Condition

The shingles are evaluated as Good when:

- the roof shingles, themselves, are intact, structurally sound and performing their intended purpose, and
- the shingles are beginning to show signs of age and deterioration, and
- the shingles should be inspected yearly for signs of wearing, and
- any shingles that are damaged should be replaced with like color shingles, and
- there are few or no cosmetic imperfections, and
- the shingles need only minor or routine maintenance.

Minor deficiency of the asphalt shingles exists where:

- The asphalt shingles should be inspected yearly for wear and localized failure, and
- shingles should be replaced where they no longer functioning to maximum capacity, and
- if inspection reveals globalized damage, then entire roof should be replaced.
- Minor deficiencies can include, but are not limited to: aging shingles.

4.7.2 Maintenance / Management Guidelines

According to *The Secretary of Interior's Standards for Rehabilitation*, the proper procedure is to respect the significance of the original materials and features, repair and retain them wherever possible, and replace them only when absolutely necessary.

The following recommendations for care of the historic roofing are to be thoroughly read and understood before a treatment is specified. *The Secretary of the Interior's Standards for Rehabilitation* should also be consulted to determine the appropriateness of any treatment.

The following is an excerpt from *The Secretary of the Interior's Standards for Rehabilitation*. Full documentation can be found at http://www2.cr.nps.gov/tps/tax/rhb/stand.htm

4.7.2.1 Identify, Retain, and Preserve

Recommended…

- Identifying, retaining, and preserving roofs--and their functional and decorative features--that is important in defining the overall historic character of the building.
- This includes the roof's shape, such as hipped, gambrel, and mansard; decorative features, such as cupolas, cresting chimneys, and weathervanes; and roofing material such as slate, wood, clay tile, and metal, as well as its size, color, and patterning.

Not Recommended…

- Radically changing, damaging, or destroying roofs, which are important in defining the overall historic character of the building so that, as a result, the character is diminished.
- Removing a major portion of the roof or roofing material that is repairable, and then reconstructing it with new material in order to create a uniform or "improved" appearance.
- Changing the configuration of a roof by adding new features such as dormer windows, vents, or skylights so that the historic character is diminished.
- Stripping the roof of sound historic material such as slate, clay tile, wood, and architectural metal.
- Applying paint or other coatings to roofing material, which has been historically uncoated.

4.7.2.2 Protect and Maintain

Recommended…

- Protecting and maintaining a roof by cleaning the gutters and downspouts and replacing deteriorated flashing. Roof sheathing should also be checked for proper venting to prevent moisture condensation and water penetration; and to insure that materials are free from insect infestation.
- Providing adequate anchorage for roofing material to guard against wind damage and moisture penetration.
- Protecting a leaking roof with plywood and building paper until it can be properly repaired.

Not Recommended…

- Failing to clean and maintain gutters and downspouts properly so that water and debris collect and cause damage to roof fasteners, sheathing, and the underlying structure.
- Allowing roof fasteners, such as nails and clips to corrode so that roofing material is subject to accelerated deterioration.
- Permitting a leaking roof to remain unprotected so that accelerated deterioration of historic building materials—masonry, wood, plaster, paint, and structural members—occurs.

4.7.2.3 Repair

Recommended…

- Repairing a roof by reinforcing the historic materials, which comprise roof features.
- Repairs will also generally include the limited replacement in-kind--or with compatible substitute material--of those extensively deteriorated or missing parts of features when there are surviving prototypes such as cupola louvers, dentils, dormer roofing; or slates, tiles, or wood shingles on a main roof.

Not Recommended…

- Replacing an entire roof feature such as a cupola or dormer when repair of the historic materials and limited replacement of deteriorated or missing parts are appropriate.
- Failing to reuse intact slate or tile when only the roofing substrate needs replacement.
- Using a substitute material for the replacement part that does not convey the visual appearance of the surviving parts of the roof or that is physically or chemically incompatible.

4.7.2.4 Replace

Recommended…

- Replacing in-kind an entire feature of the roof that is too deteriorated to repair--if the overall form and detailing are still evident--using the physical evidence as a model to reproduce the feature. Examples can include a large section of roofing, or a dormer or chimney.
- If using the same kind of material is not technically or economically feasible, then a compatible substitute material may be considered.

Not Recommended…

- Removing a feature of the roof that is unrepairable, such as a chimney or dormer, and not replacing it; or replacing it with a new feature that does not convey the same visual appearance.

MINOR REPAIRS TO ASPHALT ROLL-ROOFING OR BUILT-UP ROOFING[15]

U.S. General Services Administration

Historic Preservation Technical Procedures

07321-01

The Cultural Resources POC, DPW will review all proposed work; in addition, these guidelines must be reviewed and followed by all personnel prior to performing this procedure.

PART 1---GENERAL

A.01 SUMMARY

A. This procedure includes guidance on making minor repairs to asphalt and built-up roofing membranes. Some problems include open lap joints, blisters, splits, holes, ridges, undulations, wrinkles, and cracks.

1. Ridges:

NOTE: RIDGES SHOULD BE REPAIRED AS SOON AS POSSIBLE. CONTINUAL STRESS ON A RIDGE CAN LEAD TO SPLITTING OF THE MATERIAL.

a. Ridges are firm and do not yield under pressure. They may result from the substrate being uneven before the felt was laid, or from moisture distorting the substrate.
b. Ridging usually occurs over or near joints between boards. The ridges expand as entrapped moisture vaporizes. Ridges become a problem when they interfere with drainage or when the roof begins to leak.

2. Undulations:

a. Unlike ridging, undulations will yield to pressure.
b. Distortions of felts may result from the way the rolls were stored (flat instead of on end), inadequate pressure applied while laying, poor application of bitumen compound, or if entrapped moisture becomes vaporized.

3. Blisters:

a. Blisters will yield to pressure.
b. Blisters begin with the expansion of trapped air and/or moisture pockets and can result from inadequate pressure during laying.
c. Full Membrane Blistering: Usually occurs when no separating layer is provided between the asphalt and the substrate.
d. Inter-layer Blistering:
   - When large blisters result from additional air and water drawn in from outside through the top layer of the felt.
   - Not a common problem, but can result if the 2nd layer does not adhere well to the 1st layer due to the accumulation of dirt or dust.

