4.0 EXTERIOR AND INTERIOR WALLS ARTICLES

NOTES

4.1.0 INTRODUCTION

Every reasonable attempt should be made to repair a deteriorated wooden feature or element rather than replace. Existing material should be retained whenever possible.

The first step in any repair procedure is to identify the cause of damage and correct it.

Inspection of wood elements might reveal the following conditions of deterioration requiring repair: Peeling paint, rot, evidence of insects, breakage, excessive wear or the reduction of cross-sectional area resulting in overstressing a structural wood member.

Damage or deterioration of structural load-bearing members should be investigated by a licensed structural engineer familiar with the Secretary of the Interior's Standards for Historic Preservation before determining extent of repair necessary.

4.1.1 TYPICAL REPAIRS

4.1.1.1 Peeling Paint (If wood substrate also shows signs of rot see "rot" section below).

CAUSE

Crack or break in paint membrane, or an open joint allowing rain water to enter wood.

REPAIR

Remove all loosely adhered paint with scraper or wire brush taking care not to gouge or damage wood.
If damp, allow wood substrate to dry thoroughly.
Treat bare wood with a paintable water-repellent preservative.
Caulk open joints, finish flush with surface.
Repaint area with one coat compatible primer and two top coats.

CAUSE

Resin in wood being drawn to surface (particularly on a sunny face) causing a blister to form beneath the paint film. Look for beads of hardened resin on surface.

REPAIR

Remove all loosely adhered paint with scraper or wire brush taking care to not damage wood.
Treat bare wood with a paintable water-repellent preservative.
Seal wood with a suitable sealer.
Repaint area with one coat compatible primer and two top coats.

CAUSE

Fresh coat of latex paint applied on top of a weakly adhered old oil-base coat.

REPAIR

Remove all peeling and loosely adhered paint with scraper or hot air taking care not to damage wood.
Treat bare wood with a paintable water-repellent preservative.
Repaint area with one coat compatible primer and two top coats.

CAUSE

Moisture entering structure from leaking plumbing, failed flashing or leaking roof. Refer to appropriate sections to correct cause before proceeding.

REPAIR

Gently probe affected area with point of small knife blade or ice pick to check for rot. If rot is present see section below.
Remove any peeling or loosely adhered paint by careful scraping and/or hot air.
Allow wood to dry thoroughly.
Treat bare wood with a paintable water-repellent preservative.
Repaint. (See Article on "Paint")

CAUSE

Weatherizing. Adding insulation into frame walls and caulking without a proper vapor barrier leading to condensation/moisture build-up within the wall.

REPAIR

Remove insulation or install adequate vapor barrier on the heated side of insulation. See section on weatherizing.
Gently probe affected area with point of small knife blade or ice pick to check for rot. If present, see section below.
Remove any peeling or loosely adhered paint by careful scraping and/or hot air.
Allow wood to dry thoroughly.
Treat bare wood with a paintable water-repellent preservative.
Repaint. (See Article on "Paint")

4.1.1.2 Evidence of Insects.

If evidence of insect damage is encountered an expert exterminator should be consulted to ensure adequately thorough and safe application of insect control procedures. After the structure and surrounding soils are rid of the destructive insects, repair of the damaged wood can begin.

Hazard is greatest beneath structures without basement.

CAUSE

Termites (subterranean and non-subterranean): Detected by earthen tubes running from ground to the wood, by pellets of excreta outside the wood, by swarming of winged adults in spring, and by presence of shed wings.
Beetles: Detect by small holes normally 1/8" to 1/4" diameter and piles of fine wood dust.
Ants & Bees: Use wood for nests, not food. Look for recurring travels to and from nest.

REPAIR

Consult expert exterminator.
Treat wood with insecticide in penetrating solvent.

Wood damaged by beetles may be repaired by use of penetrating epoxy consolidant.
Heavily damaged sections of a wood member, or the entire member may be replaced with a new member matching original dimensions. Replacement wood should be preservative treated or of a naturally toxic species (redwood or cedar). Preferably match species of original.
Screen openings from flying insects.
Reduce moisture content in wood and adjacent soils.

CAUTION: Gases of fumigants are highly poisonous and may damage some types of metal, fabrics, and paint finishes; remove such items if possible.

4.1.1.3 Reduction of Member Cross Section.

Reduction of a wood members' cross-section can lead to overstressing of structural members and possible failure.

Look for excessive sag or "bouncy-ness" in load bearing members. Consult a licensed structural engineer.

CAUSE
Cutting, notching or drilling wood members in the course of alterations or installation of mechanical, plumbing, or electrical systems.

REPAIR
If intrusive element is removed and remaining cross section of member is adequate in strength, patch or plug void with tight fitting new wood of same species, grain pattern, and texture.
Glue and screw in place.
Countersink and plug screw heads.

REPAIR
If member is overstressed, install steel reinforcement around cut-outs.
If damage is extensive along full length of member, remove and replace with new of same dimensions, grain pattern and texture.
Reroute ducting, pipes, and/or conduit.
Apply water-repellent preservative to any cuts in wood member, particularly if situated in exterior or unheated space.

4.1.1.4 Fungal Rot.

Periodic inspection required with special attention given to sills, plates, timbers bearing on masonry, ends of trusses in roof-eaves, cornices, all joints, and around doors and windows. End grain is most susceptible to damage.

Look for peeling paint, discoloration, staining, presence of fungi.

Gently probe with pick or knifepoint to reveal softness.

