National Forest Foundation

Building 27, Suite 3, Fort Missoula Road
Missoula, Montana 59804
TEL 406.542.2805
NATIONALFORESTS.ORG

Palisade Wall and Alpine Tunnel Reconstruction

Statement of Work and Request for Proposals

Gunnison National Forest, Colorado

Background and Statement of Work: The National Forest Foundation (NFF) in partnership with the Gunnison Ranger District of the Grand Mesa, Uncompahgre & Gunnison (GMUG) National Forests are reconstructing the historic Alpine Tunnel Road and Palisades Wall after significant damage from a 2016 avalanche. The Alpine Tunnel is a National Historic District consisting of a two-hundred-foot-wide right-of-way along a ten-mile stretch of the original Denver, South Park, and Pacific rail bed, between the townsite of Quartz and the Alpine Tunnel Station Complex.

This Request for Proposals (RFP) is for historic rock masonry services related to the reconstruction of an approximately 100-foot section of the Palisades Wall and Alpine Tunnel Road above the wall failure. All work must be completed according to designs and align with the Secretary of Interior's Standards for Rehabilitation. This project is prioritized through the U.S. Department of Agriculture's list of deferred maintenance projects for Great American Outdoors Act funding.

The "Alpine Tunnel Historic District" was added to the National Register of Historic Places in 1996 due to its significance as North America's highest and longest narrow gauge railroad tunnel and was the first railroad tunnel of any type to cross the Continental Divide. Since becoming an Off-Highway Vehicle (OHV) road in the 1950s, the Alpine Tunnel Road has been the primary attraction for people from all over the country wishing to view the historic railroad route and its magnificent high-elevation engineering. The avalanche and related rockfall damage caused a 14' wide x 50' long x 15' deep hole in the Alpine Tunnel Road and Palisades Wall. In the summer of 2022, rock scaling crews were deployed to remove additional loose rock and reduce the risk of additional large rockfall above the wall and road prior to reconstruction.

Information Requested

If interested in this project, please provide a bid for the description of work and specifications below by providing a proposal that includes an approach, a proposed timeline/work schedule, work experience, and cost. Please also include your capacity for this project and efficiency in historic rock masonry projects in the past, if any.

This is a request for proposals only and bids furnished are not offers. This request does not commit the NFF to pay any costs incurred in the preparation or the submission of the proposal or to contract for supplies or services.

General Specifications

(a) Description of Work – This RFP is for services related to the Palisade Wall and Alpine Tunnel Road reconstruction including the following:

1. Rebuild historic dry stack stone wall:

    i. Salvage old stones, find new stones, tooling, and preparation of new stones, stockpile stones for rebuilding.
    ii. Stone removal and resetting perimeter of collapsed zones.
    iii. Dry stack retaining wall reconstruction.

2. Roadway restoration:
    i. Roadway excavation.
    ii. Roadway reconstruction, including installation of drainage base layers and installing Mechanically Stabilized Earth (MSE) with geosynthetic fabric, road base surfaces, and compaction.
    iii. Drainage ditch installation, including clay liner waterproofing, rock liner, and cross-slope rolling dip drainage with rip rap.

3. Traffic control:
    i. Signage
    ii. Traffic control includes a road closure below the work area during activities with potential safety impact. The GMUG and NFF are unable to provide traffic control support. Traffic control must be fully staffed by the selected contractor.

The Contractor shall identify which efforts and materials they can supply in terms of materials, labor, equipment, supplies, supervision, quality control, and incidentals required to complete the work described. The Contractor shall perform all work in a safe and conscientious manner.

(b) Project Location - To get to the project site from Gunnison, Colorado drive east on Hwy 50 to the intersection of Hwy 76 and head toward Ohio City. Continue on Hwy 76 to the Town of Pitkin and Forest Road #765 (Cumberland Pass Road) for 3 miles to Forest Road #839. Turn right on Forest Road #839 and the drive will take you along the Alpine Tunnel Road, to the Palisades Wall. See Google Map HERE.

Accessing the site from the east side of the Continental Divide (Towns of Salida or Buena Vista) is not recommended unless in a high-clearance, 4x4 vehicle or Off-Highway Vehicle. The project location is 11,200 feet in elevation and is only accessible in the summer.

(c) Work Schedule - The field season at this project location, on average, is mid-June to mid-October depending on when the snow melts from the site or it snows enough to limit access. A two-year project schedule is expected. The contractor may propose a one-year schedule at their discretion.

1. Provide estimated time to project completion (excluding weather delays)
    Year 1: ______ weeks
    Year 2: ______ weeks

Upon selection of a contractor, a work plan including approach and timeline with a separate traffic control plan will need to be submitted for approval prior to mobilization.

Pricing Schedule

The contractor shall price work according to the schedule below. Prevailing wages are required per conditions of funding sources.

Item	Scope of Work Item	Detail / Section References	Est'd Qty.	Unit Cost	Total
A	**Base Bid 1 – Dry Stack Stone Wall**				
1	Stone materials: salvage, new stones, tooling and preparation, stockpile for rebuilding	Drawings G-02 Spec. Section 705.3	1900 cf		
2	Stone removal and resetting at perimeter of collapsed zones	Drawings S-02, 1/ S-03 Spec. Section 620	1700 cf		
3	Dry stack retaining wall reconstruction	Drawings S-02, 2/ S-03 Spec. Section 620	1600 cf		
4	***Total Cost - Items A1 thru A3***				
B	**Base Bid 2 – Roadway Restoration**				
1	Roadway excavation	Drawings 1/S-01, 2/R-01 Spec. Section 200	15000 cf		
2	Roadway reconstruction, including installation of drainage base layers, Mechanically Stabilized Earth (MSE) with geosynthetic fabric, road base surfaces, and compaction	Drawings 1/S-01, S-06, 2/R-01 Spec. Section 255, 300	19000 cf		
3	Drainage ditch installation, including clay liner waterproofing, rock liner, cross-slope rolling dip drainage with rip-rap	Drawings 1/S-01, R-01 Spec. Sections 207, 250, 300	300 lf		
4	***Total Cost - Items B1 thru B3***				
C	**Base Bid 3 – Traffic Control**				
1	Signage	General Notes Spec. Section 156, 635	ls		
2	Traffic control: road closure below work area during activities with potential safety impact	General Notes Spec. Section 156, 635	ls		
3	***Total Cost - Items C1 thru C2***				
D	**Special Conditions**				
1	Mobilization				
2	Demobilization				
3	***Total Cost of Special Conditions - Items D1 thru D2***				
E	**Optional Bid Items**				
1	Alternate 1 – Provide 30 additional stone wall caps per design	Drawings 1/ S-05 Spec. Section 620	30 ea		

Item	Scope of Work Item	Detail / Section References	Est'd Qty.	Unit Cost	Total
2	Alternate 2 – Upper retaining walls: provide and set missing stone wall caps	Drawings S-04 Spec. Section 620	210 lf		
3	Alternate 3 – dry stack stone wall rebuilding at upper 7 retaining walls	Drawings S-04 Spec. Section 620	500 cf		
4	Alternate 4 – Rebuild breast wall near collapse	Drawings 2/S-05 Spec. Section 620	12 sf		
5	Alternate 5 – Rebuild breast wall down road from collapse	Drawings 3/S-05 Spec. Section 620	20 sf		
6	***Total Cost – Optional Bid Items E1 thru E5***				

BASE BID 1 –3 & SPECIAL CONDITIONS TOTAL	
OPTIONAL BID ITEMS TOTAL	
OPTIONAL PROJECT ADMINISTRATION AND OVERHEAD *Please describe if this is percentage of total cost, lump sum, or another calculation.*	
PROJECT TOTAL	

The Pricing Schedule is a general listing of Scope of Work items and may not be fully inclusive of the specified Scope of Work. It is the Contractor's responsibility to separately enumerate any and all Scope of Work items that are excluded from their Bid. All work items, including optional bid items, will be awarded at the discretion of the NFF, as budgetary obligations allow.

Other Project Requirements and Specifications

(a) Utilities –There will be no sanitation, water, electrical or housing services available. The Contractor shall make its own arrangements for temporary facilities. Camping may be available on a limited basis. Contractors are encouraged to coordinate with the NFF and GMUG National Forest staff to identify camping options if they wish to camp on-site, or near the site, while implementing the project. Note that running water and restroom facilities are not provided, so contractors will need to arrange for their own porta-potties, water tanks, etc. as needed.

(b) Preparatory Meeting - Prior to commencing any work on the reconstruction, the Contractor, including all field personnel to be involved in construction, shall meet with the NFF to review the Traffic Control Plan, reconstruction plans and specifications, work plans, and submittals. Contractor may need to revise plans and procedures to secure approval. Reconstruction may commence upon approval of the work plan and procedures.

(c) Specifications – Project work shall be accomplished in accordance with the following:

a. Appendix A - Construction Drawings

   Please note: These drawings are currently being reviewed for approval by the State Historical Preservation Office (SHPO). We do not anticipate significant changes. If there are any changes required from SHPO, NFF will send correspondence.

b. Appendix B - Project Manual

c. Appendix C – Secretary of Interior's Standards for Rehabilitation
d. Appendix D – GMUG Roadway Maintenance Forest Service Supplemental Specifications

Contractor Qualifications

(a) References – Please provide three references.

(b) Past Experience – Please provide a brief explanation of previous work experience with land management agencies and historic rock masonry.

Virtual Q&A Meeting

The NFF and GMUG staff will host a virtual meeting on Tuesday, April 11 at 9:00 am MST to answer any questions contractors may have about the scope of work. Please RSVP by noon on Monday, April 10 and the NFF Point of Contact will provide the virtual Microsoft Teams meeting link.

Insurance Requirements

Upon selection of the winning bid, chosen contractor will be asked to affirm that it has and shall maintain State minimum workers' compensation insurance coverage for its employees, if any. The selected contractor shall also maintain broad form general liability, property damage, and automotive liability insurance in the minimum amount of $1,000,000 for bodily injury, death, or damage to property of any person and $2,000,000 for bodily injury, death, or damage to property of more than one person. The Contractor shall name NFF an Additional Named Insured and provide NFF with documentation evidencing such coverages.

Performance Security

Chosen contractor shall post cash, a letter of credit, bond, or other financial security that is easily convertible into cash in a form acceptable to the NFF in its sole determination in the amount of 5% of the amount due to contractor, not to exceed $250,000 dollars, to assure completion of the work required under this Agreement and payment of all amounts lawfully due to all persons supplying or furnishing to the Contractor or Contractor's subcontractors with labor, laborers, materials, rental machinery, tools or equipment used or to perform the work. As work is completed in integrated component parts, inspected, approved and, if applicable, conveyed to NFF, the Performance Security shall be released in a proportional amount, unless a lesser amount of release is necessary to maintain 5% Performance Security.

Bid Submission

Submit bids via email to mrehn@nationalforests.org by April 26, 2023.

Point of Contact

For questions about the details of producing the bid, please contact:

Maddie Rehn
National Forest Foundation, GMUG Project Coordinator

970.222.3709
mrehn@nationalforests.org

Contractor Selection Process

The NFF will use the Evaluation Factors below to review each submitted bid. Based on the outcomes of that selection process, the NFF will notify successful and unsuccessful bidders by May 26, 2023, and will prepare a separate contract document.

Evaluation Factors and Relative Importance

Level 3 Criteria
- Price / cost
- Equipment and contractor capability
- Timing of when contractor can begin and/or finish the project
- Past performance, references, and USFS feedback

Level 2 Criteria
- Technical proposal / proposed approach to project
- Overall strategic benefits to meeting NFF goals and grant needs, requirements, and timelines

Level 1 Criteria
- Benefits to the local community
- Relationship to local community

Equal Opportunity Provider

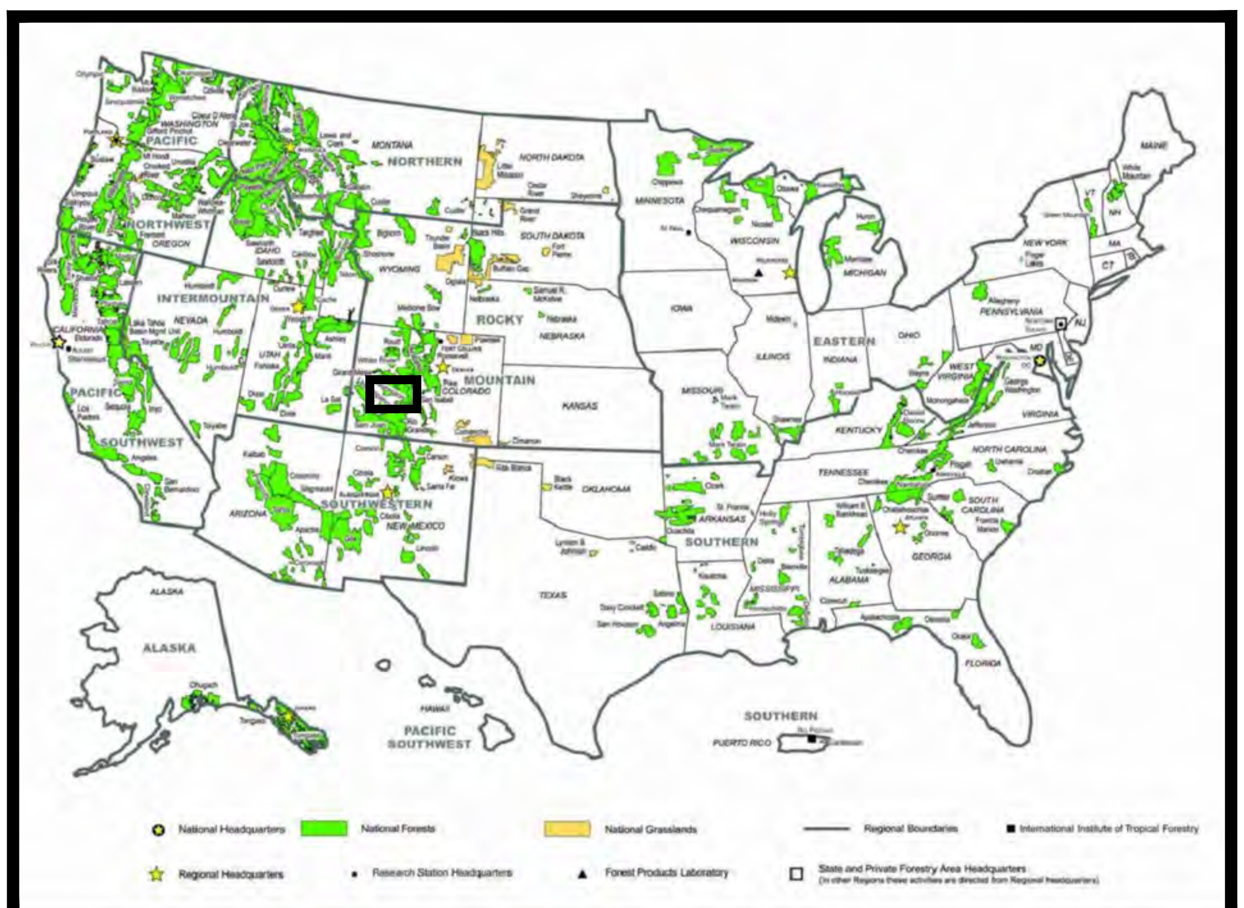
In accordance with Federal law and U.S. Department of Agriculture policy, the National Forest Foundation is prohibited from discriminating on the basis of race, color, national origin, sex, age, religion, political beliefs, or disability.

Appendix A

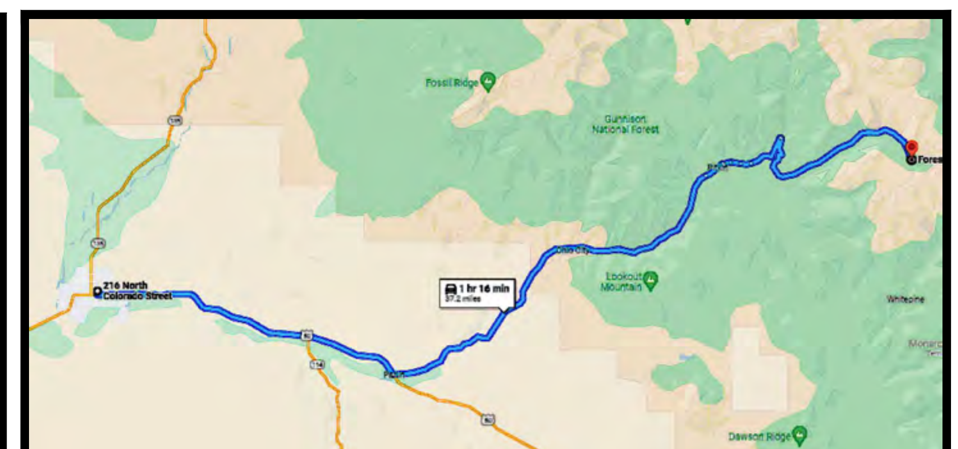
United States Department of Agriculture
Forest Service

COLORADO
GUNNISON COUNTY
R2 ROCKY MOUNTAIN REGION
GRAND MESA UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS
GUNNISON RANGER DISTRICT

PALISADE WALL AND ALPINE TUNNEL ROAD REPAIR PROJECT



FOREST LOCATION MAP



Map data ©2022 Google

PROJECT LOCATION MAP

TRAVEL DIRECTIONS:

FROM THE GUNNISON RANGER DISTRICT OFFICE, 216 N COLORADO ST., GUNNISON, CO 81230: HEAD SOUTH ON N COLORADO ST TOWARD E VIRGINIA AVE. (0.1 MI); FOLLOW US-50 E AND CO RD 76 TO STATE ST. IN PITKIN (27.0 MI); DRIVE TO NATIONAL FOREST SYSTEM RD 839 (10.1 MI). LATITUDE 38°37'25.09"N, LONGITUDE 106°23'38.15"W.

INDEX OF SHEETS

RECOMMENDED BY:

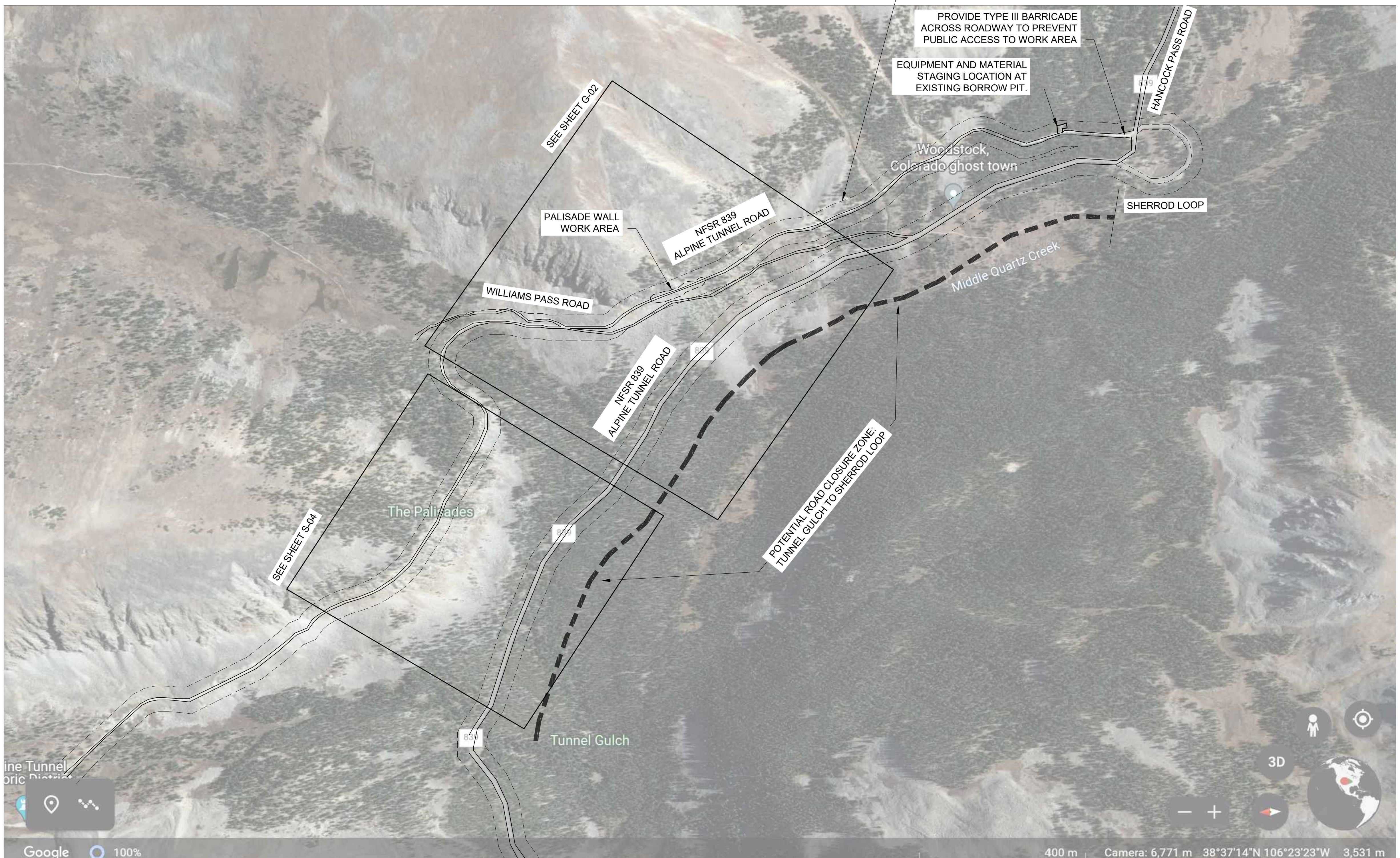
DISTRICT RANGER ____________ DATE ______

FOREST SUPERVISOR ____________ DATE ______

RO STRUCTURAL ENGINEER ____________ DATE ______

APPROVED BY:

RO DIRECTOR OF ENGINEERING ____________ DATE ______



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United States Department of Agriculture
Forest Service

R2
ROCKY MOUNTAIN REGION

Atkinson-Noland
& Associates, Inc.

NO.	REVISION / ISSUE	DATE
4		
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PROJECT NAME

PALISADE WALL AND ALPINE TUNNEL ROAD REPAIR PROJECT

GRAND MESA UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS

GUNNISON DISTRICT

DRAWING TITLE

OVERALL AREA MAP

DATE 01/27/2023
ARCHIVE NO.
DESIGNER M. SCHULLER
DRAWN N. KONDAM
CHECKED M. SCHULLER
PROJECT NO. 22-095
DRAWING SHEET NO. G-01
SHEET 002 OF 011

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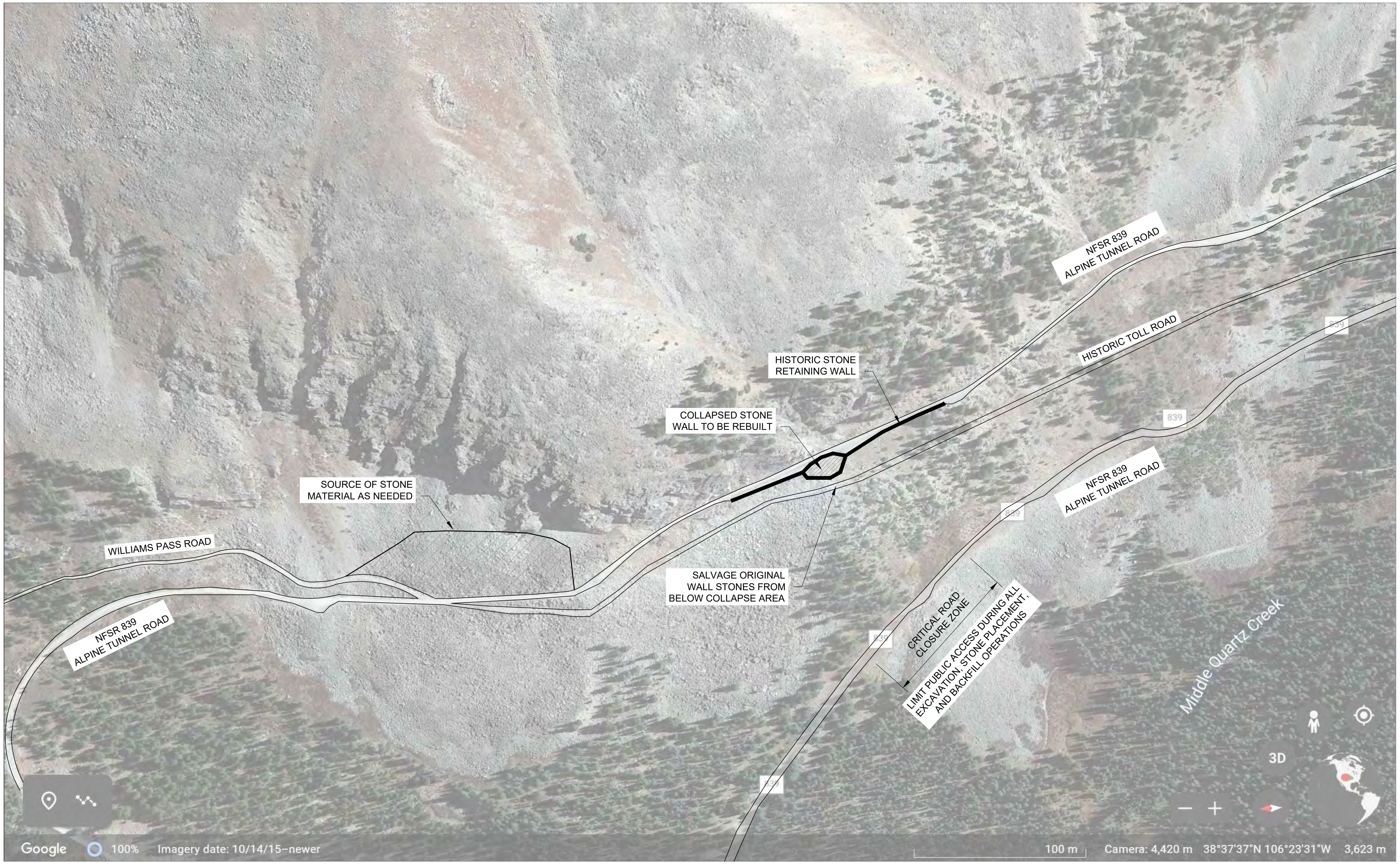

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USDA

United States Department of Agriculture
Forest Service

R2
ROCKY MOUNTAIN REGION

Atkinson-Noland
& Associates, Inc.

NO.	REVISION / ISSUE	DATE
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PROJECT NAME

PALISADE WALL AND ALPINE TUNNEL ROAD REPAIR PROJECT

GRAND MESA UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS

GUNNISON DISTRICT

DRAWING TITLE

RETAINING WALL AREA MAP

DATE 01/27/2023
ARCHIVE NO.
DESIGNER M. SCHULLER
DRAWN N. KONDAM
CHECKED M. SCHULLER
PROJECT NO. 22-095
DRAWING SHEET NO. **G-02**
SHEET 003 OF 011

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GENERAL NOTES

1. GENERAL

A. WORK TO RESTORE AND STABILIZE DRY STACK STONE MASONRY RETAINING WALLS AND HISTORIC ROADWAY IS TO BE CARRIED OUT WITHIN THE ESTABLISHED ALPINE TUNNEL HISTORIC DISTRICT IN A SENSITIVE ALPINE ENVIRONMENT. THE HISTORIC DISTRICT EXTENDS 100 FT ON EACH SIDE OF THE ROADWAY IN A HIGH ALPINE ENVIRONMENT AT ELEVATIONS EXCEEDING 11,000 FT. ALL NATURAL AND MANMADE EXISTING FEATURES WITHIN THE HISTORIC DISTRICT ARE TO BE TREATED WITH UTMOST CARE. DO NOT DISPLACE, REMOVE, DEFACE, OR OTHERWISE AFFECT HISTORIC DISTRICT FEATURES WITHOUT PRIOR WRITTEN CONSENT OF THE NATIONAL FOREST FOUNDATION (NFF).

B. REHABILITATION OF HISTORIC WALLS AND ROAD SURFACES ARE REQUIRED TO ALIGN WITH THE SECRETARY OF INTERIOR'S STANDARDS FOR REHABILITATION AND THE SECRETARY OF THE INTERIOR'S STANDARDS FOR THE TREATMENT OF HISTORIC PROPERTIES.