—OR—

[15] The following excerpt is from the U.S. General Services Administration (GSA) Technical Procedures. Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf

- If a blow develops in the 1st layer, the 2nd layer becomes thin at that point and allows air and moisture to penetrate between the layers. This can create the potential for a blister to develop.

e. A blister usually develops under the cap sheet of the membrane.
f. Inter-layer blistering is most common with unsurfaced or mineral surfaced felts on vertical or sloping surfaces. However, high performance membranes can reduce the incidence of this occurring.

4. Top Pitting:
NOTE: NO REMEDIAL TREATMENT IS RECOMMENDED, AS THIS TYPE OF BLISTERING SHOULD NOT AFFECT THE EFFICIENCY OF THE WATERPROOFING.
   a. Miniature surface blistering of the bitumen coating (especially with BS747 Type 1E and 2E mineral-surfaced felts).
   b. The blisters may range in size from 1mm to 3mm.
   c. Top pitting may be caused by:
      1) Trapped air and/or moisture in the manufacture of the material.
      2) Oliensis: Incompatibility of the saturating bitumen with the coating bitumen (i.e. oils from the coating separate as an incompatible reaction with the saturant bitumen).
   d. If numerous across the surface, the coating may separate from the membrane and result in a loss of surfacing.

5. Cockling:
   a. Rounded ridging usually in line with the length of the material.
   b. Cockles sometimes develop as a result of thermal expansion (especially with Polyester felts, which are heat sensitive). The heat from the bonding bitumen during application can create minor wrinkling or cockles, which usually disappears as the material settles.
   c. Most common in fiber and asbestos base felts as they tend to expand when their moisture content increases.
   d. Cockling is less likely in coated felts especially those with a glass or polyester base.

6. Blowing:
   a. Blows are bubbles that develop on the surface from gas moving through the asphalt. The heat of the asphalt during application causes the air to expand and creates steam by raising the temperature of the moisture.
   b. Blowing is most common in vertical application where there is no separating layer between the asphalt and the substrate.

B. Problems with mineral-surfaced, asphalt roll roofing and built-up roofing membranes are usually related to sun exposure, and excessive moisture. Exposure to the sun may cause the asphalt to dry out; resulting in cracking of the surface, separation of plies, and may eventually require replacement of the entire membrane.

C. The repairs described in this procedure are ONLY temporary. For roofs that are near the end of their useful life, these repairs may provide an extra 3 to 4 years of service, enough time to start planning for a new roof. For roofs that are relatively new, these techniques will provide protection while the cause of the problem is being investigated and repairs that are more permanent are planned.

D. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:
   1. Safety Precautions
   2. Historic Structures Precautions
   3. Submittals

4. Quality Assurance

5. Delivery, Storage and Handling
6. Project/Site Conditions
7. Sequencing and Scheduling
8. General Protection (Surface and Surrounding)

E. For additional information on factors contributing to roof deterioration, see 07500-02-S.

F. For guidance on inspecting for sources of flat roof failures, see 07500-01-S.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM), 100 Barr Drive, West Conshohocken, PA 19428, (610) 832-9585 or FAX (610) 832-9555.

1.03 DEFINITIONS

A. Asphalt--A dark brown to black semi-solid hydrocarbon obtained from crude petroleum. See ASTM D 312-78.

B. Asphalt cement--Trowelable black asphaltic mastic used for flashing and roof repairs. Contains fiber additives to thicken the mixture so that it will not run down vertical surfaces. Also called roofing cement, flashing cement, plastic asphalt cement, plastic cement, roofing tar, bitumen, and elastic cement.

C. Bitumen--A semisolid mixture of complex hydrocarbons derived from coal or petroleum, as coal-tar pitch or asphalt; before application, usually dissolved in a solvent, emulsified, or heated to a liquid state.

D. Built-up roofing--A continuous roof covering made up of laminations or plies of saturated or coated roofing felts, alternated with layers of asphalt or coal-tar pitch and surfaced with a layer of gravel or slag in a heavy coat of asphalt or coal-tar pitch or finished with a cap sheet; generally used on flat or low-pitched roofs.

E. Bituminous coating--An asphalt or tar compound used to provide a protective finish for a surface.

F. Coal tar bitumen--A dark brown to black, semi-solid hydrocarbon, a residue distillation of coal tar. It is used for the construction of low-pitch built-up roofs. It differs from coal tar pitch because of a different volatility. See ASTM D, 450, Type III.

G. Coal tar pitch--Similar to coal tar bitumen. Used for ead-level or low-slope built-up roofs. See ASTM D 450, Type I.

H. Lap cement--Thinner than asphalt cement, this is used to make watertight joints at the laps of roll roofing.

I. Roof restorant--The restorant penetrates the existing roofing felts and plasticizes the age-hardened bitumen to its originally installed state. It will not, however, stop or seal leaks. In addition, a deep coating on the surface provides a weathering surface and a binder for the replacement aggregate. Also called roof coating or roof paint.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection:
   1. Store roof system materials in a dry location. Outside, they should be placed on platforms off the ground or roof deck, covered with waterproof coverings, which will not produce condensation.
   2. Store roll materials on end to prevent their becoming deformed or damaged. Remove moisture, dirt, snow, or ice from roofing bitumens before they are heated.

3. Replace lids on cans of material stored on the job site.
4. Protect water-based materials from freezing.

1.05 PROJECT/SITE CONDITIONS

A. Environmental Requirements:
   1. It is extremely important that the roof deck be dry at the time roofing operations commence, to avoid later problems with water vapor trapped under the membrane. A deck should not be roofed when rain, snow, or frost is present in or on the deck material.
   2. Cold temperatures: Apply roofing materials only when correct bitumen temperatures can be maintained. "Wind chill" and surface temperature affects application temperatures. Keep surface temperature and asphalt thermometers at the work site.
   3. Hot temperatures: In hot weather the bitumen will cool slowly, which can lead to sticking, making the membrane susceptible to physical damage from mechanical equipment and foot traffic.
   4. Wind: Wind can blow hot materials, mastics, and coatings causing damage to surrounding property and making the handling of roll materials difficult.