Be concerned about damp conditions, possibly resulting from rain, ice, snow, ground water, plumbing leaks, interior condensation.

IDENTIFICATION

Surface Mold - discolors wood and makes surface more porous. When dry the wood is black and scaly.

White Rot - Leaves wood in fibrous, stringy leach condition.

Brown Rot - Leaves wood in brown crumbly appearance. Decayed wood breaks easily across grain. When dry it disintegrates into small chunks much like charcoal.

Dry Rot - Does not require wet wood. Is able to transport water to the wood from other sources through water conducting strands.

CAUSE

Moisture. It is imperative that prior to repairing the damaged wood the source of moisture is identified and corrected. Proper ventilation of wood member is mandatory.

REPAIR (SURFACE MOLDS)

Thoroughly dry wood and brush on a fungicide in penetrating solvent. Treat with paintable preservative prior to painting.

Retain services of professional to drill members and inject Chloropicrin.

CAUTION: Fungicidal preservatives are toxic and can be absorbed through skin. Wear rubber gloves when handling.

REPAIR (MINOR DAMAGE FROM A WET-TYPE FUNGI)

Thoroughly dry wood and keep it dry.

Treat wood with brush-on preservative. Use a paintable preservative if wood is to be painted. See caution above.

Small decayed areas on trim and other architectural elements can be removed and patched with epoxy fillers.*

REPAIR (MODERATE DAMAGE FROM WET-TYPE FUNGI - 40% OF MEMBER OR LESS)

Thoroughly dry wood and keep it dry.

Remove damaged area and dispose of off site.

Treat remaining wood with anti-fungal preservative. See caution above.

Patch removed area with new treated material matching species, grain pattern and texture. All cuts in pre-treated wood must be re-treated. Brush with preservative.

CAUTION: Wear dust mask when cutting treated wood and do not burn scraps.

Set patch in place with epoxy adhesives.*

Reinforce with corrosion resistant steel if additional strength needed and not exposed to view.

REPAIR (MINOR DAMAGE FROM DRY ROT FUNGI)
Thoroughly dry wood and surrounding environment.
Treat affected area and beyond with a penetrating epoxy consolidant.*

REPAIR (MODERATE DAMAGE FROM DRY ROT FUNGI)
Thoroughly dry wood and surrounding environment.
Remove decayed portion and dispose of off site.
Treat surrounding area of remaining wood with a penetrating epoxy consolidant.*
Patch removed area with new treated material matching species, dimensions, grain pattern and texture. All cuts in pre-treated wood must be re-treated. Brush with preservative.

CAUTION: Wear dust mask when cutting treated wood and do not burn scraps.

Set patch in place with epoxy adhesive.*
Reinforce with corrosion resistant steel if additional strength needed and not exposed to view.

REPAIR (SEVERE DAMAGE, ALL TYPES OF FUNGI)
If more than 40% of the member is decayed the entire member should be replaced.
Remove affected wood and dispose of off-site.
Replacement wood and surrounding wood must be treated with anti-fungal preservatives.
Replacement wood member should match original in dimensions, species, grain pattern and texture. Because of long lead considerations special order materials should be stock piled during the planning phase. Every attempt should be made to exactly duplicate unsalvageable pieces.

4.1.1.5 Minor Cracks, Holes, Voids.

CAUSE
Normal checking or splitting of wood with age.
Abandoned nail/screw holes.

REPAIR
Can usually be filled with common window putty and repainted.
Larger voids may require use of epoxy filler.*

4.1.2 MAINTENANCE RECOMMENDATIONS

A. Maintenance of wood primarily requires keeping it free from moisture.

B. Check paint and flashing integrity annually during rain and snow seasons.

C. Repair all areas which may allow water to enter as soon as possible.

D. Attend to insect damage and rot immediately.

E. Use only hot dipped zinc coated nails, bolts when treated wood is involved.

F. Predrill nail noles at ends of boards to reduce splitting.

G. Countersink and putty all nails that are exposed to view.

* NOTES ON USE OF EPOXIES

Epoxies are toxic substances and their use requires specialized safety, formulation and application procedures. Consult a specialist when the use of epoxies is considered. Auto body fillers or latex wood fillers should not be used.

4.2.0 INTRODUCTION

Brick is composed of clays that are formed (molded) in a plastic state and fired in kilns to create a hardened building unit.

Brick may be formed in a wire-cut extrusion process, sand molds, or water lubricated molds. Each process gives a different surface texture to the brick. A variety of colors and textures are present at Fort Lewis.

Brick color results from the particular clays mixed together in the molding process along with the variables associated with firing temperature.

Historic brick is likely to have differences in hardening between the surface and the interior (body) of the brick. The hardness of the exterior surface provides the moisture-resistant properties.

Bricks are bonded together using mortar.

Historic mortar traditionally was a lime-based mortar mixture of lime, sand, and water. These mortars develop very low compressive strengths, take a long time to harden, and have poor durability to the freeze-thaw cycle.

Low compressive strength mortar is most suitable to the softer more porous nature of historic brick. Serious damage may occur to historic brick by using high-strength portland cement based mortars. Mortar used in repointing historic masonry must always be softer than the surrounding brick to prevent breaking-up the existing materials

Many historic mortars have color additives that consist of inorganic compounds (dyes) or increased colored aggregates (sands or pulverized bricks).