C. DO NOT SCALE CONTRACT DRAWINGS FOR THE PURPOSE OF ESTABLISHING DIMENSIONS.

D. VERIFY EXISTING CONDITIONS AND DIMENSIONS PRIOR TO BEGINNING WORK OR FABRICATING OF MATERIALS. NOTIFY ENGINEER OF DISCREPANCIES BEFORE PROCEEDING WITH ANY PHASE OF WORK.

E. THE CONTRACT STRUCTURAL DRAWINGS REPRESENT THE FINISHED STRUCTURE. THE CONTRACTOR IS RESPONSIBLE FOR THE MEANS AND METHODS OF CONSTRUCTION AND FOR FOLLOWING OSHA REQUIREMENTS. PROVIDE ALL MEASURES REQUIRED TO PROTECT THE STRUCTURE, WORKMEN, AND OTHER PERSONS DURING CONSTRUCTION; INCLUDING BRACING, EXCAVATION SHORING, SHORING FOR CONSTRUCTION EQUIPMENT, FORMS AND SCAFFOLDING, SHORING OF RETAINING WALLS AND OTHER TEMPORARY SUPPORTS AS REQUIRED.

2. DESIGN CRITERIA

A. APPLICABLE CODES

- AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 9TH ED., 2020

B. TRAFFIC LOAD

- HS20.. 16,000 LB WHEEL LOADS

C. SNOW LOAD

- SNOW LOAD, Pg.. 150 PSF
- VERTICAL AVALANCHE LOAD......... 850 PSF ON ROADWAY

3. JOB CONDITIONS

A. EXAMINE THE SUBSTRATE AND THE CONDITIONS UNDER WHICH THE WORK IS TO BE PERFORMED. DO NOT PROCEED UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

B. FOLLOW OSHA REQUIREMENTS FOR SITE SAFETY INCLUDING TRENCHING, EXCAVATION, SLOPE STABILITY AND LAYBACKS, FALL PROTECTION, SCAFFOLD SAFETY, AND ANY OTHER APPLICABLE REQUIREMENTS.

C. ROCK SCALING AT AND ABOVE THE WORK AREA WAS COMPLETED IN JULY 2022. CONDITIONS CAN BE EXPECTED TO CHANGE OVER TIME. CONTRACTOR MUST HAVE THE ABILITY TO CLEAR NEW ROCKFALLS, IDENTIFY POTENTIAL HAZARDS, AND REMOVE LOOSE ROCK THAT CAN BE PULLED OFF BY HAND OR WITH A ROCK BAR THAT POSE A POTENTIAL SAFETY HAZARD TO THE WORK AREA AND PUBLIC TRAFFIC BELOW THE WORK AREA. BRING TO ATTENTION OF NFF IF ANY UNSAFE CONDITIONS ARE IDENTIFIED.

4. STAGING

A. MATERIALS AND EQUIPMENT ARE TO BE STAGED AT THE LOCATION SHOWN ON PROJECT DRAWINGS. ADDITIONAL STAGING AREAS MAY BE DEVELOPED UPON APPROVAL OF THE NFF.

5. PROTECTION AND RESTORATION

A. PROTECT ADJACENT WALL SECTIONS FROM DAMAGE INCLUDING STAINING DURING THE WORK. ANY NATURAL OR MANMADE FEATURES OUTSIDE THE DESIGNATED WORK ZONES THAT ARE DAMAGED BY THE WORK SHALL BE REPAIRED OR REPLACED AT NO COST TO THE OWNER.

6. TRAFFIC CONTROL

A. SEE PROJECT SPECIFICATIONS FOR TEMPORARY TRAFFIC CONTROL REQUIREMENTS. CLOSURES AND SIGNAGE SHALL COMPLY WITH THE FHWA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) REQUIREMENTS.

B. PROVIDE TEMPORARY SIGNAGE AT THE FOLLOWING LOCATIONS TO NOTIFY THE PUBLIC OF ROAD CLOSURES AND POSSIBLE TRAFFIC DELAYS:

- AT LOWER END OF FOREST SERVICE ROAD 839 AT INTERSECTION WITH FOREST SERVICE ROAD 765.
- ON NFSR 839 BELOW SHERROD LOOP.
- ON NFSR 839 ABOVE SHERROD LOOP.
- ON NFSR 839 AT THE INTERSECTION WITH THE WILLIAMS PASS ROAD.
- ON NFSR 295 AT THE HANCOCK SITE, NORTH OF INTERSECTION WITH FOREST SERVICE ROAD 298A.

C. PROVIDE TYPE III BARRICADE ON NFSR 839 ABOVE SHERROD LOOP TO RESTRICT PUBLIC ACCESS TO THE WORK AREA.

D. PROVIDE TEMPORARY CLOSURE AT ROADWAY BELOW THE WORK AREA AS SHOWN ON DRAWINGS. FLAGGERS AT BOTH ENDS OF CLOSURE SHALL BE IN ELECTRONIC OR VISUAL COMMUNICATION WITH THE WORK CREW. CLOSURES ARE REQUIRED DURING ALL ACTIVITIES THAT POSE A POTENTIAL HAZARD TO PUBLIC TRAFFIC, INCLUDING BUT NOT LIMITED TO: DEMOLITION,CLEARING, EXCAVATION, BACKFILLING, REBUILDING, COMPACTION, STONE LIFTING AND STONE PLACEMENT.

7. ROADWORK

A. THE ROADWAY TO THE SITE IS INTENDED FOR USE BY OFF-HIGHWAY VEHICLES AND MAY NOT BE SUITABLE FOR HEAVY CONSTRUCTION EQUIPMENT. CONTRACTOR IS RESPONSIBLE FOR VERIFYING ADEQUACY OF ROADWAY FOR CONSTRUCTION TRAVEL.

B. DO NOT OPERATE EQUIPMENT WITH AXLE WEIGHTS IN EXCESS OF 32,000 LB. ON ANY PORTION OF THE HISTORIC ROADWAYS OR ADJACENT TO HISTORIC WALL SECTIONS. COMPLY WITH LEGAL LOAD RESTRICTIONS WHEN HAULING MATERIAL AND EQUIPMENT ON PUBLIC ROADS AND BRIDGES TO AND FROM THE PROJECT. A SPECIAL PERMIT DOES NOT RELIEVE THE CONTRACTOR OF LIABILITY FOR DAMAGE RESULTING FROM THE MOVING OF MATERIAL OR EQUIPMENT.

C. SEE PROJECT SPECIFICATIONS FOR REQUIREMENTS.

D. ROADWORK REHABILITATION AT THE COLLAPSE AREA INCLUDES EXCAVATION, INSTALLATION OF MECHANICALLY STABILIZED EARTH, AND PLACEMENT AND COMPACTION OF ROAD BASE TO RESTORE THE HISTORIC TRAVEL SURFACE.

E. MATERIAL SOURCE: PROCESS EXCAVATED MATERIALS TO DEVELOP BACKFILL MEETING PROJECT SPECIFICATION REQUIREMENTS. PROVIDE ROADBASE FROM COMMERCIAL SOURCE.

F. EXCAVATION SPOILS: STOCKPILE AT STAGING AREA.

G. NEW DRAINAGE IN THE FORM OF A ROADSIDE DRAINAGE DITCH IS TO BE INSTALLED FROM THE MAIN WORK AREA TO A DRAINAGE ZONE BEYOND THE LIMIT OF THE HISTORIC STONE RETAINING WALL AS SHOWN ON PROJECT DRAWINGS. THE FULL LENGTH OF THE DRAINAGE DITCH WILL BE LINED WITH IMPERMEABLE CLAY LINER AND FACED WITH RUBBLE STONE. THE DITCH WILL DRAIN BEYOND THE END OF THE HISTORIC STONE WALL USING AN OUT-SLOPED DIP CROSS DRAIN.

8. STONE MASONRY

A. WALL REBUILDING WILL USE LOCAL NATIVE GRANITE MATERIALS TO MATCH EXISTING DRYSTACK CONSTRUCTION.

B. STONE WILL BE SOURCED FROM BELOW THE PALISADE WALL AND FROM NATURALLY OCCURRING ROCKFALL DEPOSITS AT LOCATIONS SHOWN ON DRAWINGS. DO NOT REMOVE STONE FROM ANY EXISTING WALL STRUCTURES OR FROM NATURAL OUTCROPPINGS.

C. SHAPE STONE TO THE SIZES AND SHAPES INDICATED AND TO THE TOLERANCES REQUIRED BY PROJECT SPECIFICATIONS. FINISH EXPOSED FACES TO BE ROCK-FACED AS DEFINED IN PROJECT SPECIFICATIONS.

D. MATCH COURSING AND JOINTING OF EXAMPLE AREAS AS INDICATED ON DRAWINGS. FEATHER STONE CONSTRUCTION WITH EXISTING TO PROVIDE A SMOOTH TRANSITION AT THE WORK AREA PERIMETER.

9. MECHANICALLY STABILIZED EARTH (MSE)

A. MSE CONSTRUCTION WILL BE USED TO STABILIZE BACKFILL BEHIND STONE WALLS. INSTALL FULL HEIGHT OF REBUILT STONE WALL, EXTENDING TO 12'-0" BEHIND WALLS.

B. EXCAVATE TO THE LIMITS SHOWN ON DRAWINGS. NOTIFY PROJECT ENGINEER IF BEDROCK PROFILE PREVENTS INSTALLATION OF THE FULL 12'-0" DEPTH OF MSE BEHIND WALLS.

C. GEOTEXTILE REINFORCEMENT TO HAVE A MINIMUM LONG TERM DESIGN STRENGTH OF 1,100 LB/FT.

D. INSTALL GEOTEXTILE REINFORCEMENT FABRIC IN 1'-0" LIFTS ACCORDING TO PROJECT SPECIFICATIONS. WRAP FABRIC UP AND OVER EACH LIFT AT THE STONE WALL, EMBEDDING IN EARTH AS SHOWN.

E. COMPACT EACH LIFT FOLLOWING PROJECT SPECIFICATION REQUIREMENTS.

10. PROTECTION

A. DO NOT DISTURB THE AREA BEYOND THE CONSTRUCTION LIMITS. REPLACE TREES, SHRUBS, OR VEGETATED AREAS DAMAGED BY CONSTRUCTION OPERATIONS AS DIRECTED AND AT NO COST TO THE NATIONAL FOREST FOUNDATION. REMOVE DAMAGED LIMBS OF EXISTING TREES BY AN APPROVED ARBORIST.

B. DURING CONSTRUCTION ARCHAEOLOGICAL REMAINS ARE EXPECTED TO BE ENCOUNTERED. IN MOST CASES ITEMS WILL BE ISOLATED IN NATURE. DO NOT EXCAVATE, REMOVE, DAMAGE, ALTER, OR DEFACE ARCHEOLOGICAL OR PALEONTOLOGICAL REMAINS OR SPECIMENS. CONTROL THE ACTIONS OF EMPLOYEES AND SUBCONTRACTORS ON THE PROJECT TO ENSURE THAT PROTECTED SITES AND OBJECTS ARE NOT DISTURBED OR DAMAGED. IN THE CASE THAT SIGNIFICANT ARCHAEOLOGICAL REMAINS ARE ENCOUNTERED A TEMPORARY STOPPAGE IN WORK MAY OCCUR.

C. DISCOVERED ARTIFACTS MUST BE DOCUMENTED AND SECURED ON SITE, AND BOTH THE NFF AND USFS ARCHAEOLOGIST MUST BE NOTIFIED WITHIN 24 HOURS AFTER DISCOVERY. UPON DISCOVERY SUSPEND OPERATIONS AT THE DISCOVERY SITE, AND CONTINUE OPERATIONS AT OTHER AREAS. THE NFF WILL INFORM THE CONTRACTOR WHEN OPERATIONS MAY RESUME AT THE DISCOVERY SITE.

D. ENVIRONMENTAL PROTECTION.

(a) FEDERAL WATER POLLUTION CONTROL ACT (CLEAN WATER ACT) 33 USC § 1251 ET SEQ.

(1) DO NOT OPERATE EQUIPMENT OR DISCHARGE MATERIAL WITHIN THE BOUNDARIES OF WETLANDS AND THE WATERS OF THE UNITED STATES AS DEFINED BY THE FEDERAL AND STATE REGULATORY AGENCIES. IF AN UNAUTHORIZED DISCHARGE OCCURS:

(a) PREVENT FURTHER CONTAMINATION;

(b) NOTIFY APPROPRIATE AUTHORITIES AND THE NFF; AND

(c) MITIGATE DAMAGES.

(2) CONSTRUCT AND MAINTAIN BARRIERS IN WORK AREAS AND IN MATERIAL SOURCES TO PREVENT SEDIMENT, PETROLEUM PRODUCTS, CHEMICALS, AND OTHER LIQUIDS AND SOLIDS FROM ENTERING WETLANDS OR WATERS OF THE UNITED STATES. REMOVE AND PROPERLY DISPOSE OF BARRIER COLLECTED MATERIAL.

E. PROTECTION OF FORESTS, PARKS, AND PUBLIC LANDS. COMPLY WITH REGULATIONS OF THE STATE FIRE MARSHAL, CONSERVATION COMMISSION, FEDERAL LAND MANAGEMENT AGENCY, OR OTHER AUTHORITY HAVING JURISDICTION GOVERNING THE PROTECTION OF LAND INCLUDING OR ADJACENT TO THE PROJECT.

USDA
FOREST SERVICE
U S
DEPARTMENT OF AGRICULTURE

United States Department of Agriculture
Forest Service

R2
ROCKY MOUNTAIN REGION

Atkinson-Noland
& Associates, Inc.

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PALISADE WALL AND ALPINE TUNNEL ROAD REPAIR PROJECT

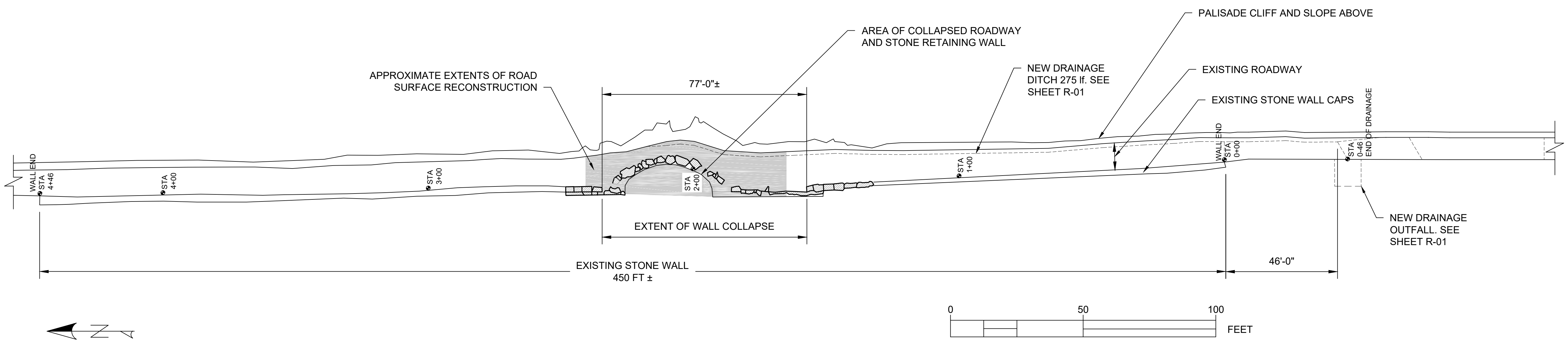
GRAND MESA UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS

GUNNISON DISTRICT

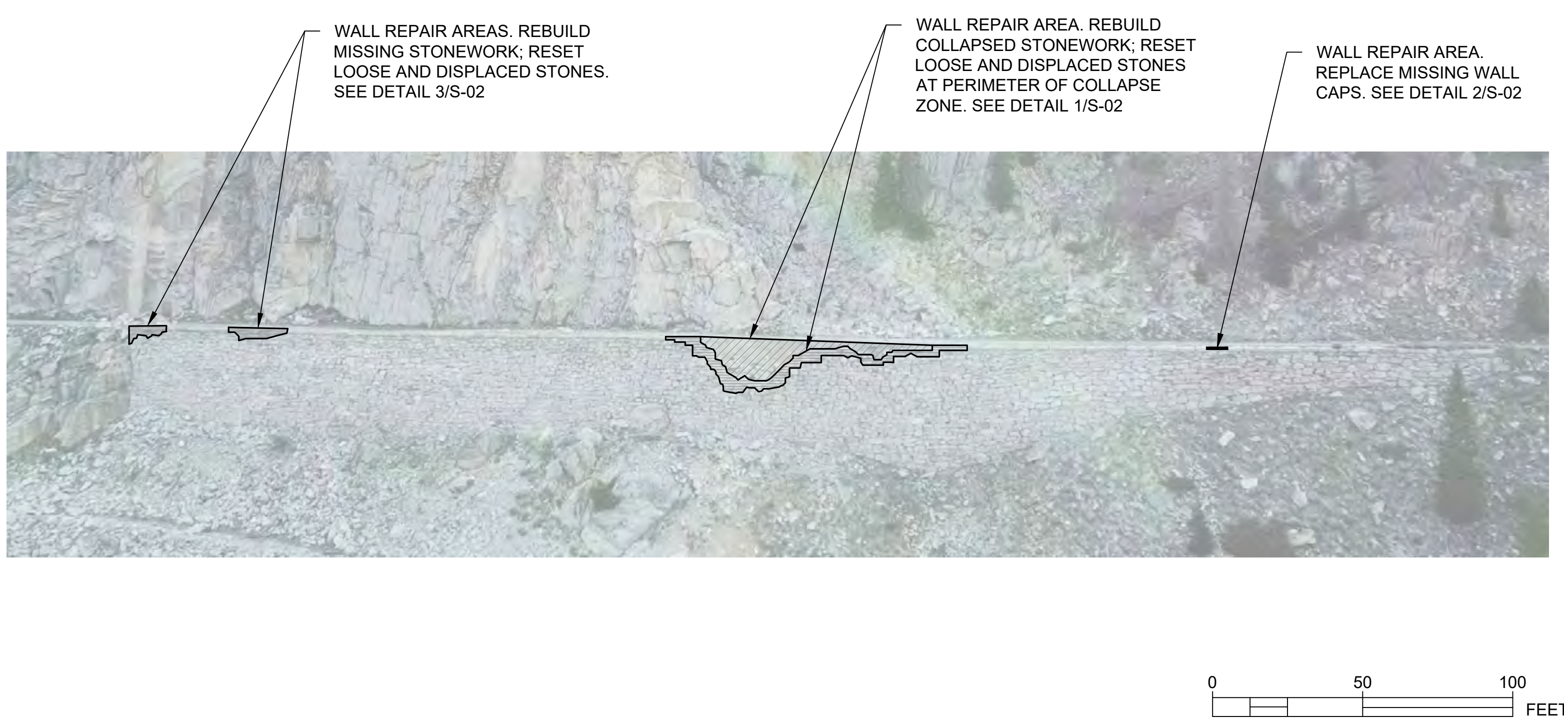
DRAWING TITLE

GENERAL NOTES

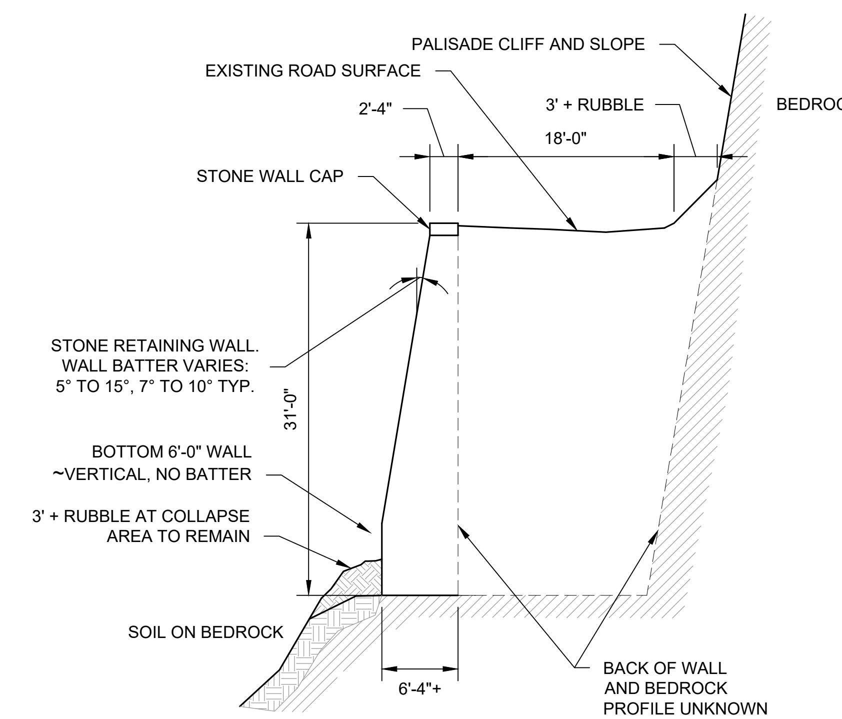
DATE 01/27/2023	ARCHIVE NO.
DESIGNER M. SCHULLER	DRAWING SHEET NO. G-03
DRAWN N. KONDAM	
CHECKED M. SCHULLER	
PROJECT NO. 22-095	SHEET 004 OF 011



1 ROADWAY PLAN
PLAN



2 RETAINING WALL
ELEVATION



3 ORIGINAL CONDITION
SECTION 1/8" = 1'-0"

USDA
United States Department of Agriculture
Forest Service

R2
ROCKY MOUNTAIN REGION

Atkinson-Noland & Associates, Inc.

NO.	REVISION / ISSUE	DATE
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3		
2		
1		

PROJECT NAME
PALISADE WALL AND ALPINE TUNNEL ROAD REPAIR PROJECT

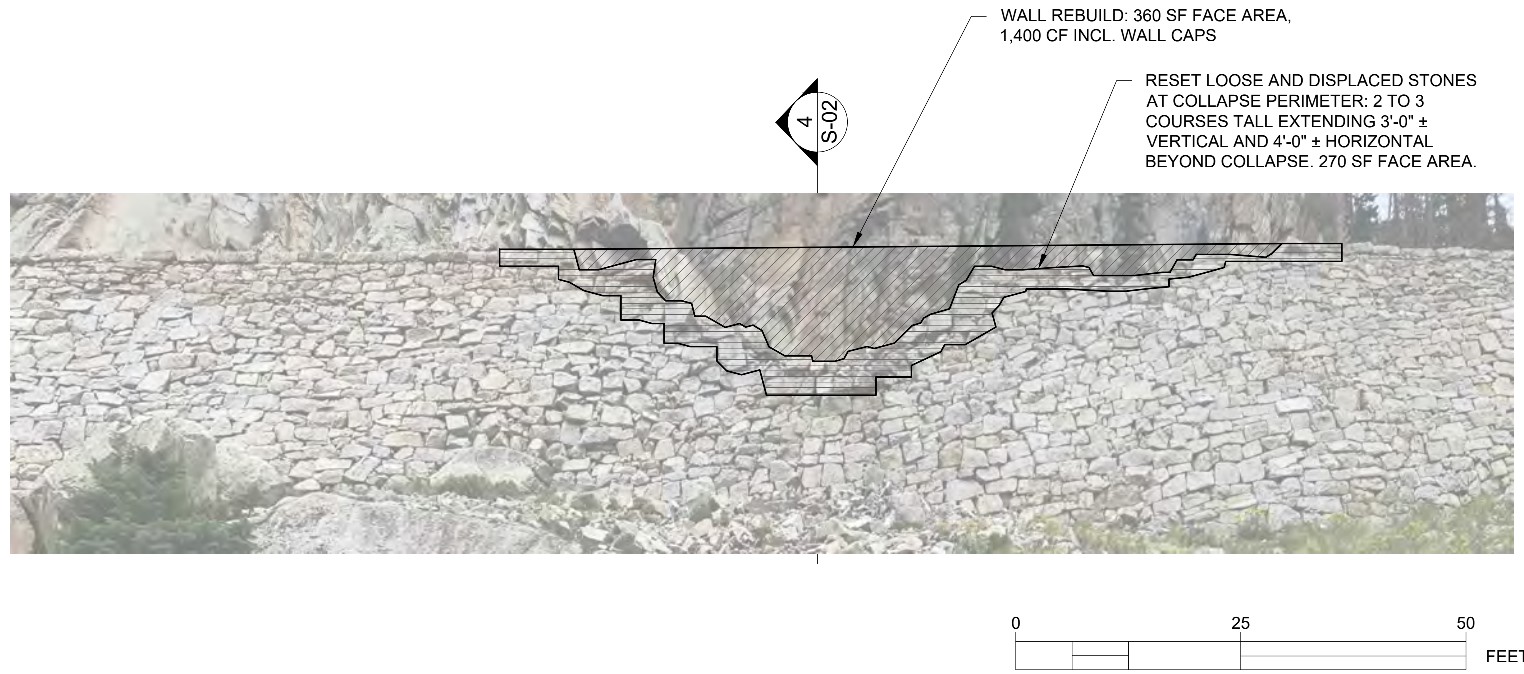
GRAND MESA UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS

GUNNISON DISTRICT

DRAWING TITLE
EXISTING CONDITIONS

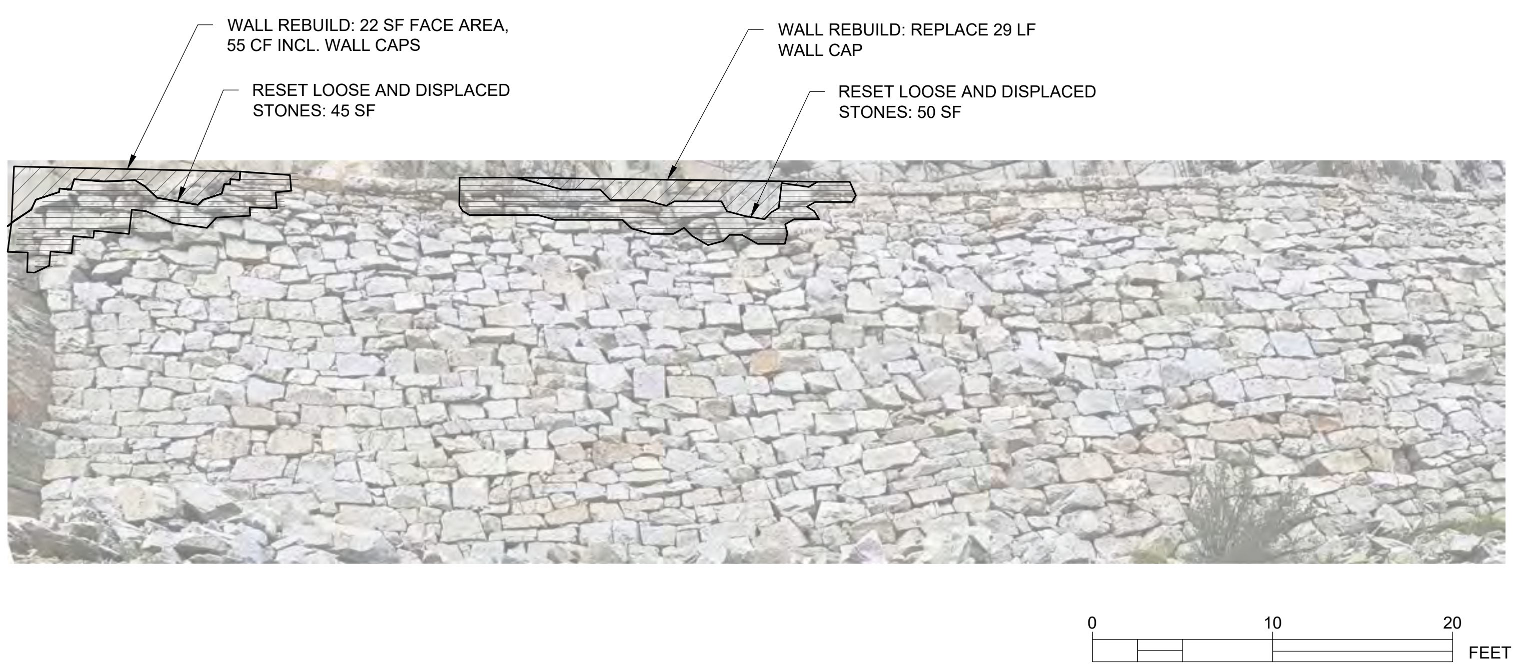
DATE 01/27/2023
ARCHIVE NO.
DESIGNER M. SCHULLER
DRAWN N. CARGILL
CHECKED M. SCHULLER
PROJECT NO. 22-095
DRAWING SHEET NO. S-01
SHEET 005 OF 011

1/27/23 15:41 MSCHU Z:\SHARED\ANA JOBS\2022 JOBS\095-22 THE PALISADES STONE RETAINING WALL\DRAWINGS\100% SUBMITTALS\DRAWING SHEETS FINAL 2013.DWG;

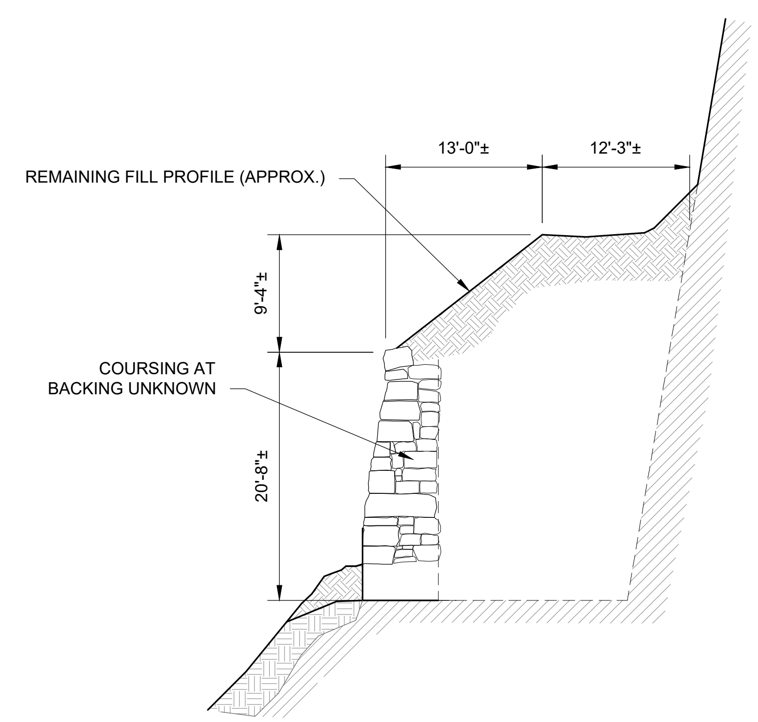


1 WALL REPAIR SCOPE AT COLLAPSE
ELEVATION

2 WALL REPAIR SCOPE SOUTH END
ELEVATION NO SCALE



3 WALL REPAIR SCOPE NORTH END
ELEVATION



4 EXISTING CONDITIONS
SECTION 1/8" = 1'-0"

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Forest Service

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ROCKY MOUNTAIN REGION

Atkinson-Noland
& Associates, Inc.