PART 2---PRODUCTS

2.01 MATERIALS

A. Sand and/or gravel to match existing or historic appearance.
B. Asphalt Roof Felts:
   1. BS747 Type 1 fiber base felts - suffer from inter-layer blistering.
   2. Type 2 Asbestos base felts - inter-layer blistering is less common.
   3. Type 3 Glass fiber felts - Extremely resistant to blistering.
   4. Polyester felts - some resistance to blistering.
C. Asphalt cement Asphalt cement (also called, among others, flashing cement or roofing cement.
D. Roof Coating (also called roof paint and roof restorant)
E. 1-1/2" Flathead galvanized roofing nails
F. Turpentine

2.02 EQUIPMENT

A. Utility knife or hook-nosed linoleum knife
B. Hammer
C. Trowel
D. Stiff bristle brushes (non-metallic)
E. Long handled brush or broom
F. Ladders, scaffolding as required

PART 3---EXECUTION

3.01 EXAMINATION

A. Inspect the surface for obvious cracks, blisters, or ridges in the membrane.
B. Check also for bald spots, areas where the gravel (built-up roof) or mineral granules (roll roofing) are missing.
C. Be especially diligent inspecting where the roof meets parapets, chimneys, vents, and other vertical surfaces.
D. If possible, check the underside of the rafters and decking for water stains or rot, which would indicate water infiltration, realizing that water, could migrate through layers of roof plies from distant points.
E. Check the interior, especially ceilings and around fireplaces and vent pipe locations, for clues as to the location of any leaks.
F. See also roofing section of 01800-01-S, "Checklist for the Routine Inspection of Buildings."

3.02 PREPARATION

A. Protection:
    1. When transporting liquid bitumen to the roof, protect adjacent surfaces and permanent equipment by providing masking or covering. Secure coverings without the use of adhesive backed tape or nails. Impervious sheeting, which produces condensation, should not be used.
    2. Keep a portable fire extinguisher on hand where work is being done.
    3. At the end of each workday, provide temporary roofing when existing roof is being opened for repair or replacement. Provide an effective way to divert water runoff away from open roof.

B. Surface Preparation:
    1. Sweep exposed felts clean of loose aggregate, dirt, and silt with stiff bristled brush or broom. Sweep at least six inches into embedded aggregate in all directions. Clean all roof surfaces, including parapets, copings, and flashings. Sometimes this can be done using a long-handled push broom. In the case of a tar and gravel roof, you may have to cut the gravel off by hand or use a gravel-removing machine. Parapet cleaning should include brushing of any efflorescence from the brickwork using stiff, non-metallic bristle brushes. Do not begin repair of flashings until completion of all pointing or resetting of parapet units and repair of coping joints.
    2. Go over the entire roof area with roofer's chalk, marking areas where repair work is to be done.

3.03 EXECUTION, INSTALLATION, APPLICATION

A. Repairing open lap joints on roll roofing:
    1. Force lap cement or asphalt cement under open seam. Weight it down with heavy weight until it is dry.
    2. If it pops again, slit wrinkle being careful not to cut sound layers of roofing below.
        a. Using 1-1/2 inch galvanized roofing nails secure both sides of the slit.
        b. Using 90-lb. roofing felt, cut a patch large enough to cover the nail heads with a 2 inch overlap on all sides.
        c. Coat the back of the patch with asphalt cement and press it into place over the nails.
        d. Nail the edges of the patch with nails spaced about 1 inch apart and cover the nail heads with more asphalt cement.
        e. Finish the patch by sprinkling light colored fine gravel or sand over the wet cement.

DO NOT ELIMINATE THIS LAST STEP. THE GRAVEL OR SAND REFLECTS SUNLIGHT THUS SLOWING THE DRYING OUT PROCESS

B. Repairing Small Blisters:
    1. If no leaks are evident, apply a solar reflective treatment (see Section 3.03 B.3. below).

        —OR—

        Starcut the blister with a hook-nosed linoleum knife or a utility knife to release trapped air,

        a. If the felt layers beneath the surface are dry, proceed with the repair.
        b. If they are damp, deepen the cut down to the wood sheathing and let the roofing dry out before proceeding. A portable electric eater-fan or hair dryer can be used to speed up the process.
        c. Patch the area and apply a solar reflective treatment (see Section 3.03 B.3. below).

        —OR—

        Release entrapped moisture by installing drying units with evaporation tubes (see manufacturer's instructions for installation procedures).

    2. If leaks are present, allow entrapped moisture to dry and then remove the felts and replace with new.

3. To Prevent Blistering: Apply chippings over the surface (a form a solar reflective treatment): Chippings are usually light colored, of limestone, granite, gravel, calcite or feldspar, 6-10 mm in size set in bitumen compound after the asphalt is laid.
    a. Advantages of chippings:
        1) Helps cool the membrane.
        2) Helps hold down the membrane.
    b. Disadvantages of chippings:
        1) Outlets may become blocked.
        2) Leaks in roof are difficult to locate and bonded chippings are difficult to remove.
    c. Alternatives of chippings include mineral-surfaced roofing and liquid-applied surface coatings (very effective on top of glass-base felts, but not so effective with others.

C. Repairing Undulations:
    1. One alternative is to remove and relay the roof with new felts.
    2. If not a serious problem, that is the problem will not be exacerbated by foot traffic on the roof, then an application of solar reflective treatment should aid in reducing the spread of undulations.

D. Repairing larger damaged areas on either built-up or roll roofing:
    1. Cut out damaged plies leaving sound layers in tact.
    2. Dip knife in turpentine periodically while cutting to keep the blade free of tar and felt fibers, and pull out the layers of felt individually.
    3. If water has soaked the felt, remove all the roofing within the rectangle, down to the sheathing and dry the area thoroughly.
    4. With the damaged area removed, apply asphalt cement under loose edges of cuts and over the entire cut out area.
    5. Using 90-lb. roofing felt, cut out patches the same size as the cutout. Press first patch into asphalt cement. Apply another coating of asphalt cement to cutout and press another patch into place. Repeat process until the patch is even with the surrounding roof. The number of layers will depend on the depth of the cutout.
    6. Cut a final patch of either roofing felt or mineral roll roofing, which will overlap the cutout area by 2 inches on all sides. Cover the bottom of the final patch with asphalt cement, press in place, and nail edges with nails spaced about 3/4 to 1 inch apart. Cover nail heads with asphalt cement and sprinkle fine gravel or sand over, as in A.3.above.