4.2.1 TYPICAL REPAIRS

4.2.1.1 REPOINTING

Repointing is necessary when the mortar holding the brickwork together is eroded by weathering or decomposed to the point that it is easily scored or removed by a screwdriver.

Mortar used in repointing should always be softer than the adjacent brick. Mortars with high Portland cement content should not be used.

Evaluation of existing mortar conditions and brick strength at Fort Lewis should be part of a future program. Historic mortar composition should be analyzed.

Repoint to match existing joint.

4.2.1.2 Mortar eroded or weathered from original joint levels. Mortar soft and easily loosened by prodding with a screwdriver.

CAUSE

Deterioration of mortar bond; weathering from wind, rain, and particulates; excessive washing by water from deteriorated gutters or downspouts.

REPAIR

Remove weathered mortar to a minimum depth of 3/4 inches from surface.

Hand chiseling is the preferred method although a few experienced contractors are capable of power techniques for horizontal joint areas.

If the latter method is specified, contract specifications should require proof of experience in dealing with certified historic preservation projects.

Use a high lime mortar mix. ASTM Type K mortar with no more than 1 part Portland cement to 4 parts lime may be used to increase strength and workability if brick-strength analysis indicates that the resulting mix is softer than the brick.

Use sand conforming to ASTM C-144 that matches grain size from original mortar.

Use clean, potable, neutral pH water.

Match color of historic mortar as closely as possible using natural materials (sand color, pulverized brick, etc.) or if necessary mortar pigments.

Always test color by either wetting original or allowing a test sample to dry before repointing.

Repointed joints should reproduce the original joint.

Tuckpointing is a special raised joint requiring particular tools and expertise.

All tuckpointing should be contracted to an experienced professional.

4.2.1.3 BRICK REPLACEMENT

Bricks require replacement if they are seriously deteriorated, are cracked from building movement, vehicular damage, or previous attempts at repair or repointing, or if programmatic requirements require infilling of openings.

Infilling of openings should be a last resort. Other means of security blocking should be considered first.

Replacement brick should match existing brick as closely as possible. This brick may be salvaged from demolished structures, relocated from an area where removal has a minimal effect on the historic character of the building, or obtained from manufacturers that carry reproduction specialty brick.

Relocated brick should be analyzed to ensure durability. Poorer brick was sometimes used for interior walls and may not withstand exterior use.

4.2.1.4 Spalled, cracked, or otherwise damaged brick.

Water damage to interior finishes or structure not caused by poor mortar joints.

CAUSE

Moisture damage from weak or poorly fired brick; moisture damage from heavy paint buildup; improper use of Portland cement mortar.

REPAIR
Work must be done by a skilled mason.
Remove brick by hand chiseling. Ensure that adjacent sound brick is not damaged.
Use replacement bricks that are a close match to original brick in color, texture, size, and hardness.
Soak new brick in neutral pH water before laying.
Stagger new brick into existing sound masonry.

Match new mortar joints to original.

4.2.1.5 Porous outer surface of brick.

CAUSE
Poor quality brick or damage from sandblast cleaning.

REPAIR
Structural engineer should evaluate overall integrity of building.
Replace brick as above if only a small area is affected.
Use of sealants is not recommended except in cases of severe deterioration.
If absolutely necessary and on the advice of a preservation architect, seal surface using a solvent-based sealer manufactured specifically for historic preservation application.

4.2.2 MAINTENANCE RECOMMENDATIONS

4.2.2.1 GENERAL PREVENTATIVE MEASURES

A. Establish an exterior cleaning program on a cycle of 5 to 10 years.

B. Establish an inspection program to identify cracking, spalling, or deteriorating brick and decomposition or weathering of mortar. Inspections should occur on a 5 to 10 year schedule.

C. Interior moisture should be investigated immediately to determine source (roof or brick) and corrective action must be taken immediately to prevent serious deterioration of building fabric.

4.2.2.2 CLEANING

A. Brick surfaces should be cleaned using the gentlest possible method to accomplish the job.

B. Low to medium pressure water cleaning or hand scrubbing are the most preferable methods. Do not use high-pressure washes (600-1800 psi) even though the timesavings appears more cost-effective. They will result in serious deterioration and moisture problems.

C. Chemical cleaning is acceptable under controlled conditions. Do not use caustic soda solutions; do not use ordinary modern detergents.

D. **Never sandblast historic brick.** This removes the hardened outer layer and speeds-up deterioration.

E. Steam cleaning is not an appropriate or cost-effective method.

F. Always test cleaning methods on a small, low-visibility area before starting major work. It may be useful to test several methods (water vs. chemical) to establish the most effective procedure.

G. Follow manufacturers' directions explicitly for all approved cleaning solutions (chemicals or detergents).

H. After initial cleaning, routine maintenance cleaning should occur on a 5-10 year schedule.

4.2.2.3 WATER SPRAYS OR SCRUBBING

A. Make sure that all surfaces to be cleaned are in good condition including both bricks and mortar. If not, repair before cleaning and allow adequate time for compounds or mortar to harden.

B. Remove all plant-growth (lichens, mosses, ivy, etc.) before major cleaning. Plant-growth should be removed using wood scrapers or non-ferrous brushes. Lichens can be killed with a solution of zinc or magnesium silica fluoride (one part to 40 parts water).

C. Cover all openings (doors, windows, etc.) where water might penetrate into the interior.

D. If quantity of water used in cleaning operation is high, use tarpaulins or other coverings at the foundation level to deflect water away from the footings.