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4		
3		
2		
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PROJECT NAME

PALISADE WALL AND ALPINE TUNNEL ROAD REPAIR PROJECT

GRAND MESA UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS

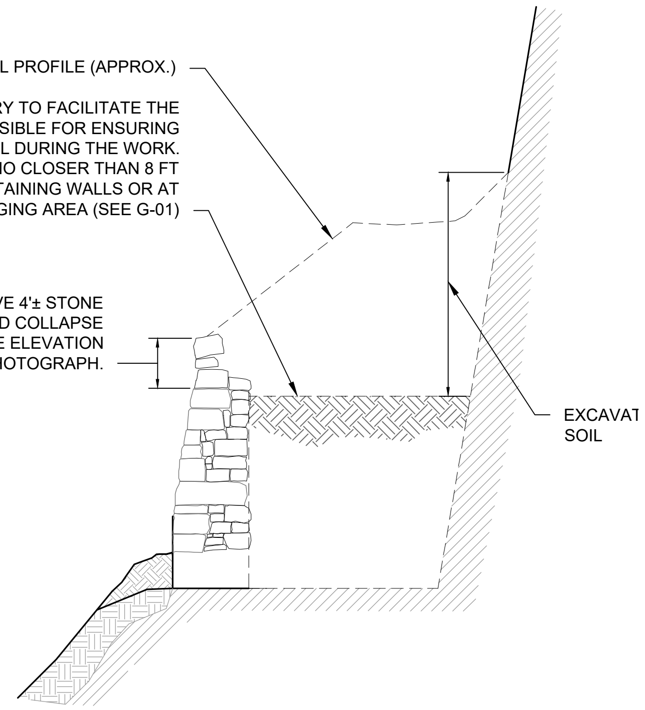
GUNNISON DISTRICT

DRAWING TITLE

WALL ELEVATIONS

DATE 01/27/2023	ARCHIVE NO.
DESIGNER M. SCHULLER	DRAWING SHEET NO.
DRAWN N. CARGILL	**S-02**
CHECKED M. SCHULLER	
PROJECT NO. 22-095	SHEET 006 OF 011

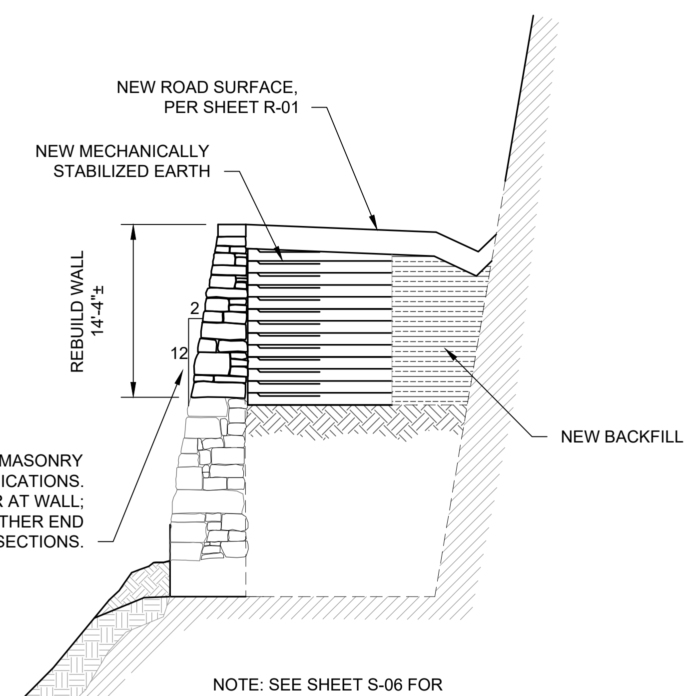
1/12/23 22:41 ANA AUTOCAD Z:\SHARED\ANA JOBS\2022 JOBS\095-22 THE PALISADES STONE RETAINING WALL\DRAWINGS\S DRAWING SHEETS.DWG;



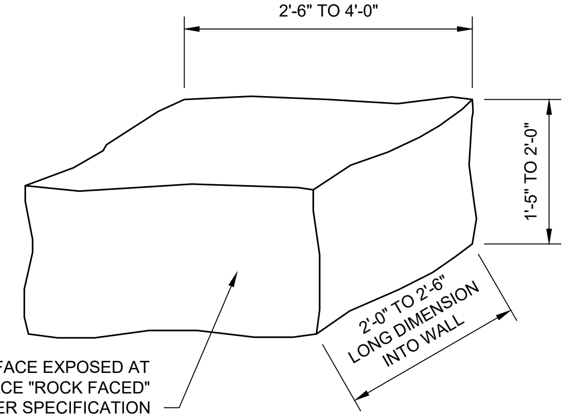
1 MATERIAL REMOVAL
SECTION 1/8" = 1'-0"

3 STONE COURSING EXAMPLE 1
PHOTO BELOW COLLAPSE 1/4" = 1'-0"

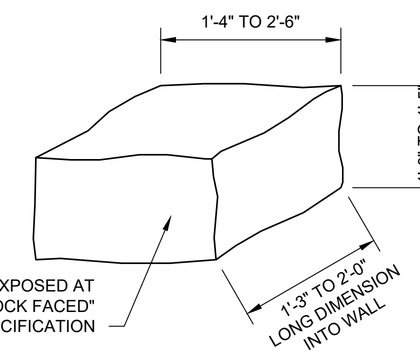
4 STONE COURSING EXAMPLE 2
PHOTO NEAR NORTH END 1/4" = 1'-0"



2 WALL REBUILD
SECTION 1/8" = 1'-0"

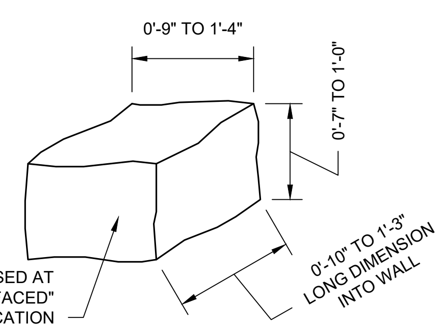


5 LARGE STONES - 40% TOTAL
ISOMETRIC 3/4" = 1'-0"

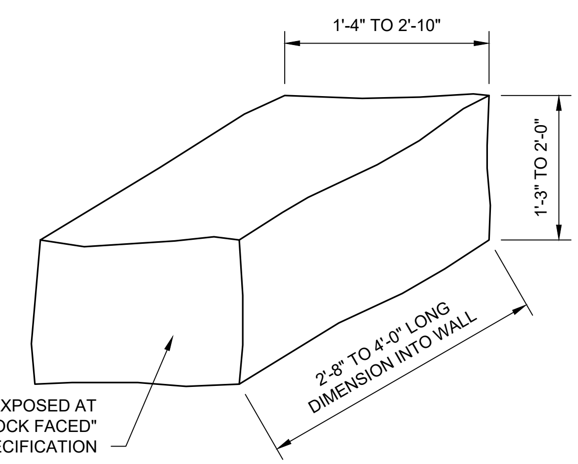


6 MEDIUM STONES - 20% TOTAL
ISOMETRIC 3/4" = 1'-0"

NOTE: SEE 1/S-05 FOR WALL CAP REQUIREMENTS



7 SMALL STONES - 20% TOTAL
ISOMETRIC 1" = 1'-0"



8 BOND STONES - 20% TOTAL
ISOMETRIC 3/4" = 1'-0"

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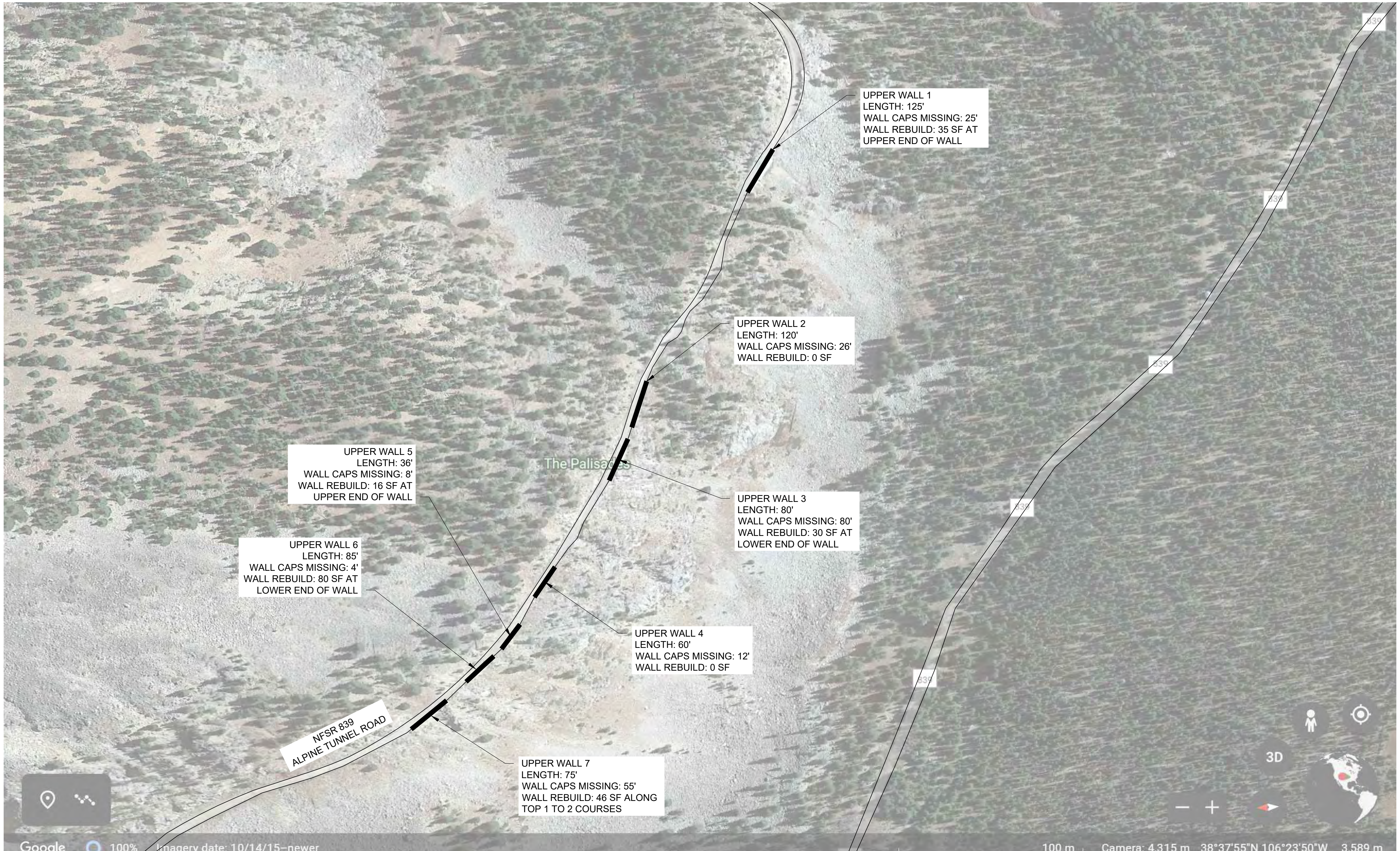
PROJECT NAME
PALISADE WALL AND ALPINE TUNNEL ROAD REPAIR PROJECT

GRAND MESA UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS

GUNNISON DISTRICT

DRAWING TITLE
WALL SECTIONS AND STONE DETAILS

DATE 01/27/2023
ARCHIVE NO.
DESIGNER M. SCHULLER
DRAWN N. KONDAM
CHECKED M. SCHULLER
DRAWING SHEET NO. S-03
PROJECT NO. 22-095
SHEET 007 OF 011



0 250 500 FEET

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3		
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PROJECT NAME

PALISADE WALL AND ALPINE TUNNEL ROAD REPAIR PROJECT

GRAND MESA UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS

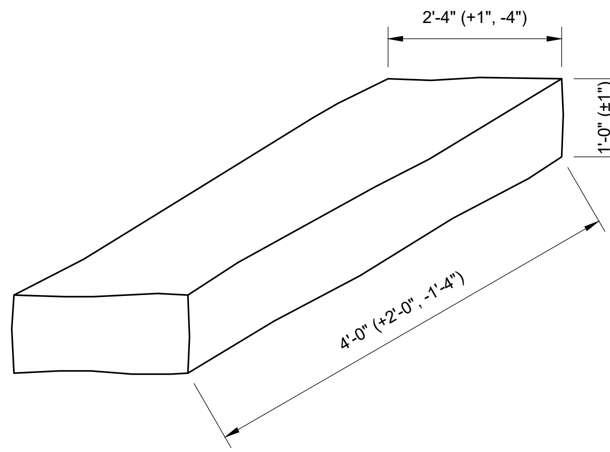
GUNNISON DISTRICT

DRAWING TITLE

OPTIONAL BID ITEMS UPPER WALLS AREA MAP

DATE: 01/27/2023
ARCHIVE NO.
DESIGNER: M. SCHULLER
DRAWN: N. KONDAM
CHECKED: M. SCHULLER
PROJECT NO. 22-095
DRAWING SHEET NO. **S-04**
SHEET 008 OF 011

1/12/23 22:41 ANA AUTOCAD Z:\SHARED\ANA JOBS\2022 JOBS\095-22 THE PALISADES STONE RETAINING WALL\DRAWINGS\S DRAWING SHEETS.DWG;



PROVIDE THIRTY (30) WALL CAPS OF THE DESIGNATED SIZE FOR FUTURE WALL REPAIRS. STOCKPILE WALL CAPS AT THE PROJECT STAGING AREA AT COMPLETION OF THE WORK.

1 OPTIONAL BID ITEM- WALL CAPS
ISOMETRIC 3/4" = 1'-0"

COLLAPSED AREA:
APPROX. 4 FT HIGH X 3 FT WIDE

REMOVE STONE AND SOIL TO 3'-0" MIN. BEYOND LIMITS OF COLLAPSE.

REBUILD STONE FACING WALL USING FIELD STONE FROM THE AREA TO THICKNESS OF 16" OR GREATER.

TIGHTLY FIT STONES TO MATCH COURSING AND STONE SIZE AT ADJACENT WALL SECTIONS.

BACKFILL WITH GRAVEL AND SOIL DURING REBUILDING.

COLLAPSED AREA:
APPROX. 5 FT HIGH X 4 FT WIDE

2 OPTIONAL BID ITEM - BREAST WALL REPAIR NEAR COLLAPSE
PHOTO NO SCALE

3 OPTIONAL BID ITEM - BREAST WALL REPAIR
PHOTO NO SCALE

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4		
3		
2		
1		

PROJECT NAME

PALISADE WALL AND ALPINE TUNNEL ROAD REPAIR PROJECT

GRAND MESA UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS

GUNNISON DISTRICT

DRAWING TITLE

OPTIONAL BID ITEMS REPAIR DETAILS

DATE 01/27/2023
ARCHIVE NO.
DESIGNER M. SCHULLER
DRAWN M. SCHULLER
CHECKED M. SCHULLER
PROJECT NO. 22-095
DRAWING SHEET NO. **S-05**
SHEET 009 OF 011

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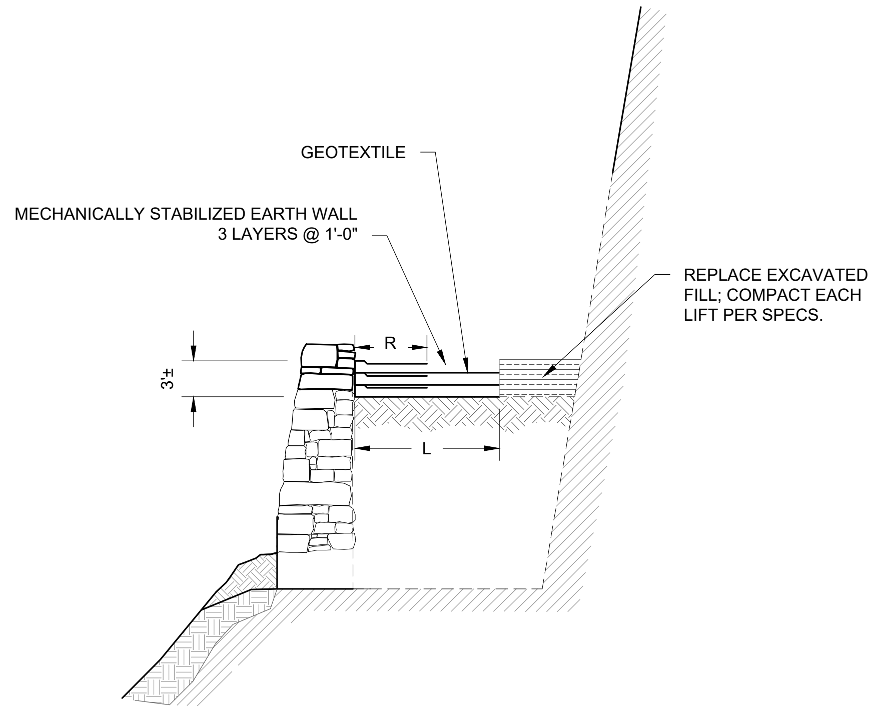
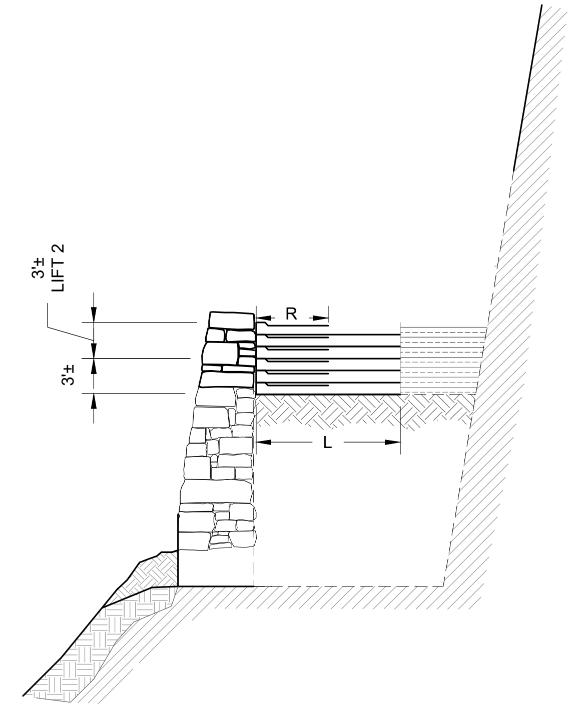
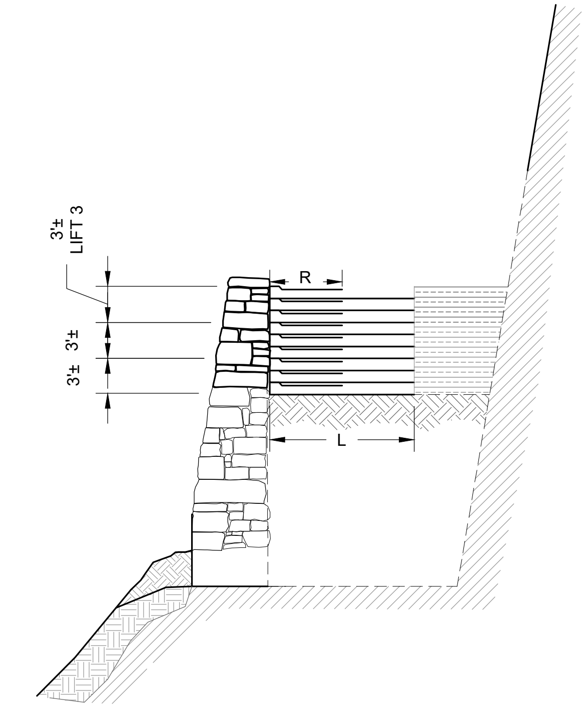


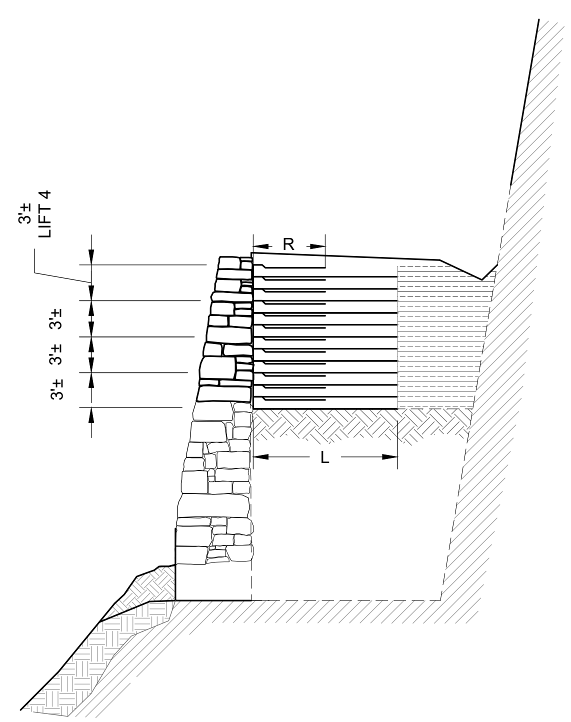
1 WALL REBUILD SEQUENCE - LIFT 1
SECTION 1/8" = 1'-0"



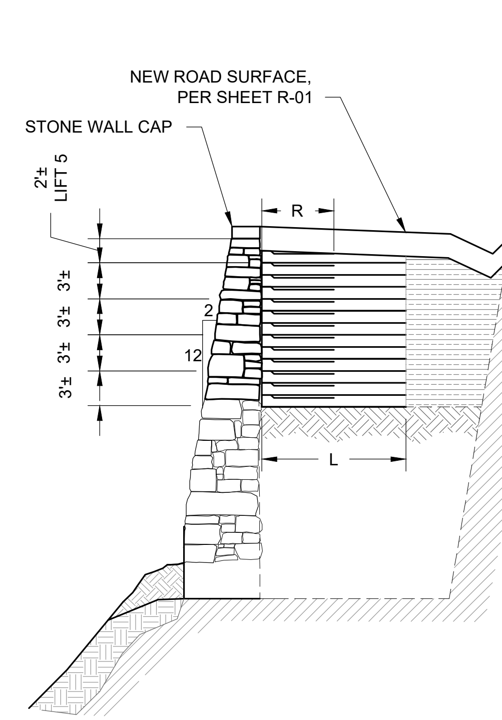
2 WALL REBUILD SEQUENCE - LIFT 2
SECTION 1/8" = 1'-0"



3 WALL REBUILD SEQUENCE - LIFT 3
SECTION 1/8" = 1'-0"



4 WALL REBUILD SEQUENCE - LIFT 4
SECTION 1/8" = 1'-0"



5 WALL REBUILD SEQUENCE - LIFT 5
SECTION 1/8" = 1'-0"

NOTES:
L - LENGTH OF BOTTOM LAYER OF FABRIC = 12'-0"
R - LENGTH OF WRAPPED LAYER OF FABRIC = 6'-0"
IF CONDITIONS ARE NOT AS EXPECTED, NOTIFY ENGINEER

1. REBUILD WALL IN 3'-0"± INCREMENTS
2. INSTALL GEOTEXTILE, MSE SYSTEM IN 1'-0" INCREMENTS

REBUILD RUBBLE MASONRY FOLLOWING PROJECT SPECIFICATIONS. INSTALL WITH 2:12 BATTER AT WALL; FEATHER WALL FACE AT EITHER END TO MATCH ADJACENT WALL SECTIONS.