E. Repairing cracks in Asphalt Flashing:
    1. Clean the area of any gravel or other debris.
    2. Coat area around crack with asphalt cement extending 6 inches beyond crack in all directions.
    3. Lay a piece of 90-lb. roofing felt in the cement maintaining the 6-inch overlap.
    4. Repeat steps (2) and (3).
    5. Finish patch with a final coat of asphalt cement and lay sand or gravel on the horizontal surfaces.

F. If there are simply bald spots on the surface, sweep up any dirt and debris; paint area with roof coating and re-spread or add more gravel.

    NOTE: DO NOT use reflective paints instead of sand or gravel, except on vertical portions of flashing. Though it is not fully understood why, reflective paints encourage wrinkling, a potentially serious form of deterioration.

G. Inspect patch at least twice a year to make sure it is still sound.

END OF SECTION

4.8 DOORS AND WINDOWS

4.8.1 Doors and Windows Elements

4.8.1.1 Doors and Windows—Wooden Doors

NR Rating: 212

Description:

One wooden four-lite doors with wainscoting on the lower half is located on the north elevation, and large sliding door is located in the center of the east elevation. In general, the doors show weathering and delamination. The wood should be cleaned, scraped, and repainted to protect it from further damage.

Doors and their frames should be cleaned, scraped, and repainted in order to prevent damage as a result of exposing the wood to the elements.

Treatment Rating 2: PRESERVE WHEREVER POSSIBLE

IF TOO DETERIORATED TO SAVE, ELEMENT MUST BE REPLACED IN-KIND.

Statement of Importance:

- The doors represent a substantial amount of historic fabric, and they contribute to the significance and historic appearance of the storehouse as a building from the World War II period, and
- the doors make a significant contribution to the property's historic appearance and as an integral part of the buildings historic construction.

Condition: ***Fair – Preserve***

Fair to good - Preserve

Poor – Replace

Inventory Quantity and Condition

The doors are evaluated as Fair when:

- the door frame has warped and is preventing the door from closing propertly on the north elevation, and
- the doors are showing surface checking, paint delamination, and deterioration of the trim, and

- the windows and screens should be inspected yearly for signs of failure and repaired as needed, and
- the doorframes are exhibiting checking and severe weathering at the bottom, and
- doors, thresholds, and trim should be cleaned, repaired, scraped and painted including the endgrain in order to prevent future deterioration as a result of water infiltration.

Minor deficiency of the wood doors exists where:

- As this is a common area for paint failure in the other buildings, the wood should be cleaned, scraped, primed, and repainted, including the end grain, and
- any repairs to the wood should be made after cleaning the surface gently if necessary, and
- damaged wood should be repaired and treated as per preservation standards, and
- doors should be treated for mold growth, and
- reglaze where needed, and
- check window putty, clean and repoint to ensure weather tight seal, and
- the frames should be inspected regularly to ensure proper fit and therefore prevent any damage that may occur as a result of warping or deterioration, and
- standard preventive maintenance practices and building conservation methods have not been followed, and/or
- there is a condition with long-term impact beyond 5 years.

Minor deficiencies can include, but are not limited to: mold growth and paint deterioration.

4.8.1.2 Doors and Windows—Wooden Windows

NR Rating: 212

Description:

Wood eight-over-eight double-hung windows are located on all facades of the storehouse. They are original to the building and contribute to the historic appearance of Building 1320. Overall the windows are in good condition. Paint should be scraped and reapplied including the endgrain in order to protect the wood from future paint failure as a result of water infiltration.

Windows and their frames show signs of wood and paint deterioration due to age.

Treatment Rating 2: PRESERVE WHEREVER POSSIBLE

IF TOO DETERIORATED TO SAVE, ELEMENT MUST BE REPLACED IN KIND.

Statement of Importance:

- The wood windows are original to the building, and contribute to the significance and historic fabric of the Building 1320 as a building from the World War II period, and
- the windows make a significant contribution both to the property's historic appearance and as an integral part of the buildings historic construction.

Condition: ***Fair – Preserve***

Fair to good - Preserve

Poor – Replace

Inventory Quantity and Condition

The windows are evaluated as Fair when:

- the window sills, mullions, and jambs are delaminating, and
- the screen frames are checking and cracked, and the lower frame pieces are weathered on all sides of the building, and
- in places the putty is missing or severely deteriorated or cracking, and
- there is alligatoring of the window sash on all facades in addition to delamination, and
- glazing on the third window from the north on the west elevation, both windows on the south, and the first window from the north on the east elevation are cracked, and

- there are holes in the screen on all sides of the building, and
- second window jamb on the north elevation is loose, and
- the wood screen frame is loose at the lower right corner on the north elevation, and
- there is a hole in the bottom right corner of the second window from the north on the west elevatiohn, and
- the first window from the west on the south elevation has holes in the screen, the sill is warped, and the paint is peeling, and
- the screen is pushed out due to the warping of the drop-lap siding avofe the windows.

Minor deficiency of the wood windows exists where:

- Make windows weathertight by recaulking, replacing, or installing weather stripping in order to improve thermal efficiency, and
- the windows and their frames in areas have deteriorated beyond repair and will need to be replaced in-kind, and
- damaged wood should be repaired as per preservation standards, and
- any repairs to the wood should be made after cleaning the surface gently, and
- wood should be primed and repainted, including the end grain, which is most susceptible to water intake, and
- the screens and frames should be inspected regularly to ensure proper fit and therefore prevent any damage that may occur as a result of warping or deterioration, and
- broken or missing glazing should be replaced in-kind, and
- the windows should be inspected yearly for signs of deterioration that would require cleaning and repainting to prevent more extensive surface damage, and
- standard preventive maintenance practices and building conservation methods have not been followed, and
- there is a reduced life expectancy of affected or related building materials and/or systems, and
- there is a condition with long-term impact beyond 5 years.