E. Water soak surfaces to soften heavy dirt.

F. Use soft-bristle brush and mild detergent for all hand cleaning.

G. Low to moderate mechanical pressure-washing (less than 600 psi with a flow rate of about 4 gallons per minute) may be used for large surfaces following initial soaking.

H. Start water cleaning procedures at the top of the area that is to be cleaned.

I. Clean small areas (no more than 200 square feet at any one time).

J. Perform a final rinse of fresh water if detergents have been used.

K. Do not use water cleaning methods during periods of cold, damp weather. Doing so will increase the chance for water penetration into materials and possibly cause long-term damage.

L. Sometimes, especially after repointing or repair, a white or green chalky coating will appear on a brick surface. This efflorescence is caused by salts leaching out of bricks or mortar. Dry-brush using stiff natural or nylon bristle brushes. If necessary, continue brushing using a neutral pH water. If efflorescence is green, brush on a solution of sodium hydroxide (12 ounces per quart of water) and allow to dry as a white salt deposit. Wash with clean water 3 to 4 days later. Do not subject to hydrochloric (muriatic) acid cleaning.

4.2.2.4 CHEMICAL CLEANING

A. Use of chemical cleaning requires consultation with an architect or person experienced with chemical cleaning of historic buildings.

B. Make sure that all surfaces to be cleaned are in good repair. Newly repointed mortar should cure for 30 days before any chemical cleaning.

C. Budget for and conduct a test in a weathered, low visibility area prior to major cleaning effort. Allow at least 6 months to evaluate chemical effects.

D. Protect all other surfaces adjacent to cleaning area particularly stone foundations. Acids will etch glass, kill plants, or ruin paint surfaces.

E. Brick chemical cleaning should use an acidic solution. No more than a 5% solution of phosphoric or hydrofluoric acid should be used. Muriatic (hydrochloric) acid is not recommended.

F. Use only soft natural bristle brushes for scrubbing.

G. Rinse with water.

4.2.2.5 PAINT REMOVAL

A. Paint removal is difficult at best and original paint may be protecting weak or porous brick.

B. Remove paint using commercially available alkaline organic paint removers (but not 100% lye). Rinse repeatedly with water.

C. Protect all plantings from residues rinsed from the painted surface.

D. Make sure that workers wear protective clothing.

4.2.2.6 STAIN REMOVAL

A. Copper and bronze stains may be removed using the following formula. Mix dry one part ammonium chloride (or sal ammonia water) and four parts powdered talc. Add ammonia water and stir until a thick paste is obtained. Using wood or non-metallic tools, apply to stain and let dry. Brush when dry and reapply until stain is removed. Flush well with water when finished.

B. Iron stains may be removed by application of a solution of oxalic acid in water (one pound per gallon) or a solution of seven parts lime-free glycerine, one part sodium citrate, and six parts warm water with whiting or kisel for thickening. Let dry, brush, and rinse thoroughly with water.

C. Lichens or moss can be killed with a solution of zinc or magnesium silica fluoride (1 part to 40) or commercial herbicides and cleaned following standard cleaning methods as discussed above.

D. Oil and tar stains may be removed by commercially available emulsifying agents or kerosene. If stubborn discoloration persists, use a poultice of benzene, naptha, or trichlorethylene. Work only in small amounts and provide protection to workers and soils to prevent injury or contamination.

4.2.3 COMMENTS

Repointing and brick repair should be done by an experienced mason through a contracting operation.

Specifications for contracted work shall require compliance with "Preservation Briefs" documents, produced by the Technical Preservation Services Division, available from the U. S. Government Printing Office.

Chemical cleaning should be contracted to an experienced firm.

Pure water cleaning may be done by self-help or general contract under the direct supervision of an experienced professional.

4.3.0 INTRODUCTION

Stucco is a combination of Portland cement, lime, sand and water. It is usually applied in three coats to wire mesh, wood lath, or a roughened substrate such as masonry or stone. It is now available in pre-mixed packages.

The first stucco coat is called a scratch coat. It is applied 3/8" thick, and is cross-hatched to provide a key for the second coat. It must be applied over lath or mesh furred out 1/4" min. or over roughened, moist, clean concrete or masonry. Force must be applied to ensure bonding.

The second coat is called the brown coat. It is also approximately 3/8" thick and must be true and even. It is applied over the moistened scratch coat, is damp cured for two days and air dried for seven days.

The last coat, called the finish coat, is applied over the moistened brown coat and can be applied and textured in a variety of ways. To match existing textures, experiment with sponges, brushes, trowels, carpet pieces, burlap, wood blocks, carwash mitts, rubber gloves, etc. Keep damp for two days and air dry for seven. Existing stucco finishes may require the use of experienced craftsmen to replicate the existing rusticated texture.

All flashing or other metals used shall be non-corrosive or rusting will occur. Many vinyl products are available for use with stucco.

Stucco is best applied on an overcast day. Keep a hose handy to mist surface frequently to prevent premature drying.

4.3.1 TYPICAL REPAIRS

4.3.1.1. Stucco is broken, chipped or loose from lath.

CAUSE
Impact, stress, deterioration, water.

REPAIR
A repair mix must have a slight amount of lime added for plasticity, unless a plasticizer has already been added by the mix manufacturer.
Cut edges of loose and broken area with a chisel to create straight, undercut edges. Remove from entire spongy area.
Remove all rusted metal lath, if any, and install new metal lath, or clean, roughen and moisten substrate if masonry.
A bonding agent is necessary. Apply to all existing surfaces.
Apply stucco in three coats and finish to match existing. Paint when cured (10 days).
Do not feather new stucco over old.