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United States Department of Agriculture
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3		
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1		

PROJECT NAME

PALISADE WALL AND ALPINE TUNNEL ROAD REPAIR PROJECT

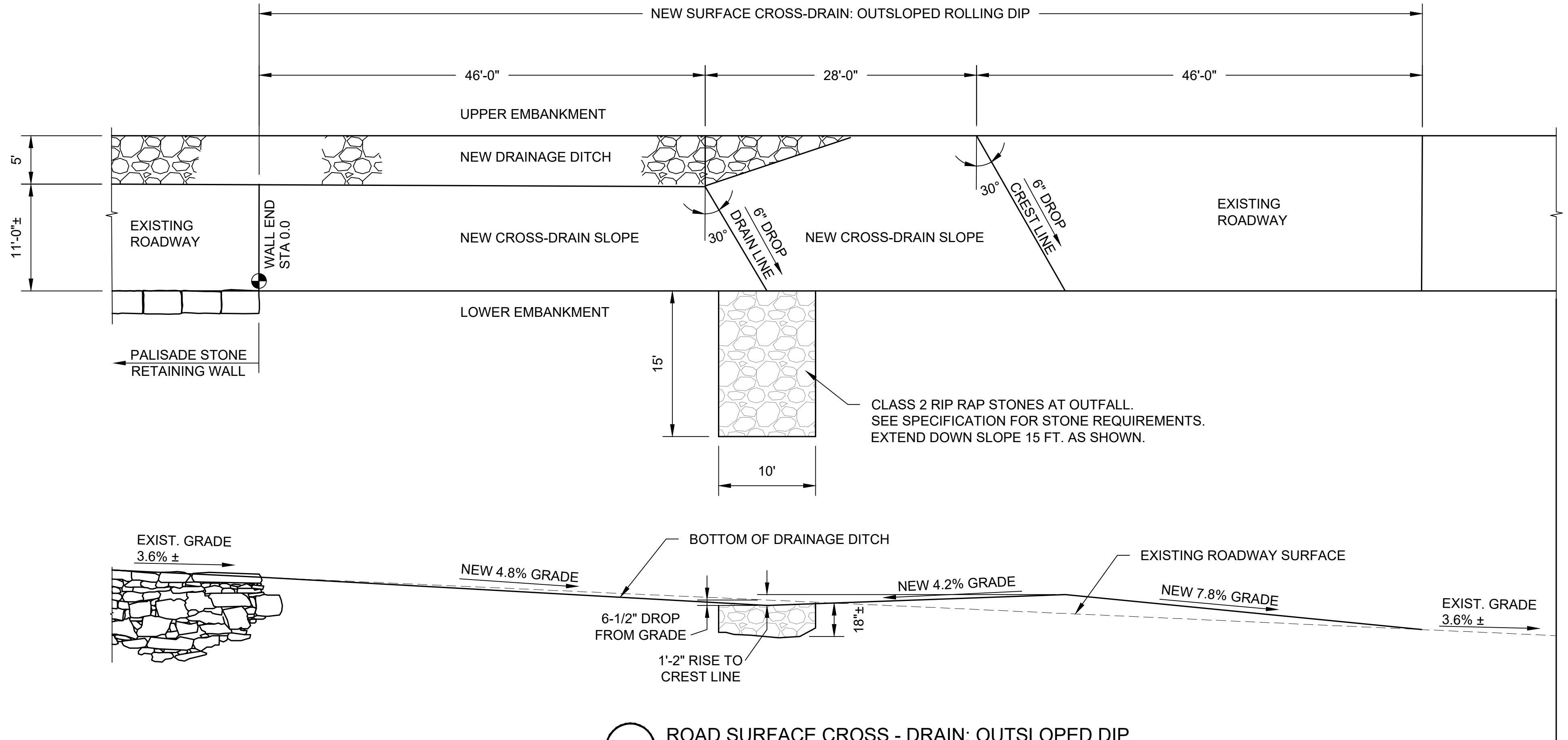
GRAND MESA UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS

GUNNISON DISTRICT

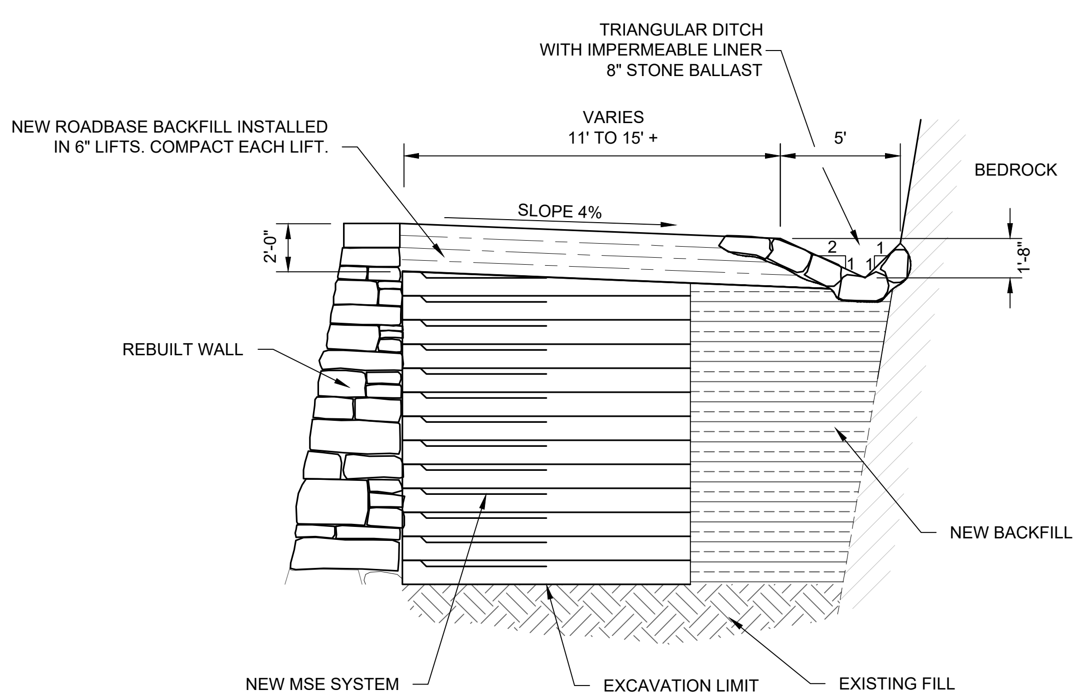
DRAWING TITLE

WALL SECTION REBUILD SEQUENCE

DATE 01/27/2023
ARCHIVE NO.
DESIGNER C. CITTO
DRAWN N. KONDAM
CHECKED M. SCHULLER
PROJECT NO. 22-095
DRAWING SHEET NO. **S-06**
SHEET 010 OF 011



1 ROAD SURFACE CROSS - DRAIN: OUTSLOPED DIP
TOP: PLAN 1/8" = 1'-0"
BOTTOM: ELEVATION



2 ROADWAY AT WALL REBUILD
SECTION 1/4" = 1'-0"

1/27/23 15:43 MSCHU Z:\SHAREDANA JOBS\2022 JOBS\095-22 THE PALISADES STONE RETAINING WALL\DRAWINGS\100% SUBMITTALS\DRAWING SHEETS FINAL 2013.DWG;

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& Associates, Inc.

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PROJECT NAME

PALISADE WALL AND ALPINE TUNNEL ROAD REPAIR PROJECT

GRAND MESA UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS

GUNNISON DISTRICT

DRAWING TITLE

ROADWAY SECTIONS

DATE 01/27/2023
ARCHIVE NO.
DESIGNER M. SCHULLER
DRAWN M. SCHULLER
CHECKED M. SCHULLER
PROJECT NO. 22-095
DRAWING SHEET NO. R-01
SHEET 011 OF 011

Appendix B

The Historic

Palisade Wall and Alpine Tunnel Road Repair Project

Gunnison District
of the
Grand Mesa, Uncompahgre and Gunnison (GMUG)
National Forests

PROJECT MANUAL
January 27, 2023

Funding Agency
National Forest Foundation
Building 27, Suite 3, Fort Missoula Road
Missoula, MT 59804
NFF Project Code(s): 1596066

United States Department of Agriculture
Forest Service
Grand Mesa, Uncompahgre and Gunnison (GMUG)
National Forests
Gunnison Ranger District
216 N Colorado Street
Gunnison, CO 81230

Design Engineer
Atkinson-Noland & Associates, Inc.
2619 Spruce Street
Boulder, CO 80302

METRIC TO U.S. CUSTOMARY CONVERSION FACTORS (approximate)				
Symbol	**When You Know**	**Multiply By**	**To Find**	**Symbol**
LENGTH				
μm	micrometers	3.9×10^{-5}	inches	in
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
AREA				
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
VOLUME				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.31	cubic feet	ft^3
m^3	cubic meters	1.308	cubic yards	yd^3
MASS				
g	grams	0.035	ounces	oz
kg	kilograms	2.2046	pounds	lb
Mg	megagrams	1.1023	short tons	T
(or "t")	(or "metric ton")		(2000 lb)	
TEMPERATURE (exact)				
°C	Celsius temperature	1.8C +32	Fahrenheit temperature	°F
ILLUMINATION				
lx	lux	0.0929	foot-candles	fc
cd/m^2	candela/m^2	0.2919	foot-Lamberts	fl
MISCELLANEOUS				
J	joule	0.7376	foot·poundforce	ft·lbf
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	Poundforce per square inch	lbf/in^2

TABLE OF CONTENTS

DIVISION 100
GENERAL REQUIREMENTS

Section 101. — TERMS, FORMAT, AND DEFINITIONS

101.01 Meaning of Terms. These specifications are generally written in the imperative mood. In sentences using the imperative mood, the subject, "*the Contractor*", is implied. Also implied in this language are "*shall*", "*shall be*", or similar words and phrases. In material specifications, the subject may also be the supplier, fabricator, or manufacturer supplying material, products, or equipment for use on the project.

Wherever "*directed*", "*required*", "*prescribed*", *or* "*ordered*" are used, the "*direction*", "*requirement*", "*prescription*", or "*order*" of the NFF is intended. Wherever something is to be "*submitted*", "*submitting to*", the NFF is intended. Similarly, wherever "*approved*", "*acceptable*", "*suitable*", "*satisfactory*", or similar words are used, the words mean "*approved by*", "*acceptable to*", or "*satisfactory to*" the NFF.

The word "*will*" generally pertains to decisions or actions of the NFF.

101.02 Specifications Format. These specifications are divided into 10 Divisions.

Division 100 consists of general contract requirements for which no direct payment is made. The requirements contained in Division 100 are applicable to all contracts.

Division 150 consists of project contract requirements that are applicable to all contracts. Work under Division 150 is paid for directly or indirectly according to Subsection 109.05 and the Section ordering the work. When there is no pay item in the bid schedule, no direct payment is made.

Divisions 200 through 600 consist of construction contract requirements for specific items of work. Work under these Divisions is paid for directly or indirectly according to Subsection 109.05 and the Section ordering the work. When there is no pay item in the bid schedule, no direct payment is made.

Division 700 contains the material requirements for Divisions 150 through 600. No direct payment is made in Division 700. Payment for material is included as part of the work required in Divisions 150 through 600.

The first three digits of the pay item number in the bid schedule identify the Section under which the work is performed.

101.03 Abbreviations. Whenever these abbreviations are used in the contract, they represent the following:

(a) Acronyms.

AASHTO — American Association of State Highway and Transportation Officials

ASTM — ASTM International

ATSSA — American Traffic Safety Services Association

CFR — Code of Federal Regulations

FHWA — Federal Highway Administration

FLH — Federal Lands Highway

MASH — Manual for Assessing Safety Hardware

MSDS — Material Safety Data Sheet

MUTCD — Manual on Uniform Traffic Control Devices for Streets and Highways

NCHRP — National Cooperative Highway Research Program

NFF — National Forest Foundation authorized representatives

NIST — National Institute of Standards and Technology

OSHA — Occupational Safety and Health Administration

PVC — Polyvinyl Chloride

SF — Standard Form

SWPPP — Storm Water Pollution Prevention Plan

U.S. — United States of America

(b) U.S. Customary unit abbreviations and symbols.

°F	—	degree Fahrenheit	temperature
ft	—	feet	length
ft²	—	square feet	area
ft³	—	cubic feet	volume
in	—	inches	length
in²	—	square inches	area
in³	—	cubic inches	volume
lb	—	pound	mass
mi	—	mile	length
oz	—	ounces	mass
psi	—	pounds per square inch	pressure
T	—	ton (2000 lb)	mass
yd	—	yards	length
yd²	—	square yards	area
yd³	—	cubic yards	volume
s	—	second	time
°	—	degree	plane angle
'	—	minute	plane angle
"	—	second	plane angle

(c) Metric unit abbreviations and symbols.

A	—	ampere	electric current
cd	—	candela	luminous intensity
°C	—	degree Celsius	temperature
d	—	day	time

g	—	gram	mass
H	—	Henry	inductance
ha	—	hectare	area
Hz	—	hertz (s^{-1})	frequency
J	—	joule (N•m)	energy
K	—	kelvin	temperature
kg	—	kilogram	mass
L	—	liter	volume
lx	—	lux	illuminance
m	—	meter	length
mm	—	millimeter	length
m^2	—	square meter	area
m^3	—	cubic meter	volume
min	—	minute	time
N	—	newton ($kg•m/s^2$)	force
Pa	—	pascal (N/m^2)	pressure
t	—	metric ton	mass
V	—	volt (W/A)	electric potential
W	—	watt (J/s)	power
Ω	—	ohm V/A	electric resistance

(d) Metric prefix symbols

E	—	exa	10^{18}
P	—	peta	10^{15}
T	—	tera	10^{12}
G	—	giga	10^{9}
M	—	mega	10^{6}
k	—	kilo	10^{3}
c	—	centi	10^{-2}
m	—	milli	10^{-3}
μ	—	micro	10^{-6}
n	—	nano	10^{-9}
p	—	pico	10^{-12}
f	—	femto	10^{-15}
a	—	atto	10^{-18}

(e) Slope notation (vertical : horizontal). For slopes flatter than 1V:1H, express the slope as the ratio of one unit vertical to a number of units horizontal. For slopes steeper than 1V:1H, express the slope as the ratio of a number of units vertical to one unit horizontal.

101.04 Definitions. The following definitions apply to this contract:

Backfill — Material used to replace or the act of replacing material removed during construction. Material placed or the act of placing material adjacent to structures.

Base — The layer or layers of material placed on a subbase or subgrade to support a surface course.

Bridge — A structure, including supports, erected over a depression or an obstruction such as water along a road, a trail, or a railway and having a deck for carrying traffic or other loads.

Clear Zone — The portion of the roadside, including the shoulder, available for the safe use by an errant vehicle in which the driver may regain control of the vehicle.

Commercial Certification — See Subsection 106.03.

Construction Limits — The limits on each side of the project that establish the area disturbed by construction operations and beyond which no disturbance is permitted. Typically the construction limits are the same as the clearing limits, except when additional clearing is required.

Contractor — The individual or legal entity contracting with the NFF for performance of prescribed work.

Crashworthy — A highway feature that has been successfully crash tested under MASH or the NCHRP Report 350, *Recommended Procedures for the Safety Performance Evaluation of Highway Features*, or accepted through analysis by FHWA based on similarity to other crashworthy features.

Cross-Section — A vertical section of the ground or structure at right angles to the centerline or baseline of the roadway or other work.

Culvert — Any structure with a bottom, regardless of fill depth, depth of invert burial, or presence of horizontal driving surface, or any bottomless (natural channel) structure with footings that will not have wheel loads in direct contact with the top of the structure.

Day — A calendar day beginning and ending at midnight.

Density — Mass per unit volume of material. Specific gravity multiplied by the density of water.

Detour — A temporary rerouting of public traffic onto alternate existing roadways to avoid the work or part of the work.

Diversion — Defined as follows:

(a) A temporary rerouting of public traffic onto a temporary alignment within the project limits to bypass the work or a portion of the work.

(b) A temporary rerouting of water into a temporary channel or through a system of structures within the project limits to maintain water flow through or around the project.

Drawings — (Public Works Contracts) Design sheets or fabrication, erection, or construction details submitted to the NFF by the Contractor. Also refers to submissions and submittals.

Forest Service – The United States of America, acting through the Forest Service, U.S. Department of Agriculture.

Federal Land Management Agencies — Federal agencies including the National Park Service, U.S. Forest Service, U.S. Fish & Wildlife Service, U.S. Army Corps of Engineers, Bureau of Land Management, and Bureau of Reclamation.

Government — The Government of the United States of America.

Highway, Street, or Road — A general term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way.

Lane Mile (Lane Kilometer) — An area of pavement one mile (kilometer) long and one lane wide; not including turn lanes, turnouts, parking area lanes, or other auxiliary lanes.

Layer — See "lift".

Lift — Defined as follows:

(a) When placing and compacting soils, aggregates, or pavement; a lift is a single, continuous layer of material that receives the same compactive effort throughout during a single work operation.

(b) When installing culvert pipe less than or equal to 48 inches (1200 millimeter) in diameter; the backfill material placed on both sides of the pipe is considered to be contained in the same lift when the material is placed to the same elevation on both sides of the culvert, the compactive effort applied to one side of the culvert is the same as that applied to the other, and the compactive effort is applied to both sides of the pipe in a continuous operation.

Material — Substances specified or necessary to satisfactorily complete the contract work.

Measurement — The process of identifying the dimensions, quantity, or capacity of a pay item. See Section 109 for measurement methods, terms, and definitions.

Mechanically Stabilized Earth (MSE) – Soil backfill installed in lifts with integral geotextile reinforcement each lift.

Neat Line – A line defining the proposed or specified limits of an excavation or structure.

NFF Representative (NFF) — An official of the National Forest Foundation with the authority to enter into, administer, and terminate contracts and make related determinations and findings. The term includes certain authorized representatives of the NFF acting within the limits of their authority as delegated by the NFF.

Pavement Structure — The combination of subbase, base, paving geotextiles, and surface courses placed on a subgrade to support and distribute the traffic load to the roadbed.

Pay Item — A specific item of work for which a unit and price is provided in the contract.

Pioneer Road – Temporary construction access built along the route of the project.

Plans — The contract plans furnished by the NFF showing the location, type, dimensions, and details of the work.

Production Certification — See Subsection 106.03.

Professional Engineer — Engineers holding valid state licenses permitting them to offer engineering services directly to the public. Engineers that are experienced in the work for which they are responsible, take legal responsibility for their engineering designs, and are bound by a code of ethics to protect the public health.

Profile Grade — The trace of a vertical plane intersecting a particular surface of the proposed road construction located according to the plans, usually along the longitudinal centerline of the roadbed. Profile grade means either elevation or gradient of the trace according to the context.

Project — The specific section of the highway or other property on which construction is to be performed under the contract.

Protected Stream Course – A drainage shown on the plans or timber sale area map that requires designated mitigation measures.

Right-of-Way — A general term denoting (1) the privilege to pass over land in some particular line (including easement, lease, permit, or license to occupy, use, or traverse public or private lands), or (2) Real property necessary for the project, including roadway, buffer areas, access, and drainage areas.

Road Order – an order affecting and controlling traffic on roads under Forest Service jurisdiction. Road Orders are issued by a designated Forest Officer under the authorities of 36 CFR, part 260.

Roadbed — The graded portion of a highway prepared as a foundation for the pavement structure and shoulders.

Roadside — The area between the outside shoulder edge and the right-of-way limits. The area between roadways of a divided highway may also be considered roadside.

Roadway — In general, the portion of a highway, including shoulders, for vehicular use. A divided highway has two or more roadways. In construction specifications, the portion of a highway within the construction limits.

Roadway Prism — The volume defined by the area between the original terrain cross-section and the final design cross-section multiplied by the horizontal distance along the centerline of the roadway.

Roller Pass — One trip of a roller in one direction over one spot.

Shop Drawings – Referred to as "Drawings" in this specification, including drawings, diagrams, layouts, schematics, descriptive literature, illustrations, lists or tables, performance and test data, and similar materials furnished by Purchaser to explain in detail specific portions of the work required by the contract.

Shoulder — A portion of the roadway contiguous with the traveled way that accommodates pedestrians, bicycles, stopped vehicles, and emergency use; as well as for lateral support of the subbase, base, and surface courses.

Sieve — See AASHTO M 92.

Solicitation — (Public Works Contracts) The complete assembly of documents (whether attached or incorporated by reference) furnished to prospective bidders.

Special Contract Requirements (SCR) — Additions and revisions to the standard specifications applicable to an individual project.

Specifications — The written requirements for performing work.

Standard Forms (SF) — Numbered forms issued by the General Services Administration for use as contract documents.

Standard Specifications — The Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects approved for general application and repetitive use.

Station — A precise location along a survey line.

Structures — Bridges, culverts, catch basins, drop inlets, retaining walls, cribbing, manholes, endwalls, buildings, sewers, service pipes, underdrains, foundation drains, and other constructed features that may be encountered in the work.

Subbase — The layer or layers of material placed on a subgrade to support a base.

Subcontract — The written agreement between the Contractor and an individual or legal entity prescribing the performance of a specific portion of the work.

Subcontractor — An individual or legal entity with which the Contractor sublets part of the work. This includes subcontractors in all tiers.

Subgrade — The top surface of a roadbed upon which the pavement structure, shoulders, and curbs are constructed.

Substantial Completion — The point at which the project is complete such that it can be safely and effectively used by the public without further delays, disruption, or other impediments. For conventional bridge and highway work, the point at which bridge deck, parapet, pavement structure, shoulder, drainage, sidewalk, major demolition, roadway obliteration, permanent signing and markings, traffic barrier, safety appurtenance, utility, and lighting work is complete.

Substructure — Components of a bridge below the bearings of simple and continuous spans, skewbacks of arches, and tops of footings of rigid frames including backwalls, wingwalls, and wing protection railings.

Suitable Material — Rock or earth material that will provide stable foundations, embankments, or roadbeds, and is free of organic matter, muck, frozen lumps, roots, sod, or other deleterious material. Suitable material may require drying or adding water, root picking, and other methods of manipulation before use. Suitable material includes the classifications of material for which the project was designed.

Superintendent — The Contractor's onsite representative who has authority to act for the Contractor and is responsible for directing and supervising construction operations on behalf of the Contractor.

Superstructure — The entire bridge, except the substructure.

Surface Course — The top layer or layers of a pavement structure designed to accommodate the traffic load and resist skidding, traffic abrasion, and weathering.

Target Value — A number established as a center for operating a given process. Once established, adjustments should be made in the process as necessary to maintain a central tendency about the target value. Test results obtained from a well-controlled process should cluster closely around the established target value and the mean of the test results should be equal to or nearly equal to the established target value.

Traveled Way — The portion of the roadway designated for the movement of vehicles, exclusive of shoulders.

Unsuitable Material — Material not capable of creating stable foundations, embankments, or roadbeds. Unsuitable material includes muck, sod, or soils with high organic contents.

Work — The furnishing of labor, material, equipment, and other incidentals necessary to complete the project according to the contract.

Section 102. — BID, AWARD, AND EXECUTION OF CONTRACT

Section not used. Refer to National Forest Foundation Contract

Section 103. — SCOPE OF WORK

Section not used. Refer to National Forest Foundation Contract

Section 104. — CONTROL OF WORK

104.01 Authority of the NFF Contracting Officer (NFF). The NFF may delegate authority to representatives to decide on acceptability of work, progress of work, suspension of work, interpretation of the contract, and acceptable fulfillment of the contract. The term "*NFF*" includes authorized representatives of the NFF, including inspectors, acting within the limits of their authority as delegated by the NFF.

104.02 Authority of Inspectors. Inspectors are authorized to inspect work including the preparation, fabrication, or manufacture of material for the project. The inspector is not authorized to alter or waive contract requirements, issue instruction contrary to the contract, act as foreman for the Contractor, or direct the Contractor's operations. The inspector has authority to identify non-conforming work until the issue can be referred to and decided by the NFF. The inspector may take necessary action to prevent imminent and substantial risk of death or injury including stopping work.

104.03 Specifications and Drawings.

(a) General. Review and submit documents required to construct the work for accuracy, completeness, and compliance with the contract for approval by the NFF. Documents submitted without evidence of Contractor approval may be returned for resubmission. Time for approval starts over when documents are returned for revision or if additional information is requested by the NFF. Do not perform work related to submitted documents or drawings before approval of the NFF. Obtain written approval before changing or deviating from the approved drawings.

(1) Documents other than drawings. Documents other than drawings include descriptive literature, illustrations, schedules, performance and test data, and similar material submitted by the Contractor to certify or explain, in detail, specific portions of the work required by the contract. Unless otherwise indicated in the contract, submit 3 paper copies and an electronic copy for review. Allow 14 days for approval by the NFF unless otherwise specified. Contractor shall provide itemized cost schedule, based on unit prices, as a supplement to the bid

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(2) Drawings. Drawings include:

(a) Layouts that show the relative position (vertical and horizontal as appropriate) of work to be performed;

(b) Fabrication details for manufactured items and assemblies;

(c) Installation and erection procedures;

(d) Details of post-tensioning and other systems;

(e) Detailed trench and excavation procedures that conform to OSHA requirements;

(f) Traffic control implementation drawings; and

(g) Methods for performing work near existing structures or other areas to be protected.

Show drawing dimensions in the same units as shown in the plans. Limit drawings to a maximum size of 24 by 36 inches (610 by 920 millimeters). Include on each drawing and calculation sheet, the project number, name, and other identification as shown in the contract.

Submit 3 paper sets of drawings, an electronic set of the drawings, and supporting calculations. Drawings will be reviewed in the order they are received. Allow 40 days for NFF approval of railroad structure drawings and 30 days for approval of other drawings. Submit additional specific drawings for unique situations to clarify layout, construction details, or method when requested by the NFF.

(b) Specific requirements for concrete and miscellaneous structures. Section not used.

(c) As-built drawings. Use one set of NFF-provided plans exclusively for as-built drawings. Use the color "*red*" to identify changes. Use approved methods to accurately and neatly record changes. Include details and notes on additional information discovered during construction. Note additions or revisions to the location, character, and dimensions of work. Strikeout details shown that are not applicable to the completed work.

As work progresses, continuously update plan sheets to reflect the as-built details. Check and initial plan sheets that were incorporated into the completed work without change. Include the following:

(1) Title sheet.

(a) "AS-BUILT DRAWINGS" (bold text);

(b) Name of Contractor;

(c) Name of NFF's on-site representative;

(d) Project completion date;

(e) Revisions to project length;

(f) Revisions to begin and end stations of project;

(h) Revisions to index to sheets;

(i) Revisions to curve widening table;

(j) Strikeout schedules or options not awarded;

(k) A note stating "Work was constructed as designed unless otherwise noted."; and

(l) Plan notes.

(2) Typical section sheets.

(a) Revisions in dimensions;

(b) Revisions in material;

(c) Revisions in station range;

(d) Revisions to begin and end stations of project; and

(e) Strikeout schedules or options not awarded.

(3) Summary of Quantities and tabulation sheets.

(a) Revisions to quantities, locations, notes/remarks, including totals;

(b) Strikeout unused pay items;

(c) Revisions to application rates; and

(d) Revisions to location, type, end treatments, riprap, and skew on the drainage summary.

(4) Plan and profile sheets. Note additions or revisions to the location, character, and dimensions of the following items:

(a) Plan.

(1) Alignment information;

(2) Construction limits;

(3) Right-of-way;

(4) Sub-excavation;

(5) Channels and ditches;

(6) Monuments and permanent references;

(7) Walls.

(b) Profile.

(1) Grades, elevations, and stationing of points of intersection;

(2) Equations;

(3) Walls; and

(4) Drainage ditches

(5) Bridge sheets. Section not used.

(6) Miscellaneous sheets. Note additions or revisions to the location, character, and dimensions of the following items:

(a) Parking areas and turnouts;

(b) Landscaping and planting;

(c) Signs;

(d) Permanent erosion control measures; and

(e) Plan notes.

(7) Standard and detail sheets. Note the additions or revisions to the character and dimensions of details.

Retain the drawings at the project site.

Keep the as-built drawings current and maintain a revision log of changes made. Meet with the NFF to jointly review the as-built drawings and log for accuracy, completeness, and legibility before submission of each monthly invoice.

Submit the final as-built drawings and revision logs before the final inspection. Correct errors and omissions found during the final inspection and resubmit the final as-built drawings for approval within 7 days after the final inspection.

When the final as-built drawings are approved, submit the finalized set of as-built drawings and a single file, electronic color copy of the drawings. Submit the electronic copy in an approved format on a CD-R, DVD-R, or other approved electronic media. Include the latest version of the approved reader on the electronic media. Provide a resolution quality where color, text, and lines are clearly discernible.

104.04 Coordination of Contract Documents. The special contract requirements, plans, and standard specifications are contract documents. A requirement in one document is binding as though occurring in all the contract documents. The contract documents are intended to be complementary and to describe and provide for a complete contract. In case of discrepancy, calculated and shown dimensions govern over scaled dimensions. The contract documents govern in the following order:

(a) Special contract requirements;

(b) Plans; and

(c) Standard specifications.

104.05 Load Restrictions.

The roadway to the site is intended for use by Off-Highway Vehicles and may not be suitable for heavy construction equipment. Contractor is responsible for verifying adequacy of roadway for construction travel.

Do not operate equipment with axle weights in excess of 32,000 lb. at roadways adjacent to historic wall sections. Comply with legal load restrictions when hauling material and equipment on public roads and bridges to and from the project. A special permit does not relieve the Contractor of liability for damage resulting from the moving of material or equipment.

Unless otherwise permitted, do not operate equipment or vehicles that exceed the legal load limits over new or existing structures, or pavements within the project; except those pavements to be removed during the same construction season.

104.06 Use of Roads by Contractor. The Contractor is authorized to use roads under the jurisdiction of the Forest Service for all activities necessary to complete this contract, subject to the limitations and authorizations designated in the Road Order(s) or described in the contract, when such use will not damage the roads or national forest resources, and when traffic can be accommodated safely.

Section 105. — CONTROL OF MATERIAL

105.01 Source of Supply and Quality Requirements. Select sources and submit acceptable material. Notify the NFF of proposed sources before delivery to the project to expedite material inspection and testing. Do not incorporate material requiring submittal into the work until approved.

Material may be approved at the source of supply before delivery to the project. Approval of a material source does not constitute acceptance of material submitted from the source. If an approved source fails to supply acceptable material during the life of the project, further use of that source may be denied.

Submit samples of material for source quality verification testing for material required to conform to Sections 703 and 705.

105.02 Material Sources.

(a) NFF-provided sources. The NFF will acquire the permits and rights to remove material from provided sources identified in the contract and to use such property for a plant site and stockpiles. Test reports and available historical material data will be furnished to the Contractor upon request.

Do not perform work within a source until a source development plan is approved. Allow 7 days for approval. Include the following as applicable:

(1) Requirements of written agreements;

(2) Requirements in Sections 204;

(3) Source development details;

(4) Restoration details; and

(5) Abandonment details.

Perform work necessary to produce acceptable material including work required by the approved source development plan.