Minor deficiencies may include, but are not limited to: paint deterioration, window frame warping, torn screens, and missing elements.

4.8.2 Maintenance / Management Guidelines

According to *The Secretary of Interior's Standards for Rehabilitation*, the proper procedure is to respect the significance of the original materials and features, repair and retain them wherever possible, and replace them only when absolutely necessary.

The following recommendations for care of the historic roofing are to be thoroughly read and understood before a treatment is specified. *The Secretary of the Interior's Standards for Rehabilitation* should also be consulted to determine the appropriateness of any treatment.

The following is an excerpt from *The Secretary of the Interior's Standards for Rehabilitation*. Full documentation can be found at http://www2.cr.nps.gov/tps/tax/rhb/stand.htm

4.8.2.1 Identify, Retain, and Preserve

Recommended…

- Identifying, retaining, and preserving windows--and their functional and decorative features--those are important in defining the overall historic character of the building.
- Such features can include frames, sash, muntins, glazing, sills, heads, hoodmolds, paneled or decorated jambs and moldings, and interior and exterior shutters and blinds.
- Conducting an in-depth survey of the conditions of existing windows early in rehabilitation planning so that repair and upgrading methods and possible replacement options can be fully explored.

Not Recommended…

- Removing or radically changing windows which are important in defining the historic character of the building so that, as a result, the character is diminished.
- Changing the number, location, size, or glazing pattern of windows, through cutting new openings, blocking-in windows, and installing replacement sash that do not fit the historic window opening.
- Changing the historic appearance of windows through the use of inappropriate designs, materials, finishes, or colors which noticeably change the sash, depth of reveal, and muntin configuration; the reflectivity and color of the glazing; or the appearance of the frame.
- Obscuring historic window trim with metal or other material.
- Stripping windows of historic material such as wood, cast iron, and bronze.
- Replacing windows solely because of peeling paint, broken glass, stuck sash, and high air infiltration. These conditions, in themselves, are no indication that windows are beyond repair.

4.8.2.2 Protect and Maintain

Recommended…

- Protecting and maintaining the wood and architectural metal which comprise the window frame, sash, muntins, and surrounds through appropriate surface treatments such as cleaning, rust removal, limited paint removal, and re-application of protective coating systems.
- Providing adequate anchorage for roofing material to guard against wind damage and moisture penetration.
- Evaluating the overall condition of materials to determine whether more than protection and maintenance are required, i.e. if repairs to windows and window features will be required.

Not Recommended…

- Failing to provide adequate protection of materials on a cyclical basis so that deterioration of the window material is accelerated.
- Retrofitting or replacing windows rather than maintaining the sash, frame, and glazing.
- Failing to undertake adequate measures to assure the protection of historic windows

4.8.2.3 Repair

Recommended…

- Repairing window frames and sash by patching, splicing, consolidating or otherwise reinforcing. Such repair may also include replacement in-kind--or with compatible substitute material--of those parts that are either extensively deteriorated or are missing when there are surviving prototypes such as architrave, hoodmolds, ash, sills, and interior or exterior shutters and blinds.

Not Recommended…

- Replacing an entire window when repair of materials and limited replacement of deteriorated or missing parts are appropriate.
- Failing to reuse serviceable window hardware such as brass sash lifts and sash locks.
- Using substitute material for the replacement part that does not convey the visual appearance of the surviving parts of the window or that is physically or chemically incompatible.

4.8.2.4 Replace

Recommended…

- Replacing in-kind an entire window that is too deteriorated to repair using the same sash and pane configuration and other design details. If using the same kind of material is not technically or economically feasible when replacing windows deteriorated beyond repair, then a compatible substitute material may be considered.

Not Recommended…

- Removing a character-defining window that is unrepairable and blocking it in, or replacing it with a new window that does not convey the same visual appearance.

REPAIR OF BOWS OR UNDULATIONS IN A WOOD DOOR FRAME[16]

U.S. General Services Administration
Historic Preservation Technical Procedures

08210-02

The Cultural Resources POC, DPW will review all proposed work; in addition, these guidelines must be reviewed and followed by all personnel prior to performing this procedure.

PART 1---GENERAL

1.01 SUMMARY

A. This procedure includes guidance on realigning a bowed wood doorframe.

B. A wood doorframe that bows or undulates may result from warping in the frame, building settlement, or pressure in the wall behind the frame.

C. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:
   1. Safety Precautions
   2. Historic Structures Precautions
   3. Submittals
   4. Quality Assurance
   5. Delivery, Storage, and Handling
   6. Project/Site Conditions
   7. Sequencing and Scheduling
   8. General Protection (Surface and Surrounding)

PART 2---PRODUCTS

2.01 MATERIAL

A. Wooden shims and blocking
B. 6d and 8d finish nails

2.02 EQUIPMENT

A. Wide blade putty knife and prybar
B. Hack saw
C. Hammer and chisel

PART 3---EXECUTION

3.01 EXAMINATION

A. To discern door problem, observe the door open and close a few times. Note the location of any binding or rubbing. Note also if door binds inconsistently from top to bottom or hinge side to latch side.

3.02 ERECTION, INSTALLATION, APPLICATION

A. Check if jamb is secured to framing by carefully twisting and pushing it.

[16] The following excerpt is from the U.S. General Services Administration (GSA). Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf

B. Push back high spots where jamb is loose and secure by nailing. Use 8d finish nails for securing the jamb into the frame and 6d finish nails for securing the trim into the jamb.

C. If jamb cannot be forced back into position, it must be freed from casing and realigned.
   1. Carefully loosen casing on less conspicuous side, with a wide blade putty knife and pry bar; insert putty knife blade first and then insert pry bar on top of knife blade, allowing the knife blade to protect the casing.
   2. Loosen casing on side that is more noticeable just enough to insert hacksaw and cut nails, which hold the casing to the jamb.
   3. Shim out low spots with solid wood wedges or blocking nailed into place through jamb. If necessary nails can be hidden by first removing door stops, nailing blocking into place and renailing stops.
   4. Cut down high spots by removing any existing shims and/or chiseling away at any blocking.
   5. When jamb is plumb and straight, resecure casing, filling nail holes as necessary.