4.3.1.2 Minor cracking, but stucco sounds solid when tapped.

CAUSE
Shrinkage or settlement.

REPAIR
Force flexible caulking compound into crack, removing excess.
Do not feather over stucco.
Match color as closely as possible.

4.3.2 MAINTENANCE RECOMMENDATIONS

A. Stucco tends to harden with age and should require little maintenance.

B. Stucco should be protected with either paint or a clear waterproofing agent. A paint finish is charactistic of this base.

C. Avoid impact to stucco finishes. Once cracking or chipping has occurred, water penetration is inevitable and stucco may begin to separate from substrate.

D. Keeping plumbing leaks repaired, gutters clean and site drainage controlled will prolong the life of stucco.

DRESSED STONE 4.4

4.4.0 INTRODUCTION

Dressed stone is used at Fort Lewis for window sills, entry portals, steps, parapet copings, quoining, water table trim, columns and decorative ornamentation.

The stone types most commonly used as building elements are granite, limestone and sandstone. Granite is the hardest type of igneous rock. Limestone and sandstone are both softer sedimentary rock. Determination of the types of stone used at Fort Lewis is beyond the scope of this text.

Stone on this base may have come from the quarries in Oregon or from Chuckanut, Wilkeson or Tenino in Washington. Some northwest stone quarries are still in operation.

Dressed stone refers to stone which has been quarried; then worked to a desired shape, ground smooth and prepared for installation.

Stone deterioration is usually due to physical, chemical or biological problems. Physical problems include heat, capillary forces and structure settlement. Chemical causes include pollutants and mineral dissolution. Biological problems may include vines, mosses, bird droppings and human vandalism.

Stone is more subject to deterioration in coastal areas due to airborne chloride ions, salts and sulphates.

4.4.1 TYPICAL REPAIRS

4.4.1.1 Stone is soiled.

CAUSE
Pollution, runoff, vegetation.

REPAIR
Remove moss with a natural bristle brush or wooden spatula.
Stone may be scrubbed with water and a natural bristle brush or nylon scouring pad. Detergent may be used if rinsed thoroughly.
Stone may be pressure washed using a spray not exceeding 500 psi.
Severe stains may be removed by use of a poultice, troweled on, left to dry and then removed. This can be made from detergent, fuller's earth or hydrated lime mixed with chalk and water.
Commercial cleaners are available. Always do a test area and dilute properly.

4.4.1.2 Stone has broken away and pieces are missing.

CAUSE
Impact, frost, deterioration, spalling.

REPAIR
Missing areas may be filled with a patching mortar compound.

Plan patching operation two months in advance since test mixes will be necessary.
Make a small test mix of:
1 part white portland cement
1 part lime
3 parts stone dust (from pulverized remnants or quarry)
Make several more test mixes varying the amount of cement and stone dust. Substitute gray portland cement in some tests.
Scrape tests with chisel to verify hardness. Select recipe with closest hardness and color match.
Clean stone, undercutting voids 30° for adhesion.
Drill sound stone with 3/8" holes to accommodate reinforcing rod. Clean again.
Form reinforcing framework with 1/2" threaded stainless steel rod and heavy gauge stainless steel wire.
Mix mortar.
Mix bonding agent.
Wet stone and apply bonding agent with brush.
Install formwork if necessary to support patch.
Place mortar in 1" fills, compact and let sit several hours. (Base coats may be made using sand instead of stone dust.)
Do not allow base coats to completely dry out.
Roughen last base coat; leave 1/2" for finish coat.
Apply finish coat and trowel smooth. Do not feather edges over existing stone.
Keep damp.
Remove forms after 3 hours.
Fill any voids or bubbles.
Hand sculpt to final form.
Brush lightly with water if a roughened texture is required to match existing.

4.4.1.3 Caulk is brittle or missing.

CAUSE
Age.

REPAIR
Remove all hard or dry caulking, clean joint and replace.

4.4.2 MAINTENANCE RECOMMENDATIONS

A. Air pollution chemicals and residue are the primary cause of stone weakening.

B. As stone weakens, it becomes more porous and tends to absorb moisture. This moisture carries additional soil thus hastening the softening process. As stone softens it becomes susceptible to erosion.

C. It is important therefore to periodically clean stone and to keep it free of soil and moss.

D. The application of a commercial stone strengthener such as manufactured by ProSoCo might be considered within the next ten years to prevent further softening, increased porosity and erosion of soft stone at Fort Lewis.

E. **Never completely coat historic stone with silicones, paraffins, epoxies or urethanes.** These waterproofers trap moisture and can cause peeling of the stone surface.

F. **Never sandblast stone.**

G. Always do a test patch if using a chemical cleaner.

NOTES

EXTERIOR PAINT 4.5

4.5.0 INTRODUCTION

Paint is a primary means of protecting the building envelope from the damaging effects of weather and moisture. It is also the most common interior finish providing a protecting, washable surface.

4.5.1 PAINT INGREDIENTS

Paint ingredients can be divided into pigments, binders and thinners.

Pigments are produced from a variety of sources, some ancient, some very new. Titanium dioxide is the most common hiding pigment.

A large percentage of pigment results in better hiding capability, thus better coverage.

Binders are either organic solvents (alkyd) or water borne (latex). Organic solvents are usually alkyd resins or linseed oil. Water borne binders consist of a latex, usually polyvinyl acetate or acrylic resin, emulsified in water.