The quality of material is generally acceptable. Variations in quality should be expected as it is not feasible to ascertain the quality of material for an entire deposit from exploratory samples. Determine the quantity, type of equipment, and work necessary and produce acceptable material to be incorporated into the work. Do not perform aggregate source quality tests listed in the Sampling, Testing, and Acceptance Requirements table of other Sections when using NFF-provided sources. Perform quality control sampling and testing according to the approved Contractor Quality Control Plan in Section 153 and the applicable Sampling, Testing, and Acceptance Requirements tables included at the end of each Section. Allow the NFF the opportunity to witness sampling and splitting of the test material.

(b) NFF-provided material stockpile. The quality of the material in the stockpile has been preapproved unless otherwise noted and is considered acceptable for the application for which it has been designated. Perform quality control sampling and testing according to the approved Contractor Quality Control Plan in Section 153 and the applicable Sampling, Testing, and Acceptance Requirements table included at the end of each Section. Test results submitted will be for the NFF's information only. Allow the NFF the opportunity to witness sampling and splitting of the test material.

(c) Contractor-located sources. The Contractor is responsible for Contractor-located material sources, including established commercial material sources. Use sources that fulfill the contract quantity and quality requirements. Determine the quantity, type of equipment, and work necessary to select and produce an acceptable material. Secure permits and clearances for use of the source and submit copies of the documents to the NFF. Submit available historical data indicating acceptable material can be produced from the source. Perform quality control sampling and testing according to the approved Contractor Quality Control Plan in Section 153, aggregate source quality tests, and applicable Sampling, Testing, and Acceptance Requirements table included at the end of each Section. Allow the NFF the opportunity to witness sampling and splitting of the test material.

105.03 Material Source Management. Notify the NFF at least 14 days before starting operations in the source. Develop and operate according to the approved source development plan for NFF-provided sources or written agreement for Contractor-located sources.

Before developing a material source, measure the sediment content of bodies of water adjacent to the work area that will receive drainage from the work area. Perform erosion and sediment control according to the source development plan and the "*Storm Water Pollution Prevention Plan (SWPPP)*" or "*Erosion Control Plan*".

Do not remove material measured in-place from borrow sources or NFF-provided stockpiles until initial ground survey measurements have been taken according to Subsection 204.13(b) and approved. Perform final ground survey measurements according to Subsection 204.13(b).

Dispose of rejected material in an approved manner.

105.04 Handling and Storing Material. Handle and store material to preserve its quality and fitness for the work. Stored material approved before storage may again be inspected before use in the work. Locate stored material to facilitate prompt inspection.

Use only approved portions of the right-of-way for storing material or equipment. Provide additional space as needed. Do not use private property for storage without written permission of the owner or lessee. Submit copies of agreements and documents.

Provide security for stored material.

Restore NFF-provided storage sites to their original condition.

105.05 Use of Material Found in the Work. Stone, gravel, sand, or other material found in the excavation may be used for another pay item when approved. If material found in the excavation is used for another pay item, material will be paid both as excavation and as the other pay item for which it is used. Replace excavation used with acceptable material at no cost to the NFF. Excavate or remove material only from within the grading limits, as indicated by the slope and grade lines.

The right to use and process material found in the work excludes the use and processing of material for nongovernment contract work, except for the disposal of waste material. If the Contractor produces or processes material from Government lands in excess of the quantities required for the contract, the NFF may:

(a) Take possession of the excess material and direct its use, paying the Contractor only for the cost of production or

(b) Require removal of the material and restoration of the land to a satisfactory condition at no cost to the NFF.

105.06 Material Source Restoration. Restore NFF-provided sources according to the approved source development plan. Restack the unused portion of the NFF-provided stockpiles upon completion of the work at no cost to the NFF. Do not measure restoration of material sources for payment.

Restore areas where stone has been removed for use on the project to minimize visual impacts by placing stones with weathered surfaces facing upwards and outwards. Newly cut or split surfaces should be placed facing downwards or away from the roadway.

Section 106. — ACCEPTANCE OF WORK

106.01 Conformity with Contract Requirements.

References to standard test methods of AASHTO, ASTM, GSA, and other recognized standard authorities refer to the methods in effect on the date of solicitation for bids.

Perform all work to the lines, grades, cross-sections, dimensions, and processes or material requirements shown in the contract.

Incorporate manufactured material into the work according to the manufacturer's recommendations or to these specifications, whichever is stricter.

Plan dimensions and contract specification values are the values to be strived for and complied with as the design values from which deviations are allowed. Perform work and provide material that is uniform in character and reasonably close to the prescribed value or within the specified tolerance range. The purpose of a tolerance range is to accommodate occasional minor variations from the median zone that are unavoidable for practical reasons.

When standard manufactured items are specified (such as fence, wire, plates, rolled shapes, and pipe conduits that are identified by gauge, density, or section dimensions) the identification will nominal masses or dimensions. Unless specific contract tolerances are noted, established manufacturing tolerances will be accepted.

The NFF may inspect, sample, or test work before final acceptance of the project. When the NFF tests work, copies of test reports are furnished to the Contractor upon request. NFF tests may or may not be performed at the work site. If Contractor testing and inspection is verified by the NFF, the Contractor's results may be used by the NFF to evaluate work for acceptance. Do not rely on the availability of NFF test results for process control.

Acceptable work conforming to the contract will be paid for at the contract unit bid price. Four methods of determining conformity and accepting work are described in Subsections 106.02 to 106.05 inclusive. The primary method of acceptance is specified in each Section of work. However, work may be rejected at any time it is found by any of the methods not to comply with the contract.

Remove, repair, or replace work that does not conform to the contract, or to prevailing industry standards where no specific contract requirements are noted. Removing, repairing, or replacing work; providing temporary traffic control; and any other related work to accomplish conformity will be at no cost to the NFF.

(a) Disputing NFF test results. If the accuracy of NFF test results is disputed, promptly inform the NFF. If the dispute is unresolved after reasonable steps are taken to resolve the dispute, further evaluation may be obtained by written request. Include a narrative describing the dispute and a proposed resolution protocol that addresses the following:

1. Sampling method
2. Number of samples
3. Sample transport
4. Test procedures
5. Testing laboratories

6. Reporting
7. Estimated time and costs
8. Validation process

If the evaluation requires additional sampling or testing be performed, mutually agree with the NFF on witnessing procedures and on sampling and testing by a third-party laboratory. Use a third-party laboratory accredited by the AASHTO accreditation program. Provide proof of the laboratory's accreditation for the test procedures to be used. Do not use the same laboratory that produced the disputed NFF test results or that produced the test results used as a basis for the dispute.

The NFF will review the proposed resolution protocol and may modify it before final approval and execution.

The NFF will use the approved resolution protocol test results to determine the validity of the disputed testing. If the NFF test results are validated, the Contractor will be responsible for all costs associated with developing and performing the resolution protocol. If the NFF test results are not validated, the NFF will be responsible for all costs associated with developing and performing the resolution protocol. If the validity of the NFF test results cannot be determined, the Contractor and NFF will equally share all costs associated with developing and carrying out the resolution protocol.

(b) Alternatives to removing and replacing non-conforming work. As an alternative to removal and replacement, the Contractor may submit a written request to:

1. Have the work accepted at a reduced price; or
2. Be given permission to perform corrective measures to bring the work into conformity.

The request must contain supporting rationale and documentation. Include references or data justifying the proposal based on an evaluation of test results, effect on service life, value of material or work, quality, aesthetics, and other tangible engineering basis. The NFF will determine disposition of the nonconforming work.

106.02 Visual Inspection. Acceptance is based on visual inspection of the work for compliance with the specific contract requirements. Use prevailing industry standards in the absence of specific contract requirements or tolerances.

106.03 Certification. Section not used.

106.04 Measured or Tested Conformance. Perform necessary measurements and tests to ensure work complies with the contract.

Use prevailing industry standards in the absence of contract requirements or tolerances.

Submit measurements, tests, and supporting data for acceptance.

106.05 Statistical Evaluation of Work and Determination of Pay Factor. Section not used.

106.07 Partial and Final Acceptance. Maintain the work during construction and until the project is accepted. Repair damage caused by the Contractor before final acceptance of the entire project at no cost to the NFF.

(a) Partial acceptance. When a segment of the project is completed, a final inspection of that segment may be requested. If the segment is complete and in compliance, it may be accepted. If accepted, the NFF may relieve the Contractor of further responsibility for maintaining accepted work

When public traffic is accommodated through construction and begins using sections of roadway as they are completed, continue maintenance of such sections until final acceptance.

(b) Final acceptance. Notify the NFF when the entire project is complete to schedule an inspection. If work is determined to be complete, the inspection will constitute the final inspection. The Contractor will be notified in writing of final acceptance as of the date of the final inspection. Final acceptance relieves the Contractor of further responsibility for the maintenance of the project.

If the inspection discloses unsatisfactory work, the NFF will provide to the Contractor a list of the work that is incomplete or requires correction. Immediately complete or correct the work. Submit notification when the work has been completed as provided above.

Section 107. — LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

Section not used.

Section 108. — PROSECUTION AND PROGRESS

Section deleted per GMUG Roadway Maintenance Forest Service Supplemental Specifications (FSSS).

Section 109. — MEASUREMENT AND PAYMENT

109.01 Measurement of Work. Take and record measurements and perform calculations to determine pay quantities for invoicing for work performed. Take or convert measurements of work according to U.S. Customary (Metric) measure.

Unless otherwise specified, measure when the work is in-place and complete according to the contract. Measure the actual work performed, except do not measure work outside the design limits or other adjusted or specified limits (staked limits). Measure structures to the lines according to the plans or to approved lines adjusted to fit field conditions.

Take measurements as described in Subsection 109.02 unless otherwise modified by the Measurement Subsection of the Section controlling the work being performed. Measurement of quantities for payment for the individual pay items will be based on the contract price for each pay item according to Table 109-1.

Table 109-1
Decimal Accuracy of Quantities for Payment

Contract Price	Decimal Accuracy of Quantities for Payment
< $1.00	0 decimal
≥ $1.00 to < $100.00	1 decimal
≥ $100.00 to < $1000.00	2 decimals
≥ $1000.00	3 decimals

Decimal precision for measurement is one decimal beyond accuracy of quantities for payment.

Remeasure quantities if it has been determined that a portion of the work is acceptable, but has not been completed to the lines, grades, and dimensions shown in the plans or established by the NFF.

Use an acceptable format for measurement records. As a minimum, include the following information

(a) Project number and name;

(b) Pay item number and description;

(c) Date the work was performed;

(d) Location of the work;

(e) Measured quantity;

(f) Calculations made to arrive at the quantity;

(g) Supporting sketches and details as needed to clearly define the work performed and the quantity measured;

(h) Names of persons measuring the work;

(i) Identification as to whether the measurement is interim or final; and

(j) Signed certification statement by the persons taking the measurements and performing the calculations, that the measurements and calculations are correct.

109.02 Measurement Terms and Definitions. Unless otherwise specified, the following terms are defined as follows:

(a) Acre (Hectare). 43,560 square feet (10,000 square meters). Make longitudinal and transverse measurements for area computations horizontally. Do not make deductions from the area computation for individual fixtures having an area of 500 square feet (50 square meters) or less.

(b) Contract quantity. The quantity to be paid is the quantity listed in the bid schedule. The contract quantity will be adjusted only when there are errors in the original design of 15% or more. If there is evidence that a quantity specified as a contract quantity is incorrect, submit calculations, drawings, or other evidence indicating why the quantity is in error and request in writing that the quantity be adjusted.

(c) Cubic yard (Cubic meter).

(1) Cubic yard (Cubic meter) in-place. Measure solid volumes by a method approved by the NFF or by the average end area method as follows:

(a) Take cross-sections of the original ground and use design or staked templates to determine end areas. Do not measure work outside of the lines or slopes established by the NFF;

(b) If a portion of the work is acceptable, but is not completed to the established lines and slopes; retake cross-sections or comparable measurements of that portion of the work. Use the remeasurements to calculate new end areas; and

(c) Compute the quantity using the average end areas multiplied by the horizontal distance along a centerline or reference line between the end areas. Deduct quantities outside the designed or staked limits.

(2) Cubic yard (Cubic meter) in the hauling vehicle. Measure the cubic yard (cubic meter) volume in the hauling vehicle using three-dimensional measurements at the point of delivery. Use vehicles bearing a legible identification mark with the body shaped so the actual contents may be readily and accurately determined. Before use, mutually agree in writing on the volume of material to be hauled by each vehicle. Vehicles carrying less than the agreed volume may be rejected or accepted at the reduced volume.

Level selected loads. If leveling reveals the vehicle was hauling less than the approved volume, reduce the quantity of all material received since the last leveled load by the same ratio as the current leveled load volume is to the agreed volume. Payment will not be made for material in excess of the agreed volume.

Material measured in the hauling vehicle may be weighed and converted to cubic yards (cubic meters) for payment purposes if the conversion factors are mutually agreed to in writing.

(3) Cubic yard (Cubic meter) in the structure. Measure according to the lines of the structure as shown in the plans, except as altered by the NFF to fit field conditions. Make no deduction for the volume occupied by reinforcing steel, anchors, weep holes, piling, or pipes less than 8 inches (200 millimeters) in diameter.

(4) Cubic yard (Cubic meter) by metering. Use an approved metering system.

(d) Day. A calendar day beginning and ending at midnight. Round portions of a day up to the full day.

(e) Each. One entire unit. Measure the actual number of units completed and accepted.

(f) Gallon (Liter). The quantity may be measured by the following methods:

(1) Measured volume container.

(2) Metered volume. Use an approved metering system.

(3) Commercially packaged volumes.

(4) Measured by mass. Use an approved weighing device.

(g) Hour. 60 minutes. Measure the actual number of hours ordered by the NFF and performed by the Contractor. Round portions of an hour up to the next half hour. Measure time in excess of 40 hours per week at the same rate as the first 40 hours.

(h) Linear foot (Meter). As applicable, measure the work along its length from end-to-end; parallel to the base or foundation; along the top; along the front face; or along the invert. Do not measure overlaps.

(i) Lump sum. Do not measure directly. The bid amount is complete payment for all work described in the contract and necessary to complete the work for that pay item. The quantity is designated as "*All*". Estimated quantities of lump sum work shown in the contract are approximate.

(j) M-gallon. 1,000 gallons. Measure according to Subsection 109.02(f).

(k) Mile (Kilometer). 5,280 linear feet (1000 meters). Measure horizontally along the centerline of each roadway, approach road, or ramp.

(l) Month. A month as defined by the Gregorian calendar. Measure portions of a month by prorating based on the total days worked.

(m) Pound (Kilogram). Measure according to Subsection 109.03. If sacked or packaged material is furnished, the net weight as packed by the manufacturer may be used.

(n) Slurry unit. Approximately 1,000 gallons (4000 liters) of water plus the specified material. Four (ten) slurry units contain material to cover one acre (hectare). Measure according to Subsection 109.02(f).

(o) Square foot and Square yard (Square meter). 1 square yard equals 9 square feet. Measurements for area computations will be made horizontally or vertically to the surface being measured. No deductions from the area computation will be made for individual fixtures having area of 9 square feet (1 square meter) or less.

(p) Thousand board feet measure, MFBM. 1000 board feet. Measurement equal to 1,000 feet of wood that is 12 inches wide and 1 inch thick.

(q) Ton (Metric ton). 2,000 pounds avoirdupois (1000 kilograms). Measure according to Subsection 109.03.

No adjustment in a contract price will be made for variations in quantity due to differences in the specific gravity or moisture content.

Use net-certified scale masses or masses based on certified volumes in the case of rail shipments as a basis of measurement subject to correction when asphalt material is lost from the car or the distributor, wasted, or otherwise not incorporated in the work. When asphalt material is shipped by truck or transport, net-certified masses, subject to correction for loss or foaming, may be used for computing quantities.

(r) Week. A 7 day period beginning and ending at the same designated time. Measure portions of a week by prorating based on the total days worked.

109.03 Weighing Procedures and Devices. Batch masses may be acceptable for determination of pay quantities when an approved automatic weighing, cycling, and monitoring system is included as part of the batching equipment.

When a weighing device is determined to indicate less than true mass; no additional payment will be made for material previously weighed and recorded. When a weighing device is determined to indicate more than true mass; material received after the last previously correct weighing accuracy test will be reduced by the percentage of error in excess of 0.5 percent.

When material is proportioned or measured and paid for by mass, provide one of the following:

(a) Commercial weighing system. Use permanently-installed and certified commercial scales.

(b) Invoices. If bulk material is shipped by truck or rail and is not passed through a mixing plant, submit a supplier's invoice with net mass or volume converted to mass. Periodic check weighing may be required.

(c) Project weighing system. Furnish, erect, and maintain acceptable automatic digital scales. Provide scales that record mass at least to the nearest 100 pounds (50 kilograms). Maintain the scale accuracy to within 0.5 percent of the correct mass throughout the range of use.

Do not use spring balances.

Install and maintain platform scales with the platform level with rigid bulkheads at each end. Make the platform of sufficient length to permit simultaneous weighing of all axle loads of the hauling vehicle. Coupled vehicles may be weighed separately or together according to Subsection 2.20, paragraph UR.3.3, *Single-Draft Vehicle Weighing* of NIST *Handbook 44, Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices*.

Install and maintain belt-conveyor scales according to Subsection 2.21, *Belt-Conveyor Scale Systems* of NIST *Handbook 44*.

Before production on the project, after relocation, and at least once per year; have the weighing portion of the system checked and certified by the State Bureau of Weights and Measures or a private scale service certified by the Bureau of Weights and Measures. Seal the system to prevent tampering or other adjustment after certification.

Attach an automatic printer to the scale that is programmed or otherwise equipped to prevent manual override of all mass information. For weighed pay quantities, program the printer to provide the following information for each weighing:

(1) Project number and name;

(2) Pay item number and description;

(3) Date;

(4) Time;

(5) Ticket number;

(6) Haul unit number;

(7) Net mass in load at least to the nearest 100 pounds (50 kilograms);

(8) Subtotal net mass for each haul unit since the beginning of the shift; and

(9) Accumulated total net mass for all haul units since the beginning of the shift.

If a printer malfunctions or breaks down, the Contractor may manually weigh and record masses for up to 48 hours provided the method of weighing meets other contract requirements.

Furnish competent scale operators to operate the system.

When platform scales are used, weigh empty haul units at least twice per day.

Use an approved format for the mass records. Submit the original records and a written certification as to the accuracy of the masses at the end of each shift.

109.04 Receiving Procedures. When the method of measurement requires weighing or volume measurement in the hauling vehicle, furnish a person to direct the spreading and distribution of material and to record the location and placement of the material on the project. During the placement, maintain a record of each delivery and document it in an acceptable manner. Include the following as applicable:

(a) Project number and name;

(b) Pay item number and description;

(c) Location where placed;

(d) Date;

(e) Load number;

(f) Truck identification;

(g) Time of arrival;

(h) Mass or volume; and

(i) Spread person's signature.

Use an approved format for the delivery records. Submit the original records and a written certification of the delivery of the material at the end of each shift.

109.05 Scope of Payment. Payment for contract work is provided, either directly or indirectly, under the pay items listed in the bid schedule.

(a) Direct payment. Payment is provided directly under a pay item listed in the bid schedule when one of the following applies:

(1) The work is measured in the Measurement Subsection of the Section ordering the work and the bid schedule contains a pay item for the work from the Section ordering the work.

(2) The Measurement Subsection of the Section ordering the work, references another Section for measuring the work and the bid schedule contains a pay item for the work from the referenced Section.

(b) Indirect payment. Work for which direct payment is not provided is a subsidiary obligation of the Contractor. Payment for such work is indirectly included under other pay items listed in the bid schedule. This includes instances when the Section ordering the work references another Section for performing the work and the work is not referenced in the Measurement Subsection of the Section ordering the work.

Compensation provided by the pay items included in the bid schedule is full payment for performing contract work in a complete and acceptable manner. Risk, loss, damage, or expense arising out of the nature or prosecution of the work is included in the compensation provided by the pay items.

Work measured and paid for under one pay item will not be paid for under other pay items.

The quantities listed in the bid schedule are approximate unless designated as a contract quantity. Limit pay quantities to the quantities staked, ordered, or otherwise authorized before performing the work. Payment will be made for the actual quantities of work performed and accepted or material furnished according to the contract. No payment will be made for work performed in excess of that staked, ordered, or otherwise authorized.

109.06 Pricing of Adjustments. Sections 109.06, 109.07, 109.08, and 109.09 deleted per GMUG Roadway Maintenance Forest Service Supplemental Specifications (FSSS).

109.07 Eliminated Work. See NFF contract.

109.08 Progress Payments. See NFF contract.

109.09 Final Payment. See NFF contract.

DIVISION 150
PROJECT REQUIREMENTS

Section 151. — MOBILIZATION

Description

151.01 This work consists of moving personnel, equipment, material, and incidentals to the project and performing work necessary before beginning work at the project site. This work also includes obtaining permits, insurance, and bonds.

Measurement

151.02 Measure the Section 151 items listed in the bid schedule according to Subsection 109.02.

Payment

151.03 The accepted quantities will be paid at the contract price per unit of measurement for the Section 151 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Progress payments for mobilization by the lump sum will be paid as follows:

(a) Bond premiums will be reimbursed, after receipt of the evidence of payment.

(b) The accepted mobilization contract amount will be paid at the contract price as listed in the bid schedule. Payment will be full compensation for mobilization. See Subsection 109.05.

Section 152. — CONSTRUCTION SURVEY AND STAKING

Description

152.01 This work consists of performing surveying, staking, calculating, and recording data for the control of work.

Staking is not required for the project but the contractor may choose to provide staking to facilitate their work.

Construction Requirements

152.02 Qualifications. Provide technically qualified survey crews experienced in highway construction survey and staking. Provide personnel capable of performing in a timely and accurate manner.

152.03 Submittals. Submit the following at the preconstruction conference:

Include the following when Automated Machine Guidance **(**AMG) methods are used:

(a) Technology statement. A written statement that includes:

(1) The manufacturer, model, and software version of the AMG equipment; and

(2) Certification that the final 3D data is compatible with the AMG equipment.

(b) Personnel qualifications.

(1) The name, authority, relevant experience, and qualifications of the person with overall responsibility for the AMG system.

(2) The names, authority, and relevant experience of personnel directly responsible for operating the AMG equipment.

(c) Contractor quality control plan. Comply with Section 153 and describe procedures for checking, mechanical calibration, and maintenance of both survey and construction equipment. Include the frequency and types of checks performed.

Include a price breakdown by individual tasks when construction survey and staking is paid by the lump sum for use in making progress payments and price adjustments.

152.04 General. Conform to the following:

(a) Personnel. Provide a crew supervisor on the project whenever surveying and staking is in progress.

(b) Equipment. Furnish survey instruments and supporting equipment capable of achieving the specified tolerances.

Construction equipment controlled with a Global Positioning System (GPS) and Robotic Total Station (RTS) machine guidance system may be used in the construction of subgrade, subbase, and base aggregate courses, or other construction operations when approved.

(c) Material. Furnish acceptable tools and supplies of the type and quality suitable for highway survey work. Furnish stakes and hubs of sufficient length to provide a solid set in the ground with sufficient surface area above ground for necessary legible and durable markings.

Include staking activities in the construction schedule. Include the dates and sequence of each staking activity.

Record survey and measurement field data in an approved format. Field data and supporting documentation become the property of the NFF upon completion of the work.

Discuss and coordinate the following with the NFF before surveying or staking:

(1) Surveying and staking methods;

(2) Stake marking;

(3) Grade control for courses of material;

(4) Referencing;

(5) Structure control;

(6) Field staking data;

(7) Localization of the GPS systems to the NFF-established control points; and

(8) Other procedures and controls necessary for the work.

Preserve initial reference and control points. Notify the CO of missing control points or stakes at least 10 days before beginning construction.

Remove and dispose of flagging, paint, lath, stakes, and other staking material after the project is complete.

Table 152-1
Construction Survey and Staking Tolerances [1]

Staking Phase	Horizontal	Vertical
Control points set from existing Government control points	±0.03 feet (±10 millimeters)	± 0.01 feet $\times \sqrt{N}$ (± 3 millimeters $\times \sqrt{N}$)[2]
Mapping, topography, and cross-section points	±0.16 feet (±50 millimeters)	±0.16 feet (±50 millimeters)
Centerline points [3] including (PC), (PT), (POT), (POC), and references	±0.06 feet (±20 millimeters)	±0.06 feet (±20 millimeters)
Slope-stake and slope-stake references [4]	±0.16 feet (±50 millimeters)	±0.16 feet ±50 millimeters)
Culverts, ditches, and minor drainage structures stakes	±0.16 feet (±50 millimeters)	±0.06 feet (±20 millimeters)
Retaining walls stakes	±0.06 feet (±20 millimeters)	±0.03 feet (±10 millimeters)
Curb and gutter stakes	±0.06 feet (±20 millimeters)	±0.03 feet (±10 millimeters)
Clearing and grubbing limit stakes	±1.00 feet (±300 millimeters)	–
Roadway subgrade finish stakes [6]	±0.16 feet (±50 millimeters)	±0.03 feet (±10 millimeters)
Roadway finish grade stakes [6]	±0.16 feet (±50 millimeters)	±0.03 feet (±10 millimeters)

(1) At statistical 95 percent confidence level. Tolerances are relative to existing Government control points.
(2) N is the number of instrument setups.
(3) Centerline points: PC - point of curve, PT - point of tangent, POT - point on tangent, POC - point on curve.
(4) Take the cross-sections normal to the centerline ±1 degree.
(5) Not used.
(6) Includes paved ditches.

152.06 Acceptance. Construction survey and staking will be evaluated under Subsections 106.02 and 106.04.

Survey notes will be evaluated under Subsection 106.02.

Measurement

152.07 Survey and staking are at the contractor's discretion and is not included as a pay item.

Payment

152.08 Survey and staking are at the contractor's discretion and is not included as a pay item.

Section 153. — CONTRACTOR QUALITY CONTROL

Description

153.01 This work consists of planning and implementing a construction quality process to ensure work conforms to the contract. This work also includes quality control inspection and documentation, and process control sampling and testing.

Construction Requirements

153.02 Qualifications. Submit the following for approval with the Quality Control Plan:

(a) Quality control manager (QCM). Provide a QCM according to (2) below.

(1) Full-time, on-site QCM. Provide a QCM with no responsibilities for performing testing and inspection, managing the project, or performing operations other than managing quality control and the following:

(a) One year experience managing quality control on construction projects of similar type and scope, and

(b) One of the following:

(1) Two years' experience as a construction project manager or superintendent on construction projects of similar type and scope;

(2) Three years' experience as a project engineer, resident engineer, foreman, construction inspector, or equivalent on construction projects of similar type and scope; or

(3) National Institute for Certification in Engineering Technologies (NICET) Level III certification or equivalent in highway construction or highway material.

(2) Part-time, on-site QCM. Furnish a QCM who has at least 2 years' experience in stone masonry and roadway construction, inspection, quality control, and material testing.

(b) Inspectors. Provide inspectors with at least 2 years' experience inspecting projects of similar complexity and with training related to the work to be inspected.

(c) Testers. Provide testers with at least one year experience in the type of sampling and testing required, and with one of the following for the type of sampling and testing performed:

(1) NICET Level II certification in highway material or equivalent state or industry certification;

(2) Certification by a regional certification program (such as Western Alliance for Quality Transportation Construction (WAQTC), Northeast Transportation Technician Certification Program (NETTCP), Southeast Task Force for Technician Training and Qualification (STFTTQ), or Multi Regional Training and Certification (M-TRAC)); or

(3) At least one year employment by an AASHTO accredited laboratory performing equivalent sampling and testing.

153.03 Quality Control Plan (QCP). Develop a QCP addressing all contract work categories. A category consists of related work items performed in one operation (such as excavation, drainage, and paving).

Include the work of subcontractors, major material suppliers, and structural and geotechnical services suppliers.

For each category, include the following:

(a) Quality control personnel. Furnish the name, authority, responsibilities, and qualifications of the quality control manager and other personnel directly involved in inspection and testing. Conform to Subsection 153.02.

(b) Quality control procedures. Describe the inspection, testing, and other activities to be performed for each phase of work in Subsection 153.04. Include methods, schedules, equipment, and laboratory facilities. Conform to Subsections 153.04 and 153.05.

List the material to be tested by:

(1) Pay item;

(2) Applicable requirements of the Sampling, Testing, and Acceptance Requirements tables;

(3) Persons responsible for performing the sampling and testing;

(4) Laboratory testing facilities to be used for process control and project testing; and

(5) Proposed reporting formats.

As a minimum perform process control testing according to the Sampling, Testing, and Acceptance Requirements tables included at the end of each Section where applicable.