END OF SECTION

UNSTICKING A WOOD DOUBLE-HUNG WINDOW SASH[17]

U.S. General Services Administration
Historic Preservation Technical Procedures

08610-03

The Cultural Resources POC, DPW will review all proposed work; in addition, these guidelines must be reviewed and followed by all personnel prior to performing this procedure.

PART 1---GENERAL

1.01 SUMMARY

A. This procedure includes guidance and procedures required to inspect and loosen a wood sash.

B. A wood window sash can bind or stick for many reasons including: window nailed shut; accumulation of paint and/or dirt; humidity causing wood expansion; bowed members; weather-stripping too tight; or building settlement. NOTE: Some sash were fixed, installed without operable parts such as single hung sash.

C. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:
   1. Safety Precautions
   2. Historic Structures Precautions
   3. Submittals
   4. Quality Assurance
   5. Delivery, Storage, and Handling
   6. Project/Site Conditions
   7. Sequencing and Scheduling
   8. General Protection (Surface and Surrounding)

1.02 SYSTEM DESCRIPTION

A. A window sash in proper working order is freely sliding, has balancing and moving apparatus in working order, and has operable sash lock(s) to deter air infiltration. In addition, operable sash often have weather-stripping and adjustable interior stops to allow for seasonal swelling and shrinkage.

PART 2---PRODUCTS

2.01 MATERIALS

A. Replacement stock is available for stop and parting beads. Be sure replacement is an exact duplicate of the original. Milling a new piece may be required.

2.02 EQUIPMENT

A. A device for cutting paint seals such as "Window zipper" (Red Devil), or approved equal; available at hardware stores.

[17] The following excerpt is from the U.S. General Services Administration (GSA). Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf

B. A rubber mallet and block of wood for jamb and stop straightening.

C. Utility knife for cutting paint seals
D. Paint scraper
E. Wide putty knife or "window zipper" to break paint seal
F. Screwdriver and screws to tighten jamb into place
G. Hand soap or household paraffin for waxing the stop and parting beads
H. Flat steel pry bar to loosen sash from outside
I. Carpenter's nippers to remove nails
J. 1" chisel to scrape paint in channel
K. Sandpaper
L. Planer
M. Nail to secure sash cord/chain
N. Soap and water

PART 3---EXECUTION

3.01 EXAMINATION

A. Determine if sash is an operable design and not fixed.

3.02 ERECTION, INSTALLATION, APPLICATION

A. The sash may be nailed shut:
    1. Check around general area of sash for the presence of any nails.
    2. If sash is nailed shut with finish nails, drive them completely through with nail set.
    3. If large headed nails were used, pull them out with carpenter's nippers being careful not to damage wood.

B. The sash may be painted shut:
    1. Break the paint seal between the stops and the sash.
    2. Use a "window zipper" or a wide putty knife with a rubber mallet.
    3. Do this on the inside and outside of the window.
    4. CAREFULLY insert a heavy screwdriver between the sash rail and jamb at groove for sash cord. TAKE CARE NOT TO MAR OR DAMAGE FINISH AND/OR SASH.
    5. Work at both sides of jambs to loosen sash.
    6. If window still will not open, use a pry bar on the outside of the sash. TAKE CARE TO PROTECT THE SASH AND SILL FROM DENTS WITH A WIDE PUTTY KNIFE OR WOOD BLOCKING. INTENSE PRESSURE ON A SMALL AREA SUCH AS THAT FROM A SMALL SCREWDRIVER OR FLAT PRYBAR CAN GOUGE OR DENT THE WOOD.

C. If the window has been opened but is difficult to move:
    1. Remove any dirt from the channel, stops, weather-stripping, and parting bead.
    2. Remove any globs of dried paint from the stops and parting bead with a 1" chisel and sand edges after paint is removed.
    3. Lubricate stops and parting bead with hand soap or household paraffin.

D. If sash still binds, determine the point of friction:
    1. If the friction occurs along the jamb; with a hammer, tap a wood block approximately 6" long 5 or 6 times against the back of channel to force the jamb back into place. If this allows the sash to move more freely, screw the jamb into the jack stud behind at 3" intervals around the point of friction.
    2. If the friction occurs with the stop, use the same procedure as above, but with less force and do not drive screws into the stop.

E. Problems such as humidity, paint build-up, or weather-stripping applied too tightly require more aggressive repair:

1. If the window is easily operable during dry times of the year but will not work properly during humid times, then humidity is to blame. Repair should not be attempted until the time of year with highest humidity. See section 1.02 A; If the window has adjustable interior stops, it may be desirable to refurbish and restore them to use.
    a. The sash must be carefully planed and should be done only once.
    b. Take off as little of the sash surface as possible to make the window operable during all times of the year.
    c. Remove the sash as described below with the problem of paint build-up.

2. If the sash binds because of the build-up of layers of paint, remove the paint. To remove the paint properly, first remove the sash:
    a. Remove the stop; break the paint seal between the inside stop and the window frame. Pry the stop away from the frame with a stiff putty knife, small pry bar, or wide chisel.
    b. Pull one side of sash out to expose the sash cord/chain.
    c. Remove cord/chain from both sides of sash. Temporarily secure the end of cord/chain with a nail through the cord/chain and across the pulley hole so that it will not fall into the pocket. Lift out the sash.
    d. Remove loose paint from all members by sanding, and repaint.
    e. Reinstall parting bead and sash.
    f. When reinstalling inner stop, check position in relation to the sash one nail at a time so that sash will fit snugly in place and will not bind or rattle.
    g. To remove the upper sash - lower the sash; remove the parting bead from the top down; at midpoint, raise the sash and continue. Follow the same procedure as above.

3. If weather-stripping applied too tightly is suspected to be the problem, removal and reinstallation of weather-stripping will be required.

END OF SECTION

THE REPAIR OF HISTORIC WOODEN WINDOWS
PRESERVATION BRIEFS: 9[18]

U.S. General Services Administration
Historic Preservation Technical Procedures

08610-01

The Cultural Resources POC, DPW will review all proposed work; in addition, these guidelines must be reviewed and followed by all personnel prior to performing this procedure.