A better quality paint should have a large percentage of binder.

Both latex and oil base paints are acceptable for exterior use.

Latex paints are more convenient, due to ease of clean-up, can be applied in damp weather, have a more rapid drying time, and are more vapor permeable and flexible. Latex paint is recommended for use on most materials at Fort Lewis. A coat of latex paint may pull away from old oil paint due to differences in flexibility.

Use only latex paint on masonry.

Oil base paints have a longer drying time which may create a better bond. They are safest to use over old oil base paints, however it is predicted that their availability will be limited in the future, thus a transition to latex may be inevitable. Oil base paints require that the surface be completely dry prior to application.

Oil base paints are recommended on ferrous metals.

Oil base primers are recommended on new or stripped wood.

A glossy or semi gloss surface will weather better and be easier to clean.

A flat finish will hide mars and uneven surfaces better.

It is safest to use primers and paints made by the same manufacturer. Avoid **"heavy bodied stains".** They do not contain enough pigment to protect from ultra-violet degradation.

4.5.2 APPLICATION AND PREPARATION

Application technique and preparation are more important than the type of paint.

Do not apply paint in direct sun or on hot surfaces or blistering will occur. Painting should be timed so that facade is in the shade. Paints must be applied between 50^{O}F and 95^{O}F. Exterior work should be done when wood is dry, between late spring and fall.

Vines should be removed or held away from surface.

Prune shrubbery touching building or dropping debris into gutter. Cover plant material adjacent to paint work. The use of drop cloths during scraping and stripping will make clean-up easier.

Surface preparation work must include cleaning, repairing and paint removal where necessary. Cleaning is best accomplished with a natural bristle brush and detergent solution. Rinse thoroughly. A low pressure (400 psi) water wash may be adequate to remove surface soil. A higher pressure is not recommended as water may be forced into cracks and cavities. Sand and dust all glossy areas.

Repair all cracks, deterioration and moisture problems before painting. Verify that flashing is adequate, that columns are vented, and that gutters are leakproof. Pay particular attention to soffits and window sills. Caulk all cracks, trim and junctions with latex caulk. Set and fill all protruding nail heads. Remove and clean all hardware. Do not paint hardware.

Prime new or stripped surfaces, using alkyd base primer on wood and rust inhibiting primer on ferrous metal.

4.5.3 PAINT REMOVAL

Technical Preservation Services of the National Park Service has grouped exterior painted surface conditions into three groups:

Class 1 **Conditions Generally Requiring No Paint Removal**

Class 2 **Conditions Generally Requiring Limited Paint Removal**

Class 3 **Conditions Generally Requiring Total Paint Removal**

These three conditions are discussed more later.

Paint removal may be accomplished by abrasion, by heat and by chemicals. Abrasion, usually scraping and sanding, is the safest method. Work should be done parallel to grain, with a putty knife or paint scraper. Round edges of tools to avoid gouging wood. Always wear goggles. Use rotary wire strippers on heavy cast metal only.

Never sandblast wood or masonry. Do not use rotary disk sanders on wood.

Use of a heat plate, combined with scraping tools is very successful on flat surfaces. A heat gun may be used on solid turned or carved members, but may ignite dust in hollow members. Keep heat gun temperature below 700^{O} to avoid toxic gas from lead paint. Always keep a fire extinguisher within reach when using heat to remove paint. If wood becomes charred, sand off all surface charring. Prime with product not containing zinc oxide. Never use propane torches.

Chemical stripping has several drawbacks: toxic waste, expense, mess, and effects on substrate. However, chemical stripping is very useful for carved ornament and window mullions. A methylene chloride product is the safest to use. Use of a "water rinseable" or lye type is discouraged. Neutralize according to manufacturer's recommendations or new paint will not adhere due to stripping chemicals still absorbed in the wood. Put waste in a covered can. A solution of one part trisodium phosphate to 5 parts water may remove paint from masonry. Let soften, wash with soapy water and rinse with clean water.

Always leave an inconspicuous area unstripped for future historians. Identify and cover with a non-corrosive plate.

4.5.4 PAINTING

Paint the body first, then trim. **Paint the entire trim element. Do not paint just the face.** Apply two coats to horizontal surfaces, applying a water repellent preservative first if members are new or have been stripped. Brushing accomplishes the best adhesion. Do not apply paint too thick or over damp primer or it will wrinkle.

An inspection and warrantee service is available through Specification Services, 27606 Pacific Highway South, Kent, Washington 98032 (206) 941-8823). Fees are approximately 4% of painting subcontract ($600.00 min.).

4.5.5 TYPICAL REPAIRS

CLASS I CONDITIONS GENERALLY REQUIRING NO PAINT REMOVAL

4.5.5.1 Dirt, Soot, Cobwebs, Cocoons, etc.

CAUSE
Environment, Insects

REPAIR
All soil must be removed prior to repainting. If not removed, surface deposits will prevent paint adhesion.
Loosen with strong spray of garden hose.
Scrub remaining soil using a diluted laundry detergent solution and a medium natural bristle brush.
Rinse thoroughly.

4.5.5.2 Mildew (Test: mildew turns white when bleach is dripped on surface).

CAUSE
Moisture, Lack of Sunshine.

REPAIR
Prune to open up shrubbery. Correct all water problems.
Remove mildew with a solution of 3 quarts warm water, 1 quart bleach, 2/3 cup t.s.p. or borax, 1/2 cup detergent.
Scrub with natural bristle brush, hose off, dry completely.