(c) Records. Describe the reporting format for inspection, testing, certification, and daily reports. Conform to Subsections 153.06 and 153.07.

At least 14 days before the start of work, submit the QCP for approval. Do not perform work on a work category unless the quality control for that category is accepted. Approval does not imply that the QCP will result in contract compliance.

Revise the QCP when contract quality requirements are not achieved and when changes occur in the contract, work progress, or personnel.

153.04 Prosecution of Work. Complete the following:

(a) Preparatory phase.

(1) Before starting each work category, hold a preparatory phase meeting. Include the project superintendent, work foreman, NFF, QCM, and appropriate subcontractors. Be prepared to discuss the following:

(a) Contract requirements for the work, including acceptance procedures, schedule, and control strip;

(b) Process and equipment for constructing the work; and

(c) Plan for inspection, process control, testing, measuring, and reporting the work.

(2) Review and coordinate certifications, submittals, plans, drawings, and permits.

(3) Verify the capabilities of equipment, material, and personnel. Provide training as necessary.

(4) Establish a detailed testing schedule based on the production schedule.

(5) Ensure preparatory testing and inspection is accomplished.

(6) Review accuracy of the surveying and staking.

(b) Start-up phase.

(1) Hold a start-up meeting to review the contract, the construction processes, and the inspection, testing, and reporting requirements with the personnel performing the work. Include the project superintendent, inspectors, testers, NFF, and QCM. Explain procedures that will be followed if defective work is identified.

(2) Inspect, test, and report start-up work according to the QCP and ensure the work conforms to the contract.

(c) Production phase.

(1) Inspect, test, and report according to the QCP and evaluate the acceptability of the work produced.

(2) Identify and correct deficiencies.

(3) Request NFF inspection and acceptance.

153.05 Sampling and Testing. Inspect commercial laboratory equipment within 45 days of project use.

Have mobile laboratory equipment inspected and calibrated after the laboratory is moved to the project and every time it is moved thereafter. Keep laboratory facilities clean and maintain equipment in proper working condition. Certify that equipment conforms to testing requirements and submit evidence of current calibrations.

Allow the NFF unrestricted access to the laboratory for inspection and review. When requested by the NFF, provide additional inspections and tests to demonstrate sampling and testing proficiency. Submit proficiency sample test results within 48 hours of sample receipt.

Perform quality control sampling and testing according to the QCP and the sampling, testing, and acceptance requirements table in applicable sections.

When no sampling frequencies are specified, submit the proposed sampling and testing frequencies.

153.06 Certifications. Obtain, review, and verify certifications for work. Submit certifications when required.

153.07 Records and Control Charts. Maintain records and control charts by pay item.

(a) Quality control and construction operations reports. Submit written quality control and construction operations reports daily according to the QCP. Document meetings, work locations, labor and equipment used including actual hours worked, testing and measurement activities, inspection results, deficiencies observed, corrective actions taken, and process changes. Use FHWA Form 1413, *Inspector's Daily Record of Construction Operations* or approved alternate forms. Include the following certification signed by the QCM on all reports:

"*I certify that the information contained in this record is accurate and that work documented herein complies with the contract. Exceptions to this certification are documented as a part of this record.*"

(b) Control charts. Maintain linear control charts that identify the test number, test parameter, upper and lower specification limit applicable to each test parameter, and test results for applicable material. Use the control charts to document variability of the process, to identify production and equipment problems, and to identify actions to improve processes or quality.

Update and post control charts daily in a location accessible to the NFF. Cease production and correct the process when problems are evident.

153.08 Acceptance. The Contractor's quality control system will be evaluated under Subsection 106.02 based on its demonstrated effectiveness to ensure work conforms to the contract.

Measurement and Payment

153.09 Do not measure Contractor quality control for payment. See Subsection 109.05.

Section 154. — CONTRACTOR SAMPLING AND TESTING

Description

154.01 This work consists of obtaining samples for testing.

When there is a pay item for Contractor testing included in the bid schedule, this work also includes sampling, testing and reporting the required test results. It excludes Contractor quality control testing required under Section 153.

Construction Requirements

154.02 General. Include the work required under this Section in the Section 153 quality control plan.

Sample and test material according to the Sampling, Testing, and Acceptance Requirements tables included at the end of each Section. Perform additional sampling and testing as directed when material does not meet requirements.

Provide the NFF the opportunity to witness sampling, splitting, and testing of material.

Where process control sampling and testing frequencies are identical to the sampling and testing frequencies for acceptance, the process control samples may be used for acceptance for the applicable work.

154.03 Sampling. Sample and split samples according to AASHTO or other acceptable procedures. The location of statistical acceptance sampling will be provided using a random number system. Perform splits when required and deliver the NFF's portion of the sample or split sample in an acceptable container suitable for shipment. Label samples with the following:

(a) Project number and name;

(b) Pay item number and description;

(c) Source of material;

(d) Sample number;

(e) Date sampled;

(f) Time sampled;

(g) Location sample taken;

(h) Name of person sampling;

(i) Name of person witnessing sampling; and

(j) Type of test required on sample.

154.04 Testing. Perform tests when there is a pay item for Contractor testing included in the bid schedule. Demonstration of testing competence may be required.

154.05 Records. When tests are on material being incorporated in the work, report test results within 24 hours unless specified otherwise in the Sampling, Testing, and Acceptance Requirements tables. Report test results on forms containing sample information required by Subsection 154.03. Label interim measurements used to determine the results. Attach work sheets used to determine test values to the test result forms. Payment for work may be delayed or the work stopped until test results are submitted.

154.06 Acceptance. Contractor sampling and testing will be evaluated under Subsections 106.02 and 106.04 based on NFF verification testing.

Measurement

154.07 Measure the Section 154 pay items listed in the bid schedule according to Subsection 109.02.

Payment

154.08 The accepted quantities will be paid at the contract price per unit of measurement for the Section 154 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Progress payments for Contractor testing lump sum will be paid as follows:

(a) 25 percent of the pay item amount, not to exceed 0.5 percent of the original contract amount, will be paid after the testing facilities are in place, qualified sampling and testing personnel are identified, and the work being tested has started.

(b) Payment for the remaining portion of the pay item amount will be prorated based on the total work completed in Section 154.

Payment may be retained if NFF verification testing does not validate the Contractor testing or if it is determined that documentation of sampling and testing does not meet requirements.

Section 155. — SCHEDULES FOR CONSTRUCTION CONTRACTS

Section deleted per GMUG Roadway Maintenance Forest Service Supplemental Specifications (FSSS).

Section 156. — PUBLIC TRAFFIC

Description

156.01 This work consists of controlling and protecting public traffic adjacent to and within the project.

Material

156.02 Conform to the following Section:

Temporary traffic control	635

Construction Requirements

156.03 Qualifications. Provide a traffic control supervisor certified by a state department of transportation, ATSSA, or other acceptable certification programs.

156.04 Accommodating Traffic During Work. Accommodate traffic according to the MUTCD, Section 635, and this Section.

Submit a traffic control plan for approval according to Subsection 104.03 at least 30 days before intended use. Traffic control plan to include signage type, wording, and locations, proposed closure zones, turnaround zones, and proposed closure schedule.

Perform work in a manner that ensures the safety and convenience of the public and protects the residents and property adjacent to the project. Accommodate public traffic on roads adjacent to and within the project until the project is accepted according to Subsection 106.07(b).

156.05 Maintaining Roadways During Work. Maintain roadways as follows:

(a) Construct and remove diversion roads and bridges as required by the traffic control plan;

(b) Maintain intersections with trails, roads, streets, businesses, parking lots, residences, garages, farms, and other features;

(c) Snow removal is not permitted on the project;

(d) Remove accumulations of soil and other material from traveled way;

(e) Do not allow water to pond on the traveled way; and

(f) Maintain the roadway, detours, and diversions in a safe and acceptable condition.

If corrective action is requested and the corrective action is not taken immediately, the condition may be corrected and the cost of the corrective action deducted from monies due the Contractor.

156.06 Maintaining Roadways During Non-Work Periods. Maintain roadways and traffic control for public traffic during periods when work is not in progress. Snow removal to provide public access is not required.

156.07 Limitations on Construction Operations. The roadway at the work area will be closed to public traffic. Public traffic at critical areas on the roadway below the work area is to be restricted as required by project drawings. When the roadway below the work area is open to public traffic, restrict operations as follows:

(a) Operate equipment in the direction of traffic, where practical;

(b) Provide minimum lane widths of 10 feet (3 meters). Use barricades, drums, or other acceptable devices to delineate traffic lanes through areas where the edge of pavement or intended path has been obliterated by construction operations;

(c) Locate staging areas at least 30 feet (9 meters) from the traveled way or behind acceptable traffic barriers. Obtain approval of the location and access to staging areas. Store unused traffic control devices at staging areas;

(d) Park equipment at least 30 feet (9 meters) from the traveled way or behind acceptable traffic barriers;

(e) Provide parking areas for employee's personal vehicles in approved areas;

(f) Provide uninterrupted two-way communications between unless flaggers are able to see each other and communicate. Use communications devices approved by the NFF. Citizen band radios are unacceptable. Make communication devices available to the NFF as necessary;

(g) Limit construction-caused delays to public traffic to a maximum of 30 minutes per passage through the project; and

156.08 Nighttime Operations. Perform construction operations during the hours of daylight (one-half hour after sunrise to one-half hour before sunset).

156.09 Traffic Control Supervisor. Provide a traffic control supervisor according to Subsection 156.03. Do not designate the superintendent as the traffic control supervisor. Furnish the traffic control supervisor's name, address, and 24-hour telephone numbers at the preconstruction conference. During the contract, including periods of suspensions and work stoppages, perform the following:

(a) Implement the traffic control plan.

(b) Coordinate traffic control operations, including those of subcontractors and suppliers.

(c) Ensure the condition, position, and applicability of traffic control devices in use.

(d) Immediately correct traffic control deficiencies.

(e) Coordinate traffic control maintenance operations with the NFF.

(f) Coordinate and ensure that traffic control devices are furnished, installed, maintained, removed, stored, replaced, relocated and cleaned according to Subsection 635.04. Ensure unused traffic control devices are properly handled and stored.

(g) Conduct weekly traffic safety meetings for construction workers, and invite the NFF to these weekly meetings.

(h) Submit a weekly certification that inspections and reviews were conducted and that the traffic control devices meet contract requirements. Include the number and types of devices in use. Report with the weekly certification, changes or corrective actions taken to ensure the safe passage of public traffic through the project.

(i) Inspect traffic control devices, including those in staging, storage, material sources, and disposal areas, as follows:

(1) Daily during daylight hours when daylight work is being performed;

(2) Daily during hours of darkness when nighttime work is being performed;

(3) Weekly during:

(a) Daylight hours and hours of darkness when work is suspended for periods of more than one week, except when the project has been shut down for the winter; and

(b) Periods of winter suspension: inspection not required during seasonal road closure as determined by the NFF.

(4) Additional inspections, day or night, as directed by the NFF; and

(5) Submit reports of inspections in an acceptable format within 2 days.

(j) Before winter suspension, conduct an inspection of the project with the NFF to ensure proper provisions are made for winter travel during the period of suspension.

(k) Provide temporary flagging assistance.

156.10 Acceptance. Public traffic work will be evaluated under Subsection 106.02.

Traffic control devices and services will be evaluated under Section 635.

Measurement and Payment

156.11 Do not measure controlling and protecting public traffic for payment. See Subsection 109.05.

Measure temporary traffic control under Section 635.

Section 157. — SOIL EROSION AND SEDIMENT CONTROL

Erosion Sediment Control Plan to be submitted by the Contractor for review by the NFF and U.S. Forest Service prior to beginning work. Once plan is reviewed and approved in writing by the the NFF and U.S. Forest Service, plan shall be submitted to the State of Colorado to obtain an Erosion Sediment Control Plan permit. The Contractor shall adhere to the State permit for the duration of the project.

Section 158. — WATERING FOR DUST CONTROL

SECTION NOT USED

DIVISION 200
EARTHWORK

Section 201. — CLEARING AND GRUBBING

SECTION NOT USED

Section 202. — ADDITIONAL CLEARING AND GRUBBING

SECTION NOT USED

Section 203. — REMOVAL OF STRUCTURES AND OBSTRUCTIONS

Description

203.01 This work consists of salvaging, removing, and disposing of existing stone and roadway materials.

Material

203.02 Conform to the following Section and Subsection:

Backfill material	704.03

Construction Requirements

203.03 Salvaging Material. Salvage with reasonable care material designated to be salvaged including wall stones and road base materials. Salvage in readily transportable sections or pieces.

Match mark members of salvaged stone for later replacement.

Stockpile salvaged material at a designated area on the project. Do not stockpile material on roadway within xx feet of historic stone retaining walls.

203.04 Removing Material.

Remove stone and other roadbed obstructions at the collapse zone full width of the roadway to 48 inches (900 millimeters) below top of wall elevations.

203.05 Disposing of Material. Reuse wall stones and roadway materials where possible. Dispose of debris, unsuitable material, and excess material as follows:

(a) Remove from project. Recycle or dispose of material legally off the project. Submit a statement documenting the nature and quantity of material processed or sold for recycling. Otherwise, submit a signed copy of the disposal agreement before disposal begins.

(b) Burn. Burning materials not permitted.

(c) Bury. Bury debris in trenches or pits in approved areas within the right-of-way when approved. Do not bury debris inside the roadway prism limits, beneath drainage ditches, or in areas subject to free-flowing water.

Place debris in alternating layers of 48 inches (1200 millimeters) of debris covered with 24 inches (600 millimeters) of earth material. Distribute large pieces to form a dense mass and minimize air voids. Cover the top layer of buried debris with at least 12 inches (300 millimeters) of compacted earth. Grade and shape the area. Seed and mulch disposal areas on Government property.

(d) Hazardous material. Hazardous materials are not expected at the project site. If any potentially hazardous materials are discovered: notify the NFF and submit a copy of disposal permits. Dispose of material according to Federal, state, and local regulations.

(1) Disposal plan. Submit a detailed disposal plan that includes how material will be handled, loaded, and transported to the disposal facility. Include the name and address of the facility where the material will be taken. Describe steps that will be taken to ensure that lead contamination will be contained throughout the process. Measures may include additional steps or precautions when lifting and handling the steel on site.

(2) Transport and delivery. Include the material safety data sheet (MSDS) with the material to the disposal facility. Ensure that loads transported from the site are adequately contained and covered to prevent dispersion en route to the disposal facility. Submit a copy of the receiving report from the disposal facility specifically acknowledging that the material being delivered is contaminated with lead paint.

203.06 Acceptance. Removal of structures and obstructions will be evaluated under Subsection 106.02.

Measurement

203.07 Measure the Section 203 pay items listed in the bid schedule according to Subsection 109.02.

Payment

203.08 The accepted quantities will be paid at the contract price per unit of measurement for the Section 203 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Section 204. — EXCAVATION AND EMBANKMENT

Description

204.01 This work consists of excavating material and constructing embankments. This work also includes furnishing, hauling, stockpiling, placing, disposing, sloping, shaping, compacting, and finishing earthen and rocky material.

204.02 Definitions.

(a) Excavation. Excavation consists of the following:

(1) Roadway excavation. Material excavated from within the right-of-way or easement areas, except subexcavation covered in Subsection 204.02(a)(2). Roadway excavation includes all material encountered regardless of its nature or characteristics.

(2) Subexcavation. Material excavated from below subgrade elevation in cut sections or from below the original ground-line in embankment sections. Subexcavation excludes the work required by Subsection 204.05 or 204.06.

(3) Borrow excavation. Material used for embankment construction that is obtained from outside the roadway prism. Borrow excavation includes unclassified borrow, select borrow, and topping.

(b) Embankment construction. Section not used.

(c) Conserved topsoil. Excavated material conserved from the roadway excavation and embankment foundation areas that is suitable for growth of grass, cover crops, or native vegetation.

(d) Waste. Excess and unsuitable roadway excavation and subexcavation that cannot be used.

Material

204.03 Conform to the following Subsections:

Select borrow	704.07
Topping	704.05
Unclassified borrow	704.06
Water	725.01(c)

Construction Requirements

204.04 Preparation for Roadway Excavation and Embankment Construction. Clear the area of vegetation and obstructions according to Sections 201 and 203.

204.05 Conserved Topsoil. Section not used.

204.06 Roadway Excavation. Excavate by scarifying existing dirt road surface to 6 inches (150 millimeters) below subgrade within the roadbed limits. Compact the scarified material according to Subsection 204.10.

Dispose of unsuitable or excess excavation material according to Subsection 204.14. Replace shortage of suitable material caused by premature disposal of roadway excavation.

Shape to drain and compact the work area to a uniform cross-section at the end of each day's operations.

204.07 Subexcavation. Excavate material to the required limits. Dispose of unsuitable material according to Subsection 204.14. Take cross-sections according to Section 152. Place backfill material in horizontal layers not exceeding 12 inches (300 millimeters) in compacted thickness and compact according to Subsection 204.10. Prevent unsuitable material from mixing with backfill.

(b) Embankment within the roadway prism

204.08 Ditches. Slope, grade, and shape ditches. Remove projecting roots, stumps, rock, or similar matter. Maintain ditches in an open condition and without sticks, and other debris.

Form furrow ditches by plowing or using other acceptable methods to produce a continuous furrow. Place excavated material on the downhill side so the bottom of the ditch is approximately 18 inches (450 millimeters) below the crest of the loose material. Clean the ditch using a hand shovel or other suitable method. Shape to provide drainage without overflow.

204.09 Sloping, Shaping, and Finishing. Complete slopes, ditches, culverts, riprap, and other underground minor structures before placing aggregate courses. Slope, shape, and finish as follows:

(a) Sloping. Leave earth slopes with uniform roughened surfaces, except as described in Subsection 204.13(b), with no noticeable break as viewed from the road. Except in solid rock, round tops and bottoms of slopes including the slopes of drainage ditches. Round material overlaying solid rock to the extent practical. Scale rock slopes.

If a slide or slipout occurs on a cut or embankment slope, remove or replace the material and repair or restore damage to the work. Bench or key the slope to stabilize the slide. Reshape the cut or embankment slope to an acceptable condition.

(b) Stepped slopes. Where required, construct steps on slopes of 1⅓V:1H to 1V:2H. Construct the steps approximately 18 inches (450 millimeters) high. Blend the steps into natural ground at the end of the cut. If the slope contains non-rippable rock outcrops, blend steps into the rock. Remove loose material found in transitional area. Except for removing large rocks that may fall, scaling stepped slopes is not required.

(c) Shaping. Shape the subgrade to a smooth surface and to the cross-section required. Shape slopes to gradually transition into slope adjustments without noticeable breaks. At the ends of cuts and at intersections of cuts and embankments, adjust slopes in the horizontal and vertical planes to blend into each other or into the natural ground.

(d) Finishing. Remove material larger than 6 inches (150 millimeters) from the top 6 inches (150 millimeters) of the roadbed. Remove unsuitable material from the roadbed, and replace it with suitable material. Finish roadbeds that are compacted according to Subsection 204.10(b) and (c) to within ±0.05 foot (±15 millimeters) of the staked line and grade. Finish roadbeds that are compacted according to Subsection 204.10(a) to within ±0.10 foot (±30 millimeters) of the staked line and grade. Finish ditch cross-sections to within ±0.10 feet (±30 millimeters) of the staked line and grade. Maintain proper ditch drainage.

Place embankment material in horizontal layers not exceeding 6 inches (300 millimeters) in compacted thickness. Incorporate oversize boulders or rock fragments into the 12-inch (300-millimeter) layers by reducing them in size or placing them individually as required by Subsection 204.10(c). Compact each layer according to Subsection 204.10 before placing the next layer.

Material composed predominately of boulders or rock fragments too large for specified layers may be placed in layers up to 24 inches (600 millimeters) thick. Incorporate oversize boulders or rock fragments into the 24-inch (600-millimeter) layer by reducing them in size or placing individual rock fragments and boulders greater than 24 inches (600 millimeters) in diameter as follows:

(1) Reduce rock to less than 48 inches (1200 millimeters) in the largest dimension;

(2) Distribute rock within the embankment to prevent nesting;

(3) Place layers of embankment material around each rock to a depth not greater than that permitted by Subsection 204.9(b). Fill voids between rocks; and

(4) Compact each layer according to Subsection 204.10(a) before placing the next layer.

204.10 Compaction. For compaction, use AASHTO T 27 to determine the quantity of material retained on a No. 4 (4.75-millimeter) sieve. Compact as follows:

(a) More than 80 percent retained on a No. 4 (4.75-millimeter) sieve. Adjust the moisture content to a level suitable for compaction. Fill the interstices around rock with earth or other fine material as practical. Compact each layer of material full width with hand-operated vibratory rammer (jumping jack) or hand-operated vibratory plate compactor and until there is no visible evidence of further consolidation. No heavy equipment shall be used at roadways adjacent to historic stone retaining walls.

(b) 50 to 80 percent retained on a No. 4 (4.75-millimeter) sieve. Classify the material according to AASHTO M 145. Adjust the moisture content of material classified A-1 through A-5 to a moisture content suitable for compaction. Adjust the moisture content of material classified A-6 and A-7 to within 2 percent of the optimum moisture content. Use AASHTO T 99 to determine the optimum moisture content of the portion of the material passing a No. 4 (4.75-millimeter) sieve. Multiply this number by the percentage of material passing a No. 4 (4.75-millimeter) sieve, and add 2 percent to determine the optimum moisture content of the material.

Use hand-operated vibratory compactors at speeds less than 3 feet (1 meter) per second. Compact each layer of material full width according to Subsection 204.10(a).

(c) Less than 50 percent retained on a No. 4 (4.75-millimeter) sieve. Classify the material according to AASHTO M 145, using low-impact equipment as required by 204.10(a). For material classified A-1 or A-2-4, determine the maximum density according to AASHTO T 180, Method D. For other material classifications, determine the optimum moisture content and maximum density according to AASHTO T 99, Method C.

Adjust the moisture content of material classified A-1 through A-5 to a moisture content suitable for compaction. Adjust the moisture content of material classified A-6 and A-7 to within 2 percent of the optimum moisture content.

Compact each layer of material full width according to subsection 204.10(a) to at least 95 percent of the maximum density. Determine the in-place density and moisture content according to AASHTO T 310 or other approved test procedures. When required, use AASHTO T 224 to correct for coarse particles.

204.11 Disposal of Unsuitable or Excess Material. Dispose of unsuitable or excess material according to Subsection 203.05(a).

When there is a pay item for waste, shape and compact the waste material in its final location. Do not mix clearing or other material not subject to payment with the waste material.

204.12 Acceptance. See Table 204-1 for sampling, testing, and acceptance requirements.

Material for embankment and conserved topsoil will be evaluated under Subsections 106.02 and 106.04.

Excavation and embankment construction will be evaluated under Subsections 106.02 and 106.04.

Subexcavation will be evaluated under Subsections 106.02 and 106.04.

Measurement

204.13 Measure the Section 204 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

(a) Roadway excavation. Measure roadway excavation in its original position as follows:

(1) Include the following volumes in roadway excavation:

(a) Roadway prism excavation;

(b) Rock material excavated and removed from below subgrade in cut sections;

(c) Unsuitable material below subgrade and unsuitable material beneath embankment areas when a pay item for subexcavation is not listed in the bid schedule;

(d) Ditches, except furrow ditches measured under a separate pay item;

(e) Conserved topsoil;

(f) Borrow material used in the work when a pay item for borrow is not listed in the bid schedule;

(g) Loose scattered rocks removed and placed as required within the roadway;

(h) Conserved material taken from pre-existing stockpiles and used in Section 204 work and

(i) Slide and slipout material not attributable to the Contractor's method of operation.

(2) Do not include the following in roadway excavation:

(a) Overburden and other spoil material from borrow sources;

(b) Overbreakage from the backslope in rock excavation;

(c) Water or other liquid material;

(d) Material used for purposes other than required;

(e) Roadbed material scarified in place and not removed;

(f) Material excavated when stepping cut slopes;

(g) Material excavated when rounding cut slopes;

(h) Preparing foundations for embankment construction;

(i) Material excavated when benching for embankments;

(j) Slide or slipout material attributable to the Contractor's method of operation;

(k) Conserved material taken from stockpiles constructed at the option of the Contractor;

(l) Material excavated outside the established slope limits; and

(m) Road pioneering for the convenience of the Contractor.

(3) When both roadway excavation and embankment construction pay items are listed in the bid schedule, measure roadway excavation only for the following:

(a) Unsuitable material below subgrade in cuts and unsuitable material beneath embankment areas when a pay item for subexcavation is not listed in the bid schedule;

(b) Slide and slipout material not attributable to the Contractor’s method of operations; and

(c) Drainage ditches, channel changes, and diversion ditches.

(b) Unclassified borrow, select borrow, and topping. When measuring by the cubic yard (cubic meter) measure in its original position. If borrow excavation is measured by the cubic yard (cubic meter) in-place, take initial cross-sections of the ground surface after stripping overburden. Upon completion of excavation and after the borrow source waste material is returned to the source, retake cross-sections before replacing the overburden.

Do not measure borrow excavation until suitable roadway excavation is depleted.

(c) Embankment construction. Section not used.

(d) Rounding cut slopes. Measure rounding cut slopes horizontally along the centerline of the roadway.

(e) Waste. Measure waste by the cubic yard (cubic meter) in its final position. Take initial cross-sections of the ground surface after stripping over-burden. Upon completion of the waste placement, retake cross-sections before replacing overburden.

(f) Slope scaling. Measure slope scaling by the cubic yard (cubic meter) in the hauling vehicle.

(g) Subexcavation. Measure subexcavation by the cubic yard (cubic meter) in its original position.

Payment

204.17 The accepted quantities will be paid at the contract price per unit of measurement for the Section 204 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Table 204-1
Sampling, Testing, and Acceptance Requirements

Material or Product (Subsection)	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time
Source								
Topping (703)	Measured and tested for conformance (106.04 & 105)	Classification[(1)]	–	AASHTO M 145	1 per soil type and source of material	Source of material	Yes	Before using in work
Unclassified borrow (703)	"	"	–	"	"	"	"	"
Select borrow (703)	"	"	–	"	"	"	"	"
		Gradation	–	AASHTO T 27 & T 11	"	"	"	"
		Liquid limit	–	AASHTO R 58 & T 89, Method A	"	"	"	"

Table 204-1 (continued)
Sampling, Testing, and Acceptance Requirements

Material or Product (Subsection)	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time
Production								
Unclassified borrow (704.06)	"	Moisture-density	–	AASHTO T 180, Method D(2) or T 99, Method C(2)	1 per soil type, but not less than 1 per each 13,000 yd^3 (10,000 m^3)	Processed material	Yes	Before using in work
		Density	–	AASHTO T 310 or other approved procedures	1 per 3500 yd^2 (3000 m^2), but not less than 1 per layer	In-place	No	Before placement of next layer

Table 204-1 (continued)
Sampling, Testing, and Acceptance Requirements

Material or Product (Subsection)	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time
Production (continued)								
Earth embankment (204.10)	Measured and tested for conformance (106.04)	Classification	–	AASHTO M 145	1 per soil type	Source of material	Yes	Before using in work
		Moisture-density	–	AASHTO T 180, Method D(2) or T 99, Method C(2)	1 per soil type, but not less than 1 per each 13,000 yd^3 (10,000 m^3)	"	"	"
		Density	–	AASHTO T 310 or other approved procedures	1 per 3500 yd^2 (3000 m^2), but not less than 1 per layer	In-place	No	Before placement of next layer
Top of subgrade (204.10)	"	Density	–	AASHTO T 310 or other approved procedures	1 per 2500 yd^2 (2000 m^2), but not less than 1 per layer	In-place	No	Before placement of next layer
Finished Product								
Roadbed (204.13)	Measured and tested for conformance (106.04)	Final line & grade	–	Field measured	Determined by the NFF	Determined by the NFF	No	Before placement of next layer

(1) Not required when using NFF-provided source.
(2) Minimum 5 points per proctor.

Section 205. — ROCK BLASTING

SECTION NOT USED

Section 206. — RESERVED

Section 207. — EARTHWORK GEOSYNTHETICS

Description

207.01 This work consists of furnishing and installing geotextile in separation, stabilization, and filter applications, geogrid in stabilization applications, and geomembrane in moisture barrier applications.

Geosynthethics are designated according to the tables in Section 714.

Material

207.02 Conform to the following Subsections:

Geotextile	714.01
Geosynthetic Clay Liner	714.02

Construction Requirements

207.03 General. Identify, store, and handle geosynthetics according to ASTM D4873 and the manufacturer's recommendations. Elevate and protect geosynthetic rolls with a waterproof cover if stored outdoors. Limit geosynthetics exposure to less than 10 days of ultraviolet radiation.