John H. Myers

This standard includes the bulk of information contained in the original Preservation Brief developed by the National Park Service. To obtain a complete copy of this brief, including figures and illustrations, please contact:

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INTRODUCTION

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

[18] The following excerpt is from the U.S. General Services Administration (GSA). Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf

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.

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 ensure that it slopes downward away from the building and allows water to drain off. In addition, it may be advisable to cut a drip line along the underside of the sill. This almost invisible treatment will ensure proper water run-off, 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.

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 end-grain 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 too 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

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.

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) weather-stripping and reinstallation of the sash, and 5) repainting. 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. Several techniques such as scraping, chemical stripping, and the use of a hot air gun are discussed in "Preservation Briefs: 10 Paint Removal from Historic Woodwork" (see 09910-01-S).

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.

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 windows, 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 weather-stripping. 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 sashes was accomplished in about one hour. Weather-stripping 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.

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 semi-rigid epoxies which saturate the porous decayed wood and then harden. The surface of the consolidated wood can then be filled with a semi-rigid epoxy-patching compound, sanded, and painted. Epoxy patching compounds can be used to build up missing sections of 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. Technical Preservation Services has published “Epoxies for Wood Repairs in Historic Buildings” by Morgan Phillips and Judith Selwyn (1978), which discusses the theory and techniques of epoxy repairs. 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.

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 molding 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 much 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 homeowner 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, retain historic significance, and which are 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 that is repaired should be made as energy efficient as possible by the use of appropriate weather-stripping 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. Weather-stripping is an historic treatment, but old weather-stripping (felt) is not likely to perform very satisfactorily. Appropriate contemporary weather-stripping should be considered an integral part of the repair process for windows. The use of sash locks installed on the meeting rail will ensure that the sash are kept tightly closed so that the weather-stripping 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 01100-04-S "Preservation Briefs: 3 Conserving Energy in Historic Buildings"). 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 that 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, an historic wooden window with a high quality storm window added should thermally outperform a new double glazed metal window that 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, 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 .049. 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.

END OF SECTION

SEALING LEAKY WOOD DOUBLE-HUNG WINDOWS[19]

U.S. General Services Administration
Historic Preservation Technical Procedures

08611-01

The Cultural Resources POC, DPW will review all proposed work; in addition, these guidelines must be reviewed and followed by all personnel prior to performing this procedure.

PART 1---GENERAL

1.01 SUMMARY

A. This procedure includes guidance on sealing leaky windows and includes caulking gaps between the wall and the frame, filling cracks in the wood, repainting and replacing loose window putty.

B. Peeling paint, the absence of putty, and open sash joints are signs of moisture infiltration into the window sash. The wood should be properly sealed against moisture to prevent deterioration in wood.

C. See 01100-07-S for general project guidelines to be reviewed along with this procedure. These guidelines cover the following sections:
   1. Safety Precautions
   2. Historic Structures Precautions
   3. Submittals
   4. Quality Assurance
   5. Delivery, Storage, and Handling
   6. Project/Site Conditions
   7. Sequencing and Scheduling
   8. General Protection (Surface and Surrounding)

PART 2---PRODUCTS

2.01 MATERIALS

A. Caulking Compound (in order of recommended usage):
   1. Polyurethanes - easily workable; paintable; 15-20 year life span; limited availability.
   2. Polysulfides - slow drying; can be sanded and painted; highly elastic; limited availability.
   3. Butyls - paintable but cannot be sanded; 7-10 year life span.
   4. Silicones - some can be painted but generally not sanded.
   5. Acrylic Latex - for exterior work, their use is best left to tight, narrow joints; short life span especially when compared to polysulfides and polyurethanes.

B. Polyethylene foam backer rod such as "Ethafoam" SB brand backer rod (available at builder's supply houses or concrete materials suppliers), or approved equal.

C. Linseed oil

D. Wood filler (there are four basic types):

[19] The following excerpt is from the U.S. General Services Administration (GSA). Full documentation can be found at: http://w3.gsa.gov/web/p/hptp.nsf

1. Water-mix Wood Putty: Easy to tint and fairly resilient, but has poor moisture resistance.
2. Solvent-based Wood Filler: Not tintable, but has many color choices. A solvent is needed to clean any excess or spills. It is difficult to sand, but has good adhesion and moisture resistance. It also has a problem with shrinkage.
3. Acrylic Latex Wood Filler: Better than water-based in adhesion, moisture resistance, and flexibility. Apply the filler in layers to avoid shrinkage.
4. Two-part Polyester Filler: Similar to auto body filler. It has excellent adherence and moisture resistance with minimal shrinkage. It stains easily, but is time consuming to prepare.

E. Wood water-repellent preservative (see 06310-01-P, Section 2.02 Materials, and 06310-01-S)

F. Paint (see 06300-01-S)

G. Linseed oil putty

H. Clean, potable water

2.02 EQUIPMENT

A. Wire brush

B. Natural bristle brushes for oil-based paints: Precondition by soaking in raw linseed oil for 24 hours. Use nylon bristle brushes for water-based paint. Do not use the same brush for both types of paint.

C. Putty knife

D. Caulking gun

PART 3---EXECUTION

3.01 EXAMINATION

A. Inspect windows periodically, at least yearly. Check for ease of operation, presence, and operation of all hardware, and cracked or missing putty and glazing.

3.02 ERECTION, INSTALLATION, APPLICATION

A. Recaulking Gaps Between Window Frame and Wall:
   1. Re-nail any loose boards in the window frame.
   2. Using a wire brush and putty knife, remove any loose dirt and debris that may have collected in the gap.
   3. For gaps 3/8 inches or wider, insert a closed-cell polyurethane backer rod.
   4. Push the backer rod into the joint to fill up the space behind the caulking.
   5. Fill gap with a flexible caulking or sealant. Apply with a caulking gun until flush with the surface.
   6. If an oil-based caulk is used, allow the caulk to dry for at least 48 hours and then paint. Paint will extend the life of oil-based paint.