4.5.5.3 Chalking.

CAUSE
Loss of resin, excessive pigment.

REPAIR
Scrub with 1/2 cup detergent in 1 gallon water.
Rinse and dry.

4.5.5.4 Rust Stains.

CAUSE
Moisture

REPAIR
Remove rust, sand element, prime with rust inhibitive primer, touch-up with two coats finish paint.
Sand nail heads, prime, set, fill, sand and touch-up with two coats finish paint.

4.5.6 TYPICAL REPAIRS
CLASS II CONDITIONS GENERALLY REQUIRING LIMITED PAINT REMOVAL

4.5.6.1 Surface Graying.

CAUSE
Aged, inflexible paint layers.

REPAIR
Sand the surface to sound paint, clean and repaint.

4.5.6.2 Intercoat Peeling.

CAUSE
Poor surface preparation or paint layers having different elasticity.

REPAIR
Remove peeled paint by scraping and sanding, clean exposed surface.
When dry, prime with oil-based primer and repaint.

4.5.6.3 Solvent Blistering.

CAUSE
Application in direct sunlight

REPAIR
Scrape, sand, clean and repaint.

4.5.6.4 Wrinkling.

CAUSE
Paint application too thick.
Second coat applied before first is dry.
Application in high temperatures.
Inadequate brushing out.

REPAIR
Scrape, sand, repaint.

4.5.7 TYPICAL REPAIRS
CLASS III CONDITIONS GENERALLY REQUIRING TOTAL PAINT REMOVAL

4.5.7.1 Peeling or Blistering to Bare Wood.

CAUSE
Moisture

REPAIR
Repair cause of moisture: ventilate rooms, vent columns, repair gutters, recaulk, reflash.
Allow wood to dry.
Repair deteriorated wood, see Article on "Wood".
Remove paint to bare wood, sand, prime, repaint.

4.5.7.2 Cracking, Alligatoring.

CAUSE
An untreated crazed condition has allowed moisture to penetrate finish.

REPAIR
Scrape to next sound layer, sand, clean and repaint.
If cracking extends to bare wood: Remove paint to bare wood, sand, prime, repaint.

NOTES

INTERIOR PAINT 4.6

4.6.0 INTRODUCTION

Paint is a primary means of protecting the building envelope from the damaging effects of weather and moisture. It is also the most common interior finish providing a protecting, washable surface.

There is evidence that some interior millwork was varnished or shellacked.

4.6.1 PAINT INGREDIENTS

Paint ingredients can be divided into pigments, binders and thinners.

Pigments are produced from a variety of sources, some ancient, some very new. Titanium dioxide is the most common hiding pigment.

A large percentage of pigment results in better hiding capability, thus better coverage.

Binders are either organic solvents (alkyd) or water borne (latex). Organic solvents are usually alkyd resins or linseed oil. Water borne binders consist of a latex, usually polyvinyl acetate or acrylic resin, emulsified in water.

A better quality paint should have a large percentage of binder.

Both latex and oil base paints are acceptable for interior use. Latex paints are more convenient, due to ease of clean-up and have a more rapid drying time. A coat of latex paint may pull away from old oil paint due to differences in flexibility.

Oil base paints have a longer drying time which may create a better bond. They are safest to use over old oil base paints, however it is predicted that their availability will be limited in the future, thus a transition to latex may be inevitable. Oil base paints require that the surface be completely dry prior to application.

Oil base paints are recommended on ferrous metals.

Oil base primers are recommended on new or stripped wood.

A glossy or semi gloss surface will be easier to clean.

A flat finish will hide mars and uneven surfaces better.

It is safest to use primers and paints made by the same manufacturer.

4.6.2 APPLICATION AND PREPARATION

Application technique and preparation are more important than the type of paint.

Surface preparation work must include cleaning, repairing and paint removal where necessary. Rinse thoroughly. Sand and dust all glossy areas.

Repair all cracks, deterioration and damage before painting. Sand spackling compound and prime. Set and fill all protruding nail heads. Remove and clean all hardware. Do not paint hardware.

Prime new or stripped surfaces, using alkyd base primer on wood, rust inhibiting primer on ferrous metal, latex primer on new gypsum board and an alkali-proof alkyd sealer on new plaster.

4.6.3 PAINT REMOVAL

Paint removal may be accomplished by abrasion, by heat and by chemicals. Abrasion, usually scraping and sanding, is the safest method. Work should be done parallel to grain, with a putty knife or paint scraper. Round edges of tools to avoid gouging wood. Always wear goggles. Use rotary wire strippers on heavy cast metal only.

Never sandblast wood or masonry. Do not use rotary disk sanders on wood.

Use of a heat plate, combined with scraping tools is very successful on flat surfaces. A heat gun may be used on solid turned or carved members, but may ignite dust in hollow members. Keep heat gun temperature below 700^0 to avoid toxic gas from lead paint. Always keep a fire extinguisher within reach when using heat to remove paint. If wood becomes charred, sand off all surface charring. Prime with product not containing zinc oxide. Never use propane torches.