For seams sewn on-site, conform to the manufacturer's recommendations. Obtain approval of the seam before installation. Use thread consisting of high strength polypropylene or polyester. Do not use nylon thread. Use thread that is resistant to ultraviolet radiation and a contrasting color to the geotextile.

Submit a seam assembly description and a sample of the sewn material at least 14 days before installation when geosynthetic joints are sewn as follows:

(a) Assembly description. Include the seam type, seam allowance, stitch type, sewing thread tex ticket numbers and types, stitch density, and stitch gauge.

(b) Sewn seam samples. Sew seam samples using the same equipment and procedures used to sew production seams. Submit samples that have at least 6 feet (1.8 meters) of sewn seam and are at least 5 feet (1.5 meters) wide. If production seams are sewn in both the machine and cross-machine directions, provide sewn seam samples that are oriented in both the machine and cross-machine directions.

Replace or repair geosynthetic that is torn or punctured. Remove the damaged area and place a patch of the same type of geosynthetic overlapping 36 inches (900 millimeters) beyond the damaged area or sew a seam around the damaged area.

207.04 Geotextile and Geogrid Separation and Stabilization Applications.

(a) Surface preparation. Before placing the geotextile prepare the surface as follows:

(1) Existing ground. Clear the area of obstructions according to Sections 201 and 203. Remove sharp objects and large rocks. Fill depressions or holes with suitable material to provide a smooth surface.

(2) Subgrade. Prepare the subgrade according to Subsections 204.13(c) and (d).

(3) Subexcavation. Perform subexcavation according to Subsection 204.07.

(b) Geotextile placement. Place the geosynthetic smooth, taut, and wrinkle free on the underlying surface. Conform to curves. Overlap in the direction of construction. Overlap at least 24 inches (600 millimeters) at the ends and sides of adjoining sheets or sew the joints according to the manufacturer's recommendations. Do not place longitudinal overlaps below anticipated wheel loads. Hold the geosynthetic in place with pins, staples, or piles of cover material.

(c) Backfilling.

(1) First layer placement and compaction. End dump the backfill material onto the geotextile from the edge of the geosynthetic or from previously placed cover material. Do not operate equipment directly on the geosynthetic. Spread the end-dumped pile of cover material maintaining a 12 inch (300 millimeters) lift over the geosynthetic. Avoid sudden stops, starts, or turns of the construction equipment. Fill ruts from construction equipment with additional cover material. Do not blade material down to remove ruts. If rutting exceeds 3 inches (75 millimeters) during placement, decrease the construction equipment size, decrease the equipment weight, or increase the first lift thickness as directed by the NFF.

Compact according to Subsection 204.10. Do not use sheepsfoot or studded compaction equipment. Compact the cover material with pneumatic-tire or nonvibratory smooth drum rollers.

(2) Subsequent layer placement and compaction. Place subsequent layers according to Subsection 204.09.

Compact according to Subsection 204.10. Vibratory rollers may not be used.

207.05 Geosynthetic Clay Liner (GCL). Use laminated GCL at drainage ditch as shown. Follow requirement of ASTM D5888, Standard Guide for Storage and Handling of Geosynthetic Clay Liners. and ASTM D 6102, Standard Guide for Installation of Geosynthetic Clay Liners.

(a) Placement. Lift GCL rolls for placement using a front end loader, backhoe, or other equipment with a spreader bar and core pipe or slings. Support roll weights with an appropriate core pipe to limit core pipe deflections to 3 inches (75 mm) as measured from end to midpoint when a full GCL roll is lifted. See manufacturer recommendations.

Prepare subgrade for membrane-laminated GCL following 207.04. The finished surface should be firm and unyielding, smooth and free of vegetation, sharp-edged rocks, stones, sticks, construction debris, and other foreign matter that could contact the GCL, with no abrupt elevation changes, voids, cracks, ice, or standing water. All protrusions extending more than 0.5 inch (12 mm) from the subgrade surface shall be removed, crushed, or pushed into the surface with a hand-operated compactor. Obtain NFF approval of the subgrade prior to GCL placement.

Equipment which could damage the GCL should not be allowed to travel directly on it. Unroll GCL in front of backwards-moving equipment. Minimize the extent to which the GCL is dragged across the subgrade in order to avoid damage to the bottom surface of the GCL. Take care when adjusting GCL panels to avoid damage to the geotextile surface of one panel of GCL by the textured sheet of another panel of GCL. A temporary geosynthetic subgrade covering, commonly known as a slip sheet or rub sheet, may be used to reduce friction damage during placement.

Place GCL mats with seams running parallel to the slope. Anchor GCL in a perimeter trench following manufacturer recommendations.

(a) **Seams.** Construct seams by overlapping adjacent panel edges and ends. Do not permit overlap zones to be contaminated with loose soil or other debris. Provide longitudinal seams overlapping a minimum of 12 inches (300 mm).

Shingle-lap end of panel overlapped seams in the direction of grade, lapping the upslope panel 12 inches (300 mm) over the top of the downslope panel. Apply granular bentonite or bentonite mastic between lapped sections. Follow manufacturer recommendations for sealing end of lap seams.

(b) **Damage repair.** Repair GCL damage by cutting a patch to fit over the damaged area. Cut the patch to size such that a minimum overlap of 12 inches (300 mm) is achieved around all parts of the damaged area. Apply granular bentonite or bentonite mastic around the damaged area prior to placement of the patch. Smaller patches may be tucked under the damaged area to prevent patch movement.

(c) **Backfilling.** Follow 207.07/

(d) **Hydration.** Hydration will occur naturally as the GCL is wetted by precipitation and runoff. No special hydration of the GCL is required.

207.06 Geotextile Filter Applications.

(a) Geotextile placement. For slope or wave protection, place the long dimension of the geotextile down the slope. For stream bank protection, place the long dimension of the geotextile parallel to the centerline of the channel.

Overlap or sew seams at the ends and sides of adjoining sheets.

(1) Overlapping. Overlap the uphill or upstream sheet over the downhill or downstream sheet. For above water applications, overlap the geotextile at least 12 inches (300 millimeters). For underwater applications, overlap the geotextile at least 36 inches (900 millimeters).

(2) Sewing. Sew the geotextile seam according to the manufacturer’s recommendations.

Offset end joints of adjacent sheets at least 5 feet (1.5 meters). Use key trenches or aprons at the crest and toe of slopes to hold the geotextile in place. As an alternative use anchor pins, at least 18 inches

(450 millimeters) long and spaced at 36 inch (900 millimeters) centers to hold the geotextile sheets in place.

(b) Backfilling. Place aggregate, slope protection, or riprap on the geotextile starting at the toe of the slope and proceeding upward. Place riprap onto the geotextile from a height of less than 12 inches (300 millimeters). Place slope protection rock or aggregate backfill onto the geotextile from a height less than 36 inch (900 millimeters). Do not allow stones weighing more than 100 pounds (45 kilograms) to roll down the slope. In underwater applications, place the geotextile and cover material in the same day.

207.07 Geomembrane Applications. Submit a geomembrane installation plan at least 10 days before installing the geomembrane. Include a drawing of the panel layout identifying the location of seams. Include a seam detail and a written description of the seaming procedure.

(a) Surface preparation. Provide a smooth, flat, firm, unyielding foundation for the geomembrane with no sudden, sharp, or abrupt changes or break in grade. Remove rocks, stones, sticks, sharp objects, and debris protruding more than ½ inch (13 millimeters) above the prepared surface.

(b) Geomembrane placement. Orient seams parallel to the line of maximum slope. Use sandbags or piles of cover material to hold the geomembrane in place. Do not drive equipment directly on the geomembrane.

(c) Backfilling. Place backfill material within the same work shift that the geomembrane is installed. End dump backfill material onto the edge of previously placed cover material and roll it into place. Do not push material along the geomembrane which can result in damage or wrinkling. Compact fill following 301.05.

207.08 Acceptance. Geosynthetics will be evaluated under Subsection 106.03. Submit a production certification with each shipment of geosynthetics.

Geosynthetic installation will be evaluated under Subsections 106.02 and 106.04.

Sewn joints will be evaluated under Subsection 106.02.

Measurement

207.09 Measure the Section 207 pay items listed in the bid schedule according to Subsection 109.02.

When measuring geosynthetics by the square yard (square meter), measure on the plane parallel to the slope face.

Do not measure overlapping material.

Payment

207.10 The accepted quantities will be paid at the contract price per unit of measurement for the Section 207 pay item listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Section 208. — STRUCTURE EXCAVATION AND BACKFILL FOR SELECTED MAJOR STRUCTURES

SECTION NOT USED

Section 209. — STRUCTURE EXCAVATION AND BACKFILL

SECTION NOT USED

Section 210. — RESERVED

Section 211. — ROADWAY OBLITERATION

SECTION NOT USED

Section 212. — LINEAR GRADING

Description

212.01 This work consists of constructing roadbeds within the specified alignment and grade tolerances.

Construction Requirements

212.02 Roadway Preparation. Clear the area of vegetation and obstructions according to Sections 201 and 203.

212.03 Roadway Excavation and Embankment. Construct the roadbeds according to the applicable requirements of Section 204, except as modified herein.

Adjust the moisture content of embankment material to a moisture content suitable for compaction. Place embankment material in 12-inch (300-millimeter) layers and compact each layer according to Subsection 204.10(a). Where compacting with rollers is not practical, use approved mechanical or vibratory compaction equipment.

Construct approach connections to existing roads, parking areas, and trails. Construct new approaches.

212.04 Grading Tolerance. Do not encroach on stream channels, impact wetlands, or extend beyond right-of-way or easement limits. Do not make alignment or profile grade adjustments that adversely affect drainage. Construct the roadbed within the following grading tolerances:

(a) Alignment (centerline). Alignment may be shifted a maximum of 1 foot (300 mm) left or right of the planned centerline. Compound curves are permitted.

(b) Profile grade. Profile grade may be shifted a maximum of 1 foot (300 mm) up or down from the plan elevation provided the new grade tangent does not vary more than 2 percent from the plan grade tangent. Connect revised forward and back grade tangents with a uniform vertical curve consistent with the design.

212.05 Acceptance. Linear grading will be evaluated under Subsections 106.02 and 106.04.

Clearing and removal of obstructions will be evaluated under Sections 201 and 203.

Measurement

212.06 Measure the Section 212 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable.

Do not measure changes in the clearing and grubbing quantity caused by alignment adjustments under Subsection 212.04.

Payment

212.07 The accepted quantities will be paid at the contract price per unit of measurement for the Section 212 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Section 212

Section 213. — SUBGRADE STABILIZATION

SECTION NOT USED

DIVISION 250
SLOPE REINFORCEMENT
AND RETAINING WALLS

Section 251. — RIPRAP

Description

251.01 This work consists of furnishing and placing riprap for bank protection, slope protection, drainage structures, and erosion control.

Riprap acceptance methods are designated according to Table 251-1. If no acceptance method is designated, use Method A.

Riprap classes are designated according to Table 705-1.

Geotextile filters are designated according to Table 714-1.

Material

251.02 Conform to the following Subsections:

Geotextile	714.01
Riprap	705.02

Construction Requirements

251.03 General. Dress the slope to produce a smooth surface. If geotextile filter is required, place according to Section 207.

251.04 Placed Riprap. Placed riprap is rock placed on a prepared surface to form a well-graded mass.

Place riprap to its full thickness in one operation to avoid displacing the underlying material. Do not place riprap material by methods that cause segregation or damage to the prepared surface. Place or rearrange individual rocks by mechanical or hand methods to obtain a dense uniform blanket with a reasonably smooth surface.

251.05 Keyed Riprap. Section not used.

251.06 Grouted Riprap. Section not used.

251.07 Acceptance. See Table 251-1 for sampling, testing, and acceptance requirements.

Rock for riprap will be evaluated under Subsections 106.02 and 106.04.

Material for grout will be evaluated under Subsections 106.02 and 106.03.

Acceptance Method A riprap construction will be evaluated under Subsection 106.02.

Acceptance Method B riprap construction will be evaluated under Subsections 106.02 and 106.04.

Placing grout will be evaluated under Subsection 106.02.

Geotextile filters will be evaluated under Section 207.

Measurement

251.08 Measure the Section 251 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

When measuring riprap by the cubic yard (cubic meter), measure in place.

Payment

251.09 The accepted quantities will be paid at the contract price per unit of measurement for the Section 251 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Table 251-1
Sampling, Testing, and Acceptance Requirements

Material or Product (Subsection)	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time	Remarks
Source									
Riprap (705.02)	Measured and tested for conformance (106.04 & 105)	Apparent specific gravity & absorption	–	AASHTO T 85	1 per material type (Not req'd if using local granite)	Source of material	Yes	Before using in work	–
		Soundness using sodium sulfate	–	AASHTO T 104	"	"	"	"	–
		LA abrasion	–	AASHTO T 96	"	"	"	"	–
Production									
Riprap (705.02)	Process control (153.03)	Size Methods A & B	–	See Note (2)	1 per 100 yd^3 (80 m^3) per Class	In-place	"	"	–
	Measured and tested for conformance (106.02 & 106.04)	Gradation[(1)] Method B	–	FLH T 521	1 per 1000 yd^3 (800 m^3) per Class	Stockpile or in-place[(3)]	No	24 hours	–

(1) Notify NFF at least 7 days before performing test.

(2) Verify riprap class by confirming that the largest accessible rock has an intermediate dimension greater than the upper limit of the D85 size range specified in Table 705-1.

(3) Point of sampling to be approved by NFF.

Section 252. — ROCKERY, SPECIAL ROCK EMBANKMENT, AND ROCK BUTTRESS

Description

252.01 This work consists of reconstructing special rock embankments (breast walls) at the uphill side of roadway.

Material

252.02 Conform to the following Subsections:

Rock for special rock embankment	705.04

Construction Requirements

252.03 Rockery. Section not used.

252.04 Special Rock Embankment. Verify the limits of embankments and buttresses. Notify the NFF if the embankment lengths, heights, or both are inadequate to intersect with adjacent slopes. Perform the work under Sections 204 as required. When specified, place geotextile filter according to Section 207.

Place rocks in a stable orientation with minimal voids to produce a random pattern matching the coursing and layout of existing adjacent construction. Construct the exposed face of the rock mass reasonably uniform with projections beyond the line of adjacent wall faces that are no greater than 6 inches (150 millimeters) for hand-placed rock.

Use rock smaller than the minimum rock size to chock the larger rock solidly in position and to fill voids between the large rocks.

252.05 Acceptance. Material for rockeries, special rock embankments, and rock buttresses will be evaluated under Subsections 106.02, 106.03, and 106.04.

Construction of rockeries, special rock embankments, and rock buttresses will be evaluated under Subsections 106.02 and 106.04.

Roadway excavation will be evaluated under Section 204.

Geotextile filters will be evaluated under Section 207.

Measurement

252.06 Measure the Section 252 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

When measuring special rock embankment and rock buttress by the cubic yard (cubic meter), measure in place.

Payment

252.07 The accepted quantities will be paid at the contract price per unit of measurement for the Section 252 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Section 253. — GABIONS AND REVET MATTRESSES

SECTION NOT USED

Section 254. — RESERVED

Section 255. — MECHANICALLY-STABILIZED EARTH WALLS

Description

255.01 This work consists of constructing mechanically-stabilized earth (MSE) walls.

Material

255.02 Conform to the following Section and Subsections:

Geotextile type II	714.01
Select granular backfill	704.10
Structural backfill	704.04

Construction Requirements

255.03 General. Grade the foundation for a width equal to the length of reinforcing elements plus 18 inches. Where the wall is set on a rocky foundation, place 6 inches of select granular backfill under the reinforcing mesh or strips.

255.04 Wall Erection. Erect the wall according to the drawings and the manufacturer's recommendations. When requested, have an experienced field representative from the wall system manufacturer available during erection.

(a) Stone-faced walls. Build up stone walls and MSE together in lifts. Lift height shall be approximately 3’-0” to match stone coursing. Do not exceed 4’-0” lift heights. Build stone wall first, then construct MSE system behind wall. Lay reinforcement fabric horizontally on compacted fill and normal to the face of the wall. Pull and anchor the reinforcement mesh taut before placing additional backfill. Place backfill and compact in 12-inch lifts. Wrap reinforcement fabric up over the compacted lift, lapping as show on design details. Face of MSE wall may be in contact with back wall face; do not leave any spaces more than 2-inch between MSE system and stone wall.

255.05 Backfilling. Backfill the stabilized volume with select granular backfill according to Subsection 302. Ensure that no voids exist below the reinforcing fabric or strips. Compact each layer according to Subsection 302, using an acceptable lightweight mechanical or vibratory compactor within 3 feet of the wall face.

Do not damage or disturb the facing or reinforcing elements. Do not operate equipment directly on top of the reinforcing mesh or strips. Correct all damaged, misaligned, or distorted wall elements.

Backfill and compact behind the stabilized volume with according to Subsection 302. At the end of the day's operation, slope the last lift of backfill away from the wall face to direct surface runoff away from the wall. Do not allow surface runoff from adjacent areas to enter the wall construction area.

255.06 Acceptance. Material for mechanically-stabilized earth walls listed under Subsection 720.01 will be evaluated under Subsections 106.02 and 106.03. Furnish a production certification with each shipment of concrete face panels.

Construction of mechanically-stabilized earth wall and services will be evaluated under Subsections 106.02 and 106.04.

Geotextile will be evaluated under Section 207.

Excavation, select granular backfill, and structural backfill will be evaluated under Section 209.

Measurement

255.07 Measure the Section 255 items listed in the bid schedule according to Subsection 109.02 and the following as applicable.

Measure mechanically-stabilized earth walls by the square foot of front wall face.

Measure select granular backfill within the stabilized volume by the cubic yard in place.

Measure foundation fill under Section 208.

Payment

255.08 The accepted quantities will be paid at the contract price per unit of measurement for the Section 255 pay item listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Section 256. — PERMANENT GROUND ANCHORS

SECTION NOT USED

Section 257. — CONTRACTOR-DESIGNED RETAINING WALLS

SECTION NOT USED

Section 258. — REINFORCED CONCRETE RETAINING WALLS

SECTION NOT USED

Section 259. — SOIL NAIL RETAINING WALLS

SECTION NOT USED

Section 260. — ROCK BOLTS AND DOWELS

SECTION NOT USED

Section 261. — REINFORCED SOIL SLOPES

SECTION NOT USED

DIVISION 300
AGGREGATE AND BASE COURSES

Section 301. — UNTREATED AGGREGATE COURSES

Description

301.01 This work consists of constructing one or more courses of aggregate on a prepared surface.

Subbase and base aggregate grading is designated according to Table 703-2. Surface course aggregate grading is designated according to Table 703-3.

Material

301.02 Conform to the following Subsections:

Subbase, base, and surface course aggregate	703.05
Water	725.01(a)

Construction Requirements

301.03 General. Prepare the surface on which the aggregate course is placed according to Section 204 or 303 as applicable.

After a representative quantity of aggregate is produced, submit proposed target values for the appropriate sieve sizes along with a representative 100-pound (50-kilogram) sample at least 14 days before incorporating the aggregate into the work.

Set target values within the gradation ranges shown in Table 703-2 or 703-3 for the required grading.

Written approval of the roadbed is required before placing aggregate.

For pit run or grid-rolled material, furnish material smaller than the maximum size, no gradation will be required otherwise. After processing on the road, remove all oversize material from the road and dispose as directed by the NFF.

Develop and use NFF furnished sources according to Section 105.

301.04 Mixing and Spreading. Determine the optimum moisture content according to AASHTO T 180, Method D. Mix the aggregate and adjust the moisture content to obtain a uniform mixture with a moisture content within 2 percent of the optimum moisture content. Spread and shape the mixture on the prepared surface in a uniform layer.

Do not place the mixture in a layer exceeding 6 inches (150 millimeters) in compacted thickness. When more than one layer is necessary, compact each layer according to Subsection 301.05 before placing the next layer. Route hauling equipment uniformly over the full width of the surface to minimize rutting or uneven compaction.

301.05 Compacting. Determine the maximum density of the mixture according to AASHTO T 180, Method D.

Compact each layer full width. Compact from the sides to the center, parallel to the centerline of the road.

Compact each layer to at least 95.0 percent of maximum density. Determine the in-place density and moisture content according to AASHTO T 310 or other approved test procedures.

301.06 Surface Tolerance. If grade finishing stakes are required, finish the surface to within ±0.05 feet (±10 millimeters) from staked line and grade elevation.

Grade finishing stakes are not required. Shape the surface to the required template and check the surface with a 10-foot (3-meter) straightedge. Defective areas are surface deviations in excess of 1 inch (25 millimeters) in 10 feet (3 meters) between two contacts of the straightedge with the surface.

Correct defective areas by loosening the material, adding or removing material, reshaping, and compacting.

301.07 Maintenance. Maintain the aggregate course to the correct line, grade, and cross-section by blading, watering, rolling, or combination thereof until placement of the next course. Correct defects according to Subsection 301.06.

301.08 Acceptance. See Table 301-1 for sampling, testing, and acceptance requirements; including the category for quality characteristics.

Aggregate gradation and surface course plasticity index will be evaluated under Subsection 106.05. Other aggregate quality properties will be evaluated under Subsections 106.02 and 106.04.

(a) Aggregate gradation. The upper and lower specification limits are equal to the calculated mean of all test results plus or minus the allowable deviations shown in Tables 703-2 and 703-3, except as follows:

(1) If the calculated mean value for a tested sieve exceeds the maximum gradation value shown in Table 703-2 or 703-3, then the upper specification is equal to the maximum gradation value plus the allowable deviation, and the lower specification is equal to the maximum gradation value minus the allowable deviation.

(2) If the calculated mean value for a tested sieve is less than the minimum gradation value shown in Table 703-2 or 703-3, then the upper specification is equal to the minimum gradation value plus the allowable deviation and the lower specification is equal to the minimum gradation value minus the allowable deviation.

(b) Plasticity index. The upper and lower specification limits for surface courses are shown in Subsection 703.05(c)(3).

Construction of untreated aggregate courses will be evaluated under Subsections 106.02 and 106.04.

Measurement

301.09 Measure the Section 301 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

When measuring aggregate by the cubic yard (cubic meter), measure in place.

When measuring aggregate by the square yard (square meter), measure the length horizontally along the centerline of the roadway. Measure the width horizontally to include the top of aggregate width, including designed widenings.

Payment

301.10 The accepted quantities will be paid at the contract price per unit of measurement adjusted according to Subsection 106.05 for the Section 301 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Table 301-1
Sampling, Testing, and Acceptance Requirements

Material or Product (Subsection)	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time	Remarks
Source									
Subbase, permeable fill, base, or surface course aggregate (703.05(b) (c))	Process control (153.03)	Gradation	–	AASHTO T 11 & T27	1 per stockpile (minimum)	Stockpile	No	24 hours	Not required when using a pre-crushed commercial source
					"	"	"	"	"
Surface course aggregate (703.05(c))	"	Plasticity index	–	AASHTO R 58, T 89, & T 90	"	Crusher belt or after processing	"	"	"
Production									
Subbase and permeable fill course Grading A & B	Statistical (106.05)	Gradation No. 4 (4.75 mm) No. 200 (75µm) Other specified sieves	 I I II	AASHTO T 27 & T 11	1 per 1000 tons (900 metric tons)	From windrow or roadbed after processing	Yes	4 hours	–

Section 302. — MINOR CRUSHED AGGREGATE

Description

302.01 This work consists of furnishing and placing crushed aggregate for bedding, backfill, and roadway aggregates on a prepared surface.

Material

302.02 Conform to the following Subsections:

Crushed aggregate	703.06
Water	725.01(a)

Construction Requirements

302.03 Preparing Surface.

(a) Roadway aggregate. Prepare the surface on which the aggregate course is placed according to Section 303.

(b) Bedding and backfill aggregate. Shape, compact, and finish the surface to the required lines, grade, elevation, and cross-section.

302.04 Placing Crushed Aggregate.

Written approval of the surface is required before placing aggregate.

(a) Roadway aggregate. For pit run or grid-rolled material, furnish material smaller than the maximum size, no gradation will be required otherwise. After processing on the road, remove all oversize material from the road and dispose as directed by the NFF.

Mix the aggregate and adjust the moisture content to obtain a uniform mixture. Adjust the moisture content to obtain proper compaction. Spread and shape in uniform layers not to exceed 6 inches (150 millimeters) compacted thickness. Where more than one layer is necessary, compact the underlying layer according to Subsection 302.05.

(b) Bedding and backfill aggregate. Place and shape the mixture in layers that, when compacted, do not exceed 6 inches (150 millimeters) in depth.

302.05 Compacting and Finishing Crushed Aggregate.

(a) Roadway aggregate. When no compaction method is specified, use either method. Finish surface according to Subsection 301.06.

(1) Method 1. Compact each layer according to Subsection 204.10(a). Compact the material along curbs, headers, walls, and places not accessible to a roller with approved tampers or compactors.

Compactive effort may be decreased if in-place densities show that less compactive effort is required under Method 2.

(2) Method 2. Compact each layer according to Subsection 301.05.

(b) Bedding and backfill aggregate. Compact each layer according to Subsection 302.

302.06 Acceptance. See Table 302-1 for sampling, testing, and acceptance requirements.

Crushed aggregate will be evaluated under Subsections 106.02 and 106.03. Submit a production certification including gradation and quality properties for each source.

Construction of roadway aggregate courses will be evaluated under Subsections 106.02 and 106.04. Method 2 compaction will be evaluated under Subsection 106.04.

Placement of bedding and backfill aggregate will be evaluated under Subsections 106.02 and 106.04.

Measurement

302.07 Measure the Section 302 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

When measuring crushed aggregate by the cubic yard (cubic meter), measure in place.

When measuring aggregate by the square yard (square meter), measure the length horizontally along the centerline of the roadway. Measure the width horizontally to include the top of aggregate width, including designed widenings.

Payment

302.08 The accepted quantities will be paid at the contract price per unit of measurement for the Section 302 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Table 302-1
Sampling, Testing, and Acceptance Requirements

Material or Product (Subsection)	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time	Remarks
Production									
Crushed aggregate	Measured and tested for conformance (106.04)	Moisture-density	–	AASHTO T 180, Method D (1)	1 per aggregate supplied	Production output or stockpile	No	4 hours	–
		Density	–	AASHTO T310 or other approved procedures	1 per 500 tons (450 metric tons)	In-place after compaction	"	End of shift	For Method 2 compaction only
Crushed aggregate	Process control (153.03)	Moisture content (in-place)	–	"	"	"	"	"	–
Finished Product									
Crushed aggregate	Measured and tested for conformance (106.04)	Surface tolerance & grade	–	Subsection 301.06	Determined by the NFF	Surface of final course	No	Before placement of next layer or as requested	–

(1) Minimum of 5 points per proctor.

Section 303. — ROAD RECONDITIONING

Description

303.01 This work consists of reconditioning ditches, shoulders, roadbeds, aggregate surfaces, or the entire road.

Material

303.02 Conform to the following Subsection:

Water	725.01(a)

Construction Requirements

303.03 Ditch Reconditioning. Remove slide material, sediment, vegetation, and other debris from existing ditches. Reshape ditches and culvert inlets/outlets per plans to achieve positive drainage and uniform ditch width, depth, and grade. Dispose of waste at designated sites.

303.04 Shoulder Reconditioning. Section not used.

303.05 Roadbed Reconditioning. Remove organic, deleterious, and material larger than 6 inches (150 millimeters) from the top 6 inches (150 millimeters) of subgrade. Repair soft and unstable areas according to Subsection 204.07. Scarify surface to a 6-inch (150-millimeter) depth. Remove irregularities and shape to a uniform surface. Finish earth surfaces to within 0.05 feet (15 millimeters) and rock surfaces to within 0.10 feet (30 millimeters) of required line, grade, and cross-section. Compact according to Subsection 204.10.

303.06 Aggregate Surface Reconditioning. Repair soft and unstable areas to the full aggregate surface depth and according to Subsection 204.07. Scarify the thickness of aggregate surfacing material or to 6 inches (150 millimeters), whichever is less. Remove irregularities and shape to a uniform surface. Finish and compact the surface according to Subsection 302.05.

303.07 Roadway Reconditioning. Perform applicable work described in Subsections 303.03 through 303.06. Maintain existing cross slope and crown or as shown in the plans.