B. Fill holes and cracks with linseed oil and fill with putty (see 06440-04-R for guidance).

C. Examine condition of paint.
   1. If paint has minor cracking or peeling, remove loose paint with a wire brush and putty knife and repaint.
   2. If paint deterioration is extensive:

a. Remove all paint from window (see 06400-07-R and 06400-09-R for guidance).
b. Liberally apply a wood preservative to the wood (see 06310-01-P for guidance). This acts as a primer for the paint.
c. Allow to dry for 24 hours.
d. Apply 2 thin coats of paint and allow to dry (see 06300-01-S, 06300-02-R, and 09900-07-S for guidance).

D. Replace Window Putty:
1. Remove loose or cracked putty using a putty knife.
2. Using a wire brush, remove loose dirt and debris from within the putty channel.
3. Brush exposed areas with linseed oil. This will be absorbed into the wood and prevent the new putty from drying too quickly and cracking.
4. Apply fresh window putty and smooth out with a putty knife.

END OF SECTION

4.9 ELECTRICAL

4.9.1 Electrical Elements

4.9.1.1 Electrical—Light Fixture

NR Rating: 211

Description:

The exterior lighting fixtures are composed of painted metal electrical tubing with bare-bulbs. These fixtures are showing signs of age, mainly small amounts of corrosion, but the fixtures are operable. The fixtures are original to the building so their character should be preserved.

The lighting fixtures show signs of wear and rust, and therefore should be cleaned and areas that are beyond surface cleaning should be replaced in kind.

Treatment Rating 1: PRESERVE.

Statement of Importance:

- The light fixtures are associated with those qualities for which the property was designated historic, and
- the light fixtures are highly distinctive architecturally and date to the World War II period, and
- the level of damage or deterioration is such that it is still feasible to preserve.

Condition: ***Good – Preserve***

Fair to good - Preserve

Poor - Replace

Inventory Quantity and Condition

The light fixture is evaluated as Good when:

- the light fixtures are intact, structurally sound and performing their intended purpose, and
- there are few or no cosmetic imperfections, and
- the metal shows minor signs of wear and rust, and

- the light fixtures need no repair and only minor or routine maintenance.

Minor deficiency of the metal light fixtures exists where:

- Clean rusty portions and repaint in order to prevent future deterioration, and
- replace portions that are beyond surface cleaning, and
- maintain light fixtures so that they remain in correct working condition, and
- standard preventive maintenance practices and building conservation methods have not been followed, and/or
- there is a reduced life expectancy of affected or related building materials and/or systems, and/or
- there is a condition with long-term impact beyond 5 years.

Minor deficiencies can include, but are not limited to: rusting surfaces and wearing finishes.

4.9.2 Maintenance / Management Guidelines

According to *The Secretary of Interior's Standards for Rehabilitation*, the proper procedure is to respect the significance of the original materials and features, repair and retain them wherever possible, and replace them only when absolutely necessary.

The following recommendations for care of the historic electrical fixtures are to be thoroughly read and understood before a treatment is specified. *The Secretary of the Interior's Standards for Rehabilitation* should also be consulted to determine the appropriateness of any treatment.

The following is an excerpt from *The Secretary of the Interior's Standards for Rehabilitation*. Full documentation can be found at http://www2.cr.nps.gov/tps/tax/rhb/stand.htm

4.9.2.1 Identify, Retain, and Preserve

Recommended…

- Identifying, retaining, and preserving visible features of early mechanical systems that are important in defining the overall historic character of the building.
- This may include radiators, vents, fans, grilles, plumbing fixtures, switchplates, and lights.

Not Recommended…

- Removing or radically changing features of mechanical systems that are important in defining the overall historic character of the building so that, as a result, the character is diminished.

4.9.2.2 Protect and Maintain

Recommended…

- Protecting and maintaining mechanical, plumbing, and electrical systems and their features through cyclical cleaning and other appropriate measures.
- Preventing accelerated deterioration of mechanical systems by providing adequate ventilation of attics, crawlspaces, and cellars so that moisture problems are avoided.

- Improving the energy efficiency of existing mechanical systems to help reduce the need for elaborate new equipment. Consideration should be given to installing storm windows, insulating attic crawl space, or adding awnings, if appropriate.

Not Recommended…

- Failing to provide adequate protection of materials on a cyclical basis so that deterioration of mechanical systems and their visible features results.
- Enclosing mechanical systems in areas that are not adequately ventilated so that deterioration of the systems results.
- Installing unnecessary air conditioning or climate control systems which can add excessive moisture to the building. This additional moisture can either condense inside, damaging interior surfaces, or pass through interior walls to the exterior, potentially damaging adjacent materials as it migrates.

4.9.2.3 Repair

Recommended…

- Repairing mechanical systems by augmenting or upgrading system parts, such as installing new pipes and ducts; rewiring; or adding new compressors or boilers.

Not Recommended…

- Replacing a mechanical system or its functional parts when it could be upgraded and retained.

4.9.2.4 Replace

Recommended…

- Replacing in kind--or with compatible substitute material--those visible features of mechanical systems that are either extensively deteriorated or are prototypes such as ceiling fans, switchplates, radiators, grilles, or plumbing fixtures.

Not Recommended…

- Installing a replacement feature that does not convey the same visual appearance.

5.0 MAINTENANCE LOG

DATE	CONTRACTOR INFORMATION	WORK PERFORMED	WEATHER CONDITIONS	PROBLEMS OR COMPLICATIONS	SUPERVISOR SIGNATURE

DATE	CONTRACTOR INFORMATION	WORK PERFORMED	WEATHER CONDITIONS	PROBLEMS OR COMPLICATIONS	SUPERVISOR SIGNATURE

DATE	CONTRACTOR INFORMATION	WORK PERFORMED	WEATHER CONDITIONS	PROBLEMS OR COMPLICATIONS	SUPERVISOR SIGNATURE

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14. ABSTRACT

This report is a record of all maintenance proposed for the Fort Leonard Wood Storehouse (Bldg. 1320). Each individual element section contains further details. The maintenance and management guidelines and procedures follow for site, masonry, metal, wood, roofing, doors and windows, and furnishings. Recommendations for maintenance and management of each particular element should be strictly followed, and work should be logged in the back of this manual (date, weather conditions, supervisor signature, contractor information, work performed, and problems).

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