Chemical stripping has several drawbacks: toxic waste, expense, mess, and effects on substrate. However, chemical stripping is very useful for carved ornament and window mullions. A methylene chloride product is the safest to use. Use of a "water rinseable" or lye type is discouraged. Neutralize according to manufacturer's recommendations or new paint will not adhere due to stripping chemicals still absorbed in the wood. Put waste in a covered can. Denatured alcohol will strip clear finished wood if finish was shellac. A solution of one part trisodium phosphate to 5 parts water may remove paint from masonry. Let soften, wash with soapy water and rinse with clean water.

Always leave an inconspicuous area unstripped for future historians. Identify and cover with a non-corrosive plate.

4.6.4 PAINTING

Paint the wall first, then trim. **Paint the entire trim element. Do not paint just the face.** Apply two coats to horizontal surfaces. Brushing accomplishes the best adhesion. Do not apply paint too thick or over damp primer or it will wrinkle.

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4.6.5 TYPICAL REPAIRS

4.6.5.1 Intercoat Peeling.

CAUSE
Poor surface preparation or paint layers having different elasticity.

REPAIR
Remove peeled paint by scraping and sanding, clean exposed surface. When dry, prime with oil-based primer and repaint.

4.6.5.2 Wrinkling.

CAUSE
Paint application too thick.
Second coat applied before first is dry.
Inadequate brushing out.

REPAIR
Scrape, sand, repaint.

4.6.5.3 Peeling or Blistering to Bare Wood.

CAUSE
Moisture or excessive build up.

REPAIR
Remove paint to bare wood, sand, prime, repaint.

NOTES

4.7.0 INTRODUCTION

Plaster wall systems generally include a lath base or metal screening, which keys (locks) the plaster to the wall, several coarse scratch coats, and a fine finish coat. In some cases, plaster is applied directly to masonry or concrete surfaces.

Plaster types used at Fort Lewis should be analyzed as part of a future program if interior plaster repair is anticipated.

Original plaster surfaces should be maintained in major public spaces such as entry foyers; severely deteriorated plaster in these areas should be repaired by replastering. Seriously deteriorated plaster in less accessible areas may be replaced using a sheetrock system. In the latter case, care should be taken to maintain the original surface thickness as closely as possible. Step ceiling cove molding should be carefully detailed and new baseboard should be the same width as the original design.

Both lime and gypsum plasters are susceptible to the effects of moisture and chemical actions common to masonry; they are also brittle in their finished state and subject to cracking from building settlement and mechanical damage. They will last indefinitely if properly maintained and repaired.

Large plaster jobs or skim surface coats are best done by a professional plasterer.

4.7.1 TYPICAL REPAIRS

4.7.1.1 GENERAL

Plaster failure generally results from either moisture conditions or movement of the building.

Major building settlement either at foundations or from sagging joists can cause the lath key to break. This allows separation from the lath and buckling or cracking in the plaster.

In many cases, particularly if keying has been damaged, it is better to resurface a large area than to try to patch obvious cracks. Attempts at spot correction are usually more costly and less satisfactory than removing the plaster and installing a new plaster (or in some cases sheetrock) system.

4.7.1.2 Efflorescence (white powdery fluff on surface of plaster).

CAUSE

Moisture penetrating plaster layer from interior wall cavity. May be a result of leaking plumbing, leaking roof, or poorly maintained or deteriorated gutter systems.

REPAIR

Make sure that the cause of the moisture has been remedied.

Remove all surface deposits on the plaster with a dry bristle brush, and wipe all affected areas with a damp cloth.

Allow to dry and repaint surface.

4.7.1.3 Hairline or check cracks in plaster surface (sometimes not evident if paint surface has not cracked).

CAUSE

General differential shrinkage of plaster material or limited settling of the substrate.

REPAIR

Chip away dry chips where finish coat has separated from basecoats.

Bevel the edges of the finish plaster around the perimeter of each area and drybrush all surfaces.

Apply a bonding agent to the exposed basecoat and the edges of the cut area.

Allow agent to dry thoroughly following manufacturer's recommendations.

Apply a finish coat of patching plaster, pressing tightly against the backing coat to make a good bond.

Immediately apply a second coat to bring area up to the level of the undisturbed finish coat.

When the patch has stiffened, imperfections or trowel marks may be removed by light trowel pressure.

Water trowel the surface if a dense polished finish is required, or float the surface for a textured finish.

Finish should match the original adjacent surface.

4.7.1.4 Large cracks or unkeyed and buckled areas.

CAUSE

Most often this is a result of sagging or shifts in the major structural systems.

Make sure that the system is sound and stabilized before effecting repairs.

REPAIR

Before beginning corrective measures, cut the plaster in the area of one crack through its entire thickness to the backing material.

Verify the condition of the backing material and establish the type and thickness of the original plaster.

Rake and undercut the plaster for its full thickness making the cut sufficiently wide (at least double the width for cracks).

Drybrush all loose plaster from the area.

Mix and apply basecoats of patching plaster.

For masonry backing, apply double backing coats of scratch and browncoat layers composed of one cubic foot of sand to 100 pounds of wood-fibered gypsum plaster.

True surface, but leave rough to accept finish coat.

Press all scratch coats firmly to make sure that the material will form good keys on the backside.

Apply a finish coat of either a lime-putty gypsum trowel finish or, if the surface is extremely hard, a Keene's cement-lime putty mix.

Apply finish coat to a partially dry basecoat or to a thoroughly dry basecoat that has been evenly wetted with a light water spray.
Water should not be excessive.

4.7.2 MAINTENANCE

A. General maintenance to sound plaster is relatively minimal. Surfaces should be kept painted and clean, and any evident moisture problems should be corrected immediately.

NOTES