303.08 Acceptance. See Table 303-1 for sampling, testing, and acceptance requirements.

Road reconditioning work will be evaluated under Subsections 106.02 and 106.04.

Measurement

303.09 Measure the Section 303 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

Measure waste under Section 204.

Payment

303.10 The accepted quantities will be paid at the contract price per unit of measurement for the Section 303 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Table 303-1
Sampling, Testing, and Acceptance Requirements

Material or Product (Subsection)	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time	Remarks
Production									
Existing roadbed material or aggregate surfacing	Measured and tested for conformance (106.04)	Classification	–	AASHTO M 145	1 per soil type	Roadbed	Yes	Before using in work	–
		Moisture-density	–	AASHTO T 180, Method D (1) or AASHTO T 99, Method C(1)	1 per mixture or change in material	Processed material	No	"	–
		Density	–	AASHTO T 310 or other approved procedures	1 per 2000 yd^2 (1700 m^2)	In-place after compaction	"	End of shift	For Subsection 204.10(c) cases only
	Process control (153.03)	Moisture content (in-place)	–	"	"	"	"	"	–
Finished Product									
Aggregate surface reconditioning (303.06)	Measured and tested for conformance (106.04)	Surface tolerance & grade	–	Subsection 301.06	Determine by the NFF	Surface of final course	No	Before placement of next layer or as requested	–

(1) Minimum of 5 points per proctor.

Section 304. — FULL DEPTH RECLAMATION

SECTION NOT USED

Section 305. — FULL DEPTH RECLAMATION WITH CEMENT

SECTION NOT USED

Section 306. — FULL DEPTH RECLAMATION WITH ASPHALT

SECTION NOT USED

Section 307. — RESERVED

Section 308. — RESERVED

Section 309. — EMULSIFIED ASPHALT-TREATED BASE COURSE

SECTION NOT USED

Section 310. — COLD IN-PLACE RECYCLED ASPHALT BASE COURSE

SECTION NOT USED

Section 311. — STABILIZED AGGREGATE SURFACE COURSE

SECTION NOT USED

Section 312. — DUST PALLIATIVE

SECTION NOT USED

Section 313. — AGGREGATE-TOPSOIL COURSE

SECTION NOT USED

Section 314. — STOCKPILED AGGREGATES

SECTION NOT USED

DIVISION 400
ASPHALT PAVEMENTS AND SURFACE TREATMENTS

DIVISION NOT USED

Section 415. — PAVING GEOTEXTILES

SECTION NOT USED.

DIVISION 500
RIGID PAVEMENTS

DIVISION NOT USED

DIVISION 550
BRIDGE CONSTRUCTION

DIVISION NOT USED

DIVISION 600
INCIDENTAL CONSTRUCTION

Section 601. — MINOR CONCRETE STRUCTURES

SECTION NOT USED

Section 602. — CULVERTS AND DRAINS

SECTION NOT USED.

Section 603. — STRUCTURAL PLATE STRUCTURES

SECTION NOT USED

Section 604. — MANHOLES, INLETS, AND CATCH BASINS

SECTION NOT USED

Section 606. — CORRUGATED METAL SPILLWAYS

SECTION NOT USED

Section 607. — CLEANING, RELAYING, AND REPAIRING EXISTING DRAINAGE STRUCTURES

SECTION NOT USED

Section 608. — PAVED WATERWAYS

SECTION NOT USED

Section 609. — CURB AND GUTTER

SECTION NOT USED

Section 610. — HORIZONTAL DRAINS

SECTION NOT USED

Section 611. — WATER SYSTEMS

SECTION NOT USED

Section 612. — SANITARY SEWER SYSTEMS

SECTION NOT USED

Section 613. — SIMULATED STONE MASONRY SURFACE

SECTION NOT USED

Section 614. — LEAN CONCRETE BACKFILL

SECTION NOT USED

Section 615. — SIDEWALKS, PADS, AND PAVED MEDIANS

SECTION NOT USED

Section 616. — SLOPE PAVING

SECTION NOT USED

Section 617. — GUARDRAIL

SECTION NOT USED

Section 618. — CONCRETE BARRIERS AND PRECAST GUARDWALLS

SECTION NOT USED

Section 619. — FENCES, GATES, CATTLE GUARDS AND BOLLARD POSTS

SECTION NOT USED

Section 620. — STONE MASONRY

Description

620.01 This work consists of rehabilitating and constructing stone masonry retaining wall and breast wall structures using dry stack rubble masonry construction.

Masonry class is designated as follows:

(a) Dimensioned masonry. Not used;

(b) Class A masonry. Not used;

(c) Class B masonry. Not used; and

(d) Rubble masonry. Stones vary in size and shape, are roughly dressed, and placed in random courses using dry stack construction without mortar.

Material

620.02 Conform to the following Section and Subsections:

Rock for masonry structures	705.03

Construction Requirements

620.03 General. Submit stone samples representing the range of colors and sizes to be used 14 days before beginning stone placement work.

Keep an adequate inventory of stone on the site to provide a variety of stones. Mix new stone with existing stone to produce a uniform pattern and color.

Perform excavation and embankment according to Section 204.

620.04 Dressing Rock. Remove thin or weak portions of rock. Dress face rock bed and joint lines to a maximum variation from true line as follows:

- Rubble masonry 1½ in (38 mm)

(a) Bed surfaces. Dress face rock bed surfaces normal to the face to a depth of 3 inches (75 millimeters). Beyond that point, do not exceed 2 inches (50 millimeters) in 12 inches (300 millimeters). Bedded surfaces shall be well-scabbed or otherwise worked so they can be set close with minimal pinning or chinking.

(b) Joint surfaces. Dress face rock joint surfaces to form an angle with the bed surface of not less than 45 degrees.

Dress face rock joint surfaces normal to the face to a depth of 2 inches (50 millimeters). Beyond that point, do not exceed 1 inch in 12 inches (25 millimeters in 300 millimeters) departure from normal.

Do not round corners at the meeting of the bed and joint lines in excess of the following radii:

(1) Dimensioned masonry	Not used
(2) Class A masonry	Not used
(3) Class B masonry	Not used
(4) Rubble masonry	1½ inches (38 millimeters)

(c) Arch ring rock joint surfaces. Section not used.

(d) Finish for exposed faces. No sawcut edges are allowed for visible faces or visible edges. Rough-trim stones by hand or using drilled holes and splitting wedges. Remove drill or quarry marks from 90% of exposed faces; drill and quarry marks are permissible at up to 10% of exposed faces. Pitch face stones using chisels to the line along beds and joints. Finish the exposed faces as specified in the contract. The following abbreviations are used to represent the type of surface or dressing specified:

(1) Rock faced (R.F.). Provide an irregular projecting surface without tool marks, concave surfaces below the pitch line, and projections beyond the specified pitch line no greater than 1½ inches (38 millimeters). Uniformly distribute stones of the same height of projection.

620.05 Placing Stone. Follow dry stack stone placement procedures outlined by the Dry Stone Conservancy, Building & Repairing Dry Stone Fences and Retaining walls, (Lexington, Kentucky) 2001.

Clean stones of loose dirt and debris before placing. Use hand tools to clean the exposed faces of the stones when removing and resetting stone masonry.

Appearance of rubble stone construction shall match adjacent existing stone masonry and design requirements. Lay beds for battered walls from level to normal to the batter line of the face of the wall.

Place stone to provide a consistent pattern and color. Lay stones with the longest dimension turning into the wall thickness and the exposed face parallel to the masonry face.

Construct masonry bed joints head joints and bed joints to thickness of 0 – 1 inches (0 – 25 millimeters). Construct head joints at angles with the vertical from 0 to 30 degrees.

Lay the face stones level, packing beneath each one thoroughly to provide firm bedding. Use wedge-shaped rocks as pins beneath rears and sides of placed stones to fill cavities and spaces for solid bedding. Add stone pins at joints for firm bedding to stabilize stones. After final placement each stone should not wobble or move with hand pressure. Do not rely on face chinking: face chinking is not needed if stones are correctly laid. If a face rock needs to be supported by a stone wedge inserted into the front, use a rock that extends at least 6 inches (152 mm) into the wall.

Do not dump gravel or small rocks to fill interior spaces. Pack small stones and fragments by hand into interior spaces, filling all gaps and spaces greater than 2 inch (51 mm).

620.06 Pointing. Section not used.

620.07 Constructing Walls. Construct a mockup section of wall at least 5 feet (1.5 meters) high and 8 feet (2.4 meters) long, showing examples of wall face, top of wall, and method of forming joints. The mockup section may remain in place as part of the finished work. Do not construct stone masonry before the mockup section is approved by NFF.

Set face stones to produce the effect demonstrated in the approved mockup section. Do not extend bed joints in an unbroken line through more than five stones and head joints through more than two stones. Cover vertical joints by placing stone as two over one, breaking the joints every 2 to 3 courses. Bond each face stone with contiguous face stones at least 6 inches (150 millimeters) longitudinally and 2 inches (50 millimeters) vertically. Do not allow the corners of four stones to be adjacent to each other.

Do not bunch small stones or stones of the same size, color, or texture. Construct walls using stones decreasing in size from the bottom to the top matching the appearance of existing stonework. Use large stones at ends of walls and at corners.

(a) Headers. Use header (bond) stones of the size and number indicated to tie together stone layers. Distribute bond stones evenly throughout the construction at vertical and horizontal spacing of no more than 36 inch (915 mm).

(b) Backing. Construct the backing out of large stones of the specified size. Bond the individual stones composing the backing and heart with the stones in the face wall and with each other. Fill openings and interstices in the backing with spalls.

620.08 Facing for Concrete. Section not used.

620.09 Constructing Arches. Section not used.

620.10 Wall Caps. Place wall cap stones as the top course, pinning with stone pieces to be level and solidly bedded. Use capstones extending for the full width at the top of walls meeting the dimensions specified. Place capstones with varying lengths randomly to avoid a pattern. Cap stone head joints shall not align with head joints in the top wall course: place cap stones to cover all vertical joints in courses below.

620.11 Acceptance. Rock for masonry structures will be evaluated under Subsections 106.02 and 106.04.

Construction or rehabilitation of stone masonry will be evaluated under Subsections 106.02 and 106.04.

Excavation and backfill will be evaluated under Section 302.

Measurement

620.12 Measure the Section 620 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

When measuring stone masonry by the cubic yard (cubic meter), measure in the structure.

When measuring stone masonry wall caps, measure the length along the top of wall including terminal sections.

When measuring areas where masonry is removed and reset by the cubic yard (cubic meter), measure in the structure after resetting.

Do not measure mockup wall sections not incorporated in the work.

Payment

620.13 The accepted quantities will be paid at the contract price per unit of measurement for the Section 620 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Section 621. — MONUMENTS AND MARKERS

SECTION NOT USED

Section 622. — RENTAL EQUIPMENT

SECTION NOT USED

Section 623. — GENERAL LABOR

Description

623.01 This work consists of furnishing workers and hand tools for construction work ordered by the NFF and not otherwise provided for under the contract.

Construction Requirements

623.02 Workers and Equipment. Furnish competent workers and appropriate hand tools for the work.

Obtain approval of the length of workday and workweek before beginning work. Keep daily records of the number of hours worked. Submit the records along with certified copies of the payroll.

623.03 Acceptance. General labor work will be evaluated under Subsections 106.02 and 106.04.

Measurement

623.04 Measure the Section 623 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

Do not measure time for workers transportation to and from the project site.

Payment

623.05 The accepted quantities will be paid at the contract price per unit of measurement for the Section 623 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Section 624. — TOPSOIL

SECTION NOT USED

Section 625. — TURF ESTABLISHMENT

SECTION NOT USED

Section 626. — PLANTS, TREES, SHRUBS, VINES, AND GROUNDCOVERS

SECTION NOT USED

Section 627. — SOD

SECTION NOT USED

Section 628. — RESERVED

Section 629. — ROLLED EROSION CONTROL PRODUCTS AND CELLULAR CONFINEMENT SYSTEMS

SECTION NOT USED

Section 630. — RESERVED

Section 631. — RESERVED

Section 632. — RESERVED

Section 633. — PERMANENT TRAFFIC CONTROL

SECTION NOT USED

Section 634. — PERMANENT PAVEMENT MARKINGS

SECTION NOT USED

Section 635. — TEMPORARY TRAFFIC CONTROL

Description

635.01 This work consists of furnishing, installing, maintaining, relocating, and removing temporary traffic control devices and services as ordered for the control and protection of public traffic through the project.

Advance warning barricade types are designated in the MUTCD.

Material

635.02 Conform to the MUTCD and the following Sections and Subsections:

Retroreflective sheeting	718.01
Sign panels	633.05
Sign posts	633.04

Construction Requirements

635.03 Qualifications. Provide flaggers certified by ATSSA, the National Safety Council, a state department of transportation, or other acceptable organization. Use pilot car operators conforming to the qualifications of a flagger.

635.04 General. Furnish, install, and maintain temporary traffic control devices adjacent to and within the project as required by the MUTCD, traffic control plan, and Section 156. Install and maintain traffic control devices as follows:

(a) Furnish and install traffic control devices before the start of construction operations;

(b) Install only those traffic control devices needed for each stage or phase;

(c) Relocate temporary traffic control devices as necessary;

(d) Remove devices that no longer apply to the existing conditions;

(e) Immediately replace devices that are lost, stolen, destroyed, or inoperative;

(f) Keep temporary traffic control devices clean;

(g) Furnish and maintain traffic control devices that meet the "*acceptable*" standard described in ATSSA, *Quality Standards for Work Zone Traffic Control Devices*. Amend the ATSSA standards as follows:

(1) Repair or remove and replace "*marginal*" devices within 48 hours; and

(2) Repair or remove and replace "*unacceptable*" devices immediately;

(h) Remove temporary traffic control devices upon contract completion or when approved; and

(i) Furnish crashworthy temporary traffic control devices.

635.05 Barricades. Use barricades of the type and size specified or according to the MUTCD. Use Type III, IV, IX, or XI retroreflective sheeting.

635.06 Cones and Tubular Markers. Use cones or tubular markers of the height specified or according to the MUTCD. Use Type III or Type VI retroreflective sheeting.

635.07 Construction Signs. Use Type III, IV, VIII, IX, or XI prismatic retroreflective sheeting. Use fluorescent sheeting for orange signs. For roll-up signs, use florescent Type VI retroreflective sheeting.

Portable sign supports may be used instead of sign posts when approved by the NFF.

Remove or completely cover unnecessary signs. Use metal, plywood, or other acceptable material to cover signs. Do not use adhesives glues, tapes, or mechanical fasteners that mar the face of the panel of the sign to be covered.

635.08 Drums. Use plastic drums that are at least 36 inches (900 millimeters) high and at least 18 inches (450 millimeters) in diameter. Use Type III or Type VI retroreflective sheeting.

635.09 Flaggers. Use flaggers certified according to Subsection 635.03. Use Type III, IV, VIII, IX, or XI retroreflective sheeting on flagger paddles. Do not use flags.

635.10 Pilot Cars. Section not used.

635.11 Temporary Barriers. Use temporary barriers that are crashworthy and are new or used provided they are not badly damaged. Lifting holes no larger than 4 inches (100 millimeters) or lifting loops are permitted.

Mount white or yellow retroreflectors as applicable, to the top or side of the barrier on 25-foot (8-meter) centers. Mount the retroreflectors at a uniform height at least 24 inches (600 millimeters) above the road surface. Flexible barrier delineators or barrier delineation tape may be used instead of retroreflectors when approved by the NFF.

635.12 Temporary Guardrail. Section not used.

635.13 Temporary Pavement Markings and Delineation. Section not used.

635.14 Vertical Panels. Use vertical panels that are at least 24 inches (600 millimeters) in height and 8 to 12 inches (200 to 300 millimeters) wide. Use Type III, IV, VIII, IX, or XI retroreflective sheeting.

635.15 Warning Lights. Section not used.

635.16 Shadow Vehicle. Section not used.

635.19 Temporary Signal System. Use a temporary signal system according to MUTCD Parts 4 and 6.

Provide the names and telephone numbers of at least two emergency contacts who can be reached 24 hours a day, and who are available to arrive on site within 4 hours of notification to repair or replace malfunctioning temporary signal equipment. In addition, provide for emergency flaggers who can be reached 24 hours a day, and who are available to perform traffic control operations within the timeframes specified below until the temporary signal system is operable.

If the traffic signal malfunctions during construction operations, immediately begin traffic control operations using flaggers until the system is returned to normal signal operation. Complete traffic signal repairs within 6 hours of the malfunction.

If the traffic signal malfunctions during a period when no construction activity is taking place, begin traffic control operations using flaggers as soon as possible, but no later than 2 hours after the initial notification. Continue temporary flagging operations until the system is returned to normal signal operation. Complete traffic signal repairs within 12 hours of notification.

No payment will be made for the use of flaggers in place of a malfunctioning or inoperable temporary signal system.

635.20 Temporary Fence. Section not used.

635.21 Temporary Rumble Strip. Section not used.

635.22 Steel Plates. Section not used.

635.23 Acceptance. Material for temporary traffic control devices will be evaluated under Subsections 106.02 and 106.03.

Vehicles for pilot cars and shadow vehicles will be evaluated under Subsections 106.02 and 106.04.

Placement of temporary traffic control devices will be evaluated under Subsections 106.02 and 106.04.

Temporary traffic control services will be evaluated under Subsections 106.02 and 106.04.

Measurement

635.24 Measure the Section 635 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable when ordered by the NFF and installed.

When measuring temporary traffic control pay items, measure only one time even if relocated or replaced, except for pay items paid by the hour.

Measure barricades by the linear foot (meter) of width.

When measuring construction signs by the square foot (square meter), measure front face sign panel. Do not measure posts and temporary supports.

When there is a pay item for moving temporary barriers, do not measure movement of temporary barriers for work access or the convenience of the Contractor.

Measure replacement barrels or cartridges for crash cushions for the barrels or cartridges damaged by public traffic.

Payment

635.25 The accepted quantities will be paid at the contract price per unit of measurement for the Section 635 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Progress payments for temporary traffic control devices will be paid as follows:

(a) 50 percent of the pay item amount will be paid upon installation.

(b) An additional 25 percent of the pay item amount will be paid following completion of 50 percent of the contract amount.

(c) Payment of the remaining portion of the pay item amount will be paid when the temporary traffic control devices are removed from the project.

Progress payments for pay items paid for by the hour will be paid at 100 percent of the pay item amount when ordered by the NFF and furnished.

Section 636. — TRAFFIC SIGNAL, TRAFFIC COUNTER, LIGHTING, AND ELECTRICAL SYSTEMS

SECTION NOT USED

Section 637. — FACILITIES AND SERVICES

SECTION NOT USED

DIVISION 700
MATERIAL

Section 701. — CEMENT

SECTION NOT USED

Section 702. — ASPHALT MATERIAL

SECTION NOT USED

Section 703. — AGGREGATE

703.01 Fine Aggregate for Concrete. Furnish sand conforming to AASHTO M 6, Class B, except as amended or supplemented by the following:

(a) Material passing No. 200 (75-µm) sieve, AASHTO T 11	3.0 percent max.
(b) Alkali-silica reactivity. Test the aggregate for alkali silica reaction and conform to one of the following (1) through (5):	
(1) Alkali-silica reactivity, ASTM C1260	≤ 0.10 percent at 16 days after casting
(2) Alkali-silica reactivity, ASTM C1260	0.11 percent to 0.20 percent at 16 days after casting
And one of the following examinations:	
(a) Petrographic examination of aggregates, ASTM C295, performed within 1 year from time of submittal	Favorable report for use
(b) Petrographic examination of hardened concrete, ASTM C856, performed on ASTM C1260 specimens after test	Favorable report for use
(3) Alkali-silica reactivity with cementitious material, ASTM C1567, performed on approved mix design mass percent combinations. Do not use lithium compounds as mitigation measures	≤ 0.10 percent at 16 days after casting
(4) Alkali silica reaction, ASTM C1293	< 0.04 percent at 12 months
(5) Alkali-silica reaction with cementitious material, ASTM C1293, performed on approved mix design mass percent combinations	< 0.04 percent at 24 months

For lightweight fine aggregate, conform to AASHTO M 195.

703.02 Coarse Aggregate for Concrete. Section not used.

703.03 Granular Backfill. Furnish aggregate for the following installations.

(a) Granular fill. Furnish granular backfill using on-site material or crushed stone conforming to AASHTO M 43, Size Number 5, 57, 67, or 7.

703.04 Reserved.

703.05 Subbase, Base, and Surface Course Aggregate.

(a) General. Furnish particles or fragments of crushed stone from the site without organic matter and lumps or balls of clay.

(b) Subbase or base aggregate. In addition to Subsection 703.05(a), conform to the following:

(1) Gradation	Table 703-2
(2) Liquid limit, AASHTO T 89	25 max.

Table 703-2
Target Value Ranges for Subbase and Base Gradation

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 and T 11)				
	Grading Designation				
	A (Subbase)	B (Subbase)	C (Base)	D (Base)	E (Base)
2½ inch (63 mm)	100(1)				
2 inch (50 mm)	97 – 100(1)	100(1)	100(1)		
1½ inch (37.5 mm)		97 – 100(1)			
1 inch (25 mm)	65 – 79 (6)		80 – 100 (6)	100(1)	
¾ inch (19 mm)			64 – 94 (6)	86 – 100 (6)	100(1)
½ inch (12.5 mm)	45 – 59 (7)				
⅜ inch (9.5 mm)			40 – 69 (6)	51 – 82 (6)	62 – 90 (6)
No. 4 (4.75 mm)	28 – 42 (6)	40 – 60 (8)	31 – 54 (6)	36 – 64 (6)	36 – 74 (6)
No. 40 (425 µm)	9 – 17 (4)			12 – 26 (4)	12 – 26 (4)
No. 200 (75 µm)	4.0 – 8.0 (3)	4.0 – 12.0 (4)	4.0 – 7.0 (3)	4.0 – 7.0 (3)	4.0 – 7.0 (3)

(1) Statistical procedures do not apply.

( ) The value in the parentheses is the allowable deviation (±) from the target values.

(c) Surface course aggregate. In addition to Subsection 703.05(a), conform to the following:

(1) Gradation	Table 703-3
(2) Liquid limit, AASHTO T 89, Method A	35 max.
(3) Plasticity index, AASHTO T 90	10±3

Do not furnish material that contains asbestos fibers.

Table 703-3
Target Value Ranges for Surface Course Gradations

Sieve Size	Percent by Mass Passing Designate Sieve (AASHTO T 27 & AASHTO T 11)
1 inch (25 mm)	100[(1)]
½ inch (12.5 mm)	70 – 80 (5)
No. 4 (4.75 mm)	40 – 50 (7)
No. 10 (2.0 mm)	25 – 40 (6)
No. 40 (425 µm)	15 – 25 (5)
No. 200 (75 µm)	8.0 – 14.0 (4)

(1) Statistical procedures do not apply.

( ) The value in the parentheses is the allowable deviation (±) from the target values.

703.06 Crushed Aggregate. Furnish hard, durable particles or fragments of crushed stone or gravel conforming to the size and quality requirements for crushed aggregate material normally used locally in the construction and maintenance of highways by Federal or state agencies. Furnish crushed aggregate with a maximum size of 1 inch (25 millimeters) as determined by AASHTO T 27 and AASHTO T 11. Furnish crushed aggregate uniformly graded from coarse to fine and free of organic matter, lumps or balls of clay, and other deleterious material.

703.07 Asphalt Concrete Aggregate. Section not used.

Table 703-5
Allowable Deviation Based on Target Value

Percent by Mass Passing		Allowable Deviation
Minimum	**Maximum**	
70.1	89.9	4
60.1	70.0	5
55.1	60.0	6
45.1	55.0	7
40.1	45.0	6
30.1	40.0	5
21.1	30.0	4
8.1	21.0	3
0	8.0	2

703.08 Open-Graded Asphalt Friction Course Aggregate. Section not used.

703.09 Chip Seal Aggregate. Section not used.

703.10 Slurry Seal and Micro Surfacing Aggregate. Section not used.

703.11 Reserved.

703.12 Blotter. Section not used.

703.13 Aggregate for Aggregate-Topsoil Course. Section not used.

703.14 Sand. Furnish clean material conforming to the following:

(a) Gradation AASHTO M 6

(b) Deleterious material AASHTO M 6, Class B

703.15 Aggregate for Lean Concrete Backfill. Section not used.

703.16 Shotcrete Aggregate. Section not used.

703.17 Granular Rock Backdrain. Section not used.

Section 704. — SOIL

704.01 Foundation Fill. Section not used.

704.02 Bedding Material. Section not used.

704.03 Backfill Material. Section not used.

704.04 Structural Backfill. Furnish free draining granular material free of excess moisture, muck, frozen lumps, roots, sod, or other deleterious material conforming to the following:

(a) Maximum particle size	3 inches
(b) Material passing No. 200 sieve, AASHTO T 27 and T 11	15% max.
(c) Liquid limit, AASHTO T 89	30% max.

704.05 Topping. Section not used.

704.06 Unclassified Borrow. Section not used.

704.07 Select Borrow. Section not used.

704.08 Select Topping. Section not used.

704.09 Bed Course. Section not used.

704.10 Select Granular Backfill. Furnish sound, durable, granular material free from organic matter or other deleterious material. Conform to the following:

(a) Quality requirements.

(1) Gradation	Table 704-4
(2) Angle of internal friction on the portion passing the No. 10 sieve, AASHTO T 236	34° min.

Note: Compact samples for AASHTO T 236 to 95 percent of the maximum density determined according to AASHTO T 99, method C or D and corrected for oversized material according to AASHTO T 99, Note 9.

(3) Sodium sulfate soundness loss (5 cycles), AASHTO T 104	15% max.
(4) Plasticity index, AASHTO T 90	6 max.

(b) Electrochemical requirements for MSE walls with metallic reinforcements.

(1) Resistivity, AASHTO T 288	3000 Ωcm min.
(2) pH, AASHTO T 289	5.0 to 10.0
(3) Sulfate content, AASHTO T 290	200 ppm max.

(4) Chloride content, AASHTO T 291 100 ppm max.

Note: Tests for sulfate and chloride content are not required when resistivity is greater than 5000 ohm centimeters.

(c) Electrochemical requirements for MSE walls with geosynthetic reinforcements.

pH, AASHTO T 289 5.0 to 10.0

Table 704-4
Select Granular Backfill Gradation

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 & T 11)
4 inch	100
No. 40	0 – 60
No. 200	0 – 15

704.11 Reserved.

704.12 Crib Wall Backfill. Section not used.

Section 705. — ROCK

705.01 Gabion and Revet Mattress Rock. Section not used.

705.02 Riprap. Furnish hard, durable, angular rock from on site that is free of organic or other unsuitable material. Angular rock is characterized by sharp, clean edges at the intersections of relatively flat surfaces. Use local granite removed from approved material area. Do not use shale, rock with shale seams, or other fissile or fissured rock that may break into smaller pieces in the process of handling and placing. Conform to the following:

(a) Rock particle intermediate dimension (width) and minimum dimension (thickness)	⅓ longest dimension (length) min.
(b) Gradation, FLH T 521	Table 705-1

Table 705-1
Gradation Requirements for Riprap[(1)]

Class	% of Rock Equal or Smaller by Count, D_X	Range of Intermediate Dimensions,[(2)] inches (millimeters)	Range of Rock Mass,[(3)] pounds (kilograms)
1	100	9 – 15 (230 – 380)	59 – 270 (27 – 120)
	85	7 – 11 (180 – 280)	28 – 110 (13 – 50)
	50	5 – 8 (130 – 200)	10 – 42 (5 – 19)
	15	3 – 6 (80 – 150)	2 – 18 (1 – 8)
2	100	15 – 21 (380 – 530)	270 – 750 (120 – 340)
	85	11 – 15 (280 – 380)	110 – 270 (50 – 120)
	50	8 – 11 (200 – 280)	42 – 110 (19 – 50)
	15	6 – 8 (130 – 200)	10 – 42 (6 – 19)
3	100	21 – 27 (530 – 690)	750 – 1600 (340 – 730)
	85	15 – 19 (380 – 480)	270 – 560 (120 – 250)
	50	11 – 14 (280 – 360)	110 – 220 (50 – 100)
	15	8 – 10 (200 – 250)	42 – 81 (19 – 37)
4	100	27 – 33 (690 – 840)	1600 – 2900 (730 – 1300)
	85	19 – 23 (480 – 580)	560 – 990 (250 – 450)
	50	14 – 17 (360 – 430)	220 – 400 (100 – 180)
	15	9 – 12 (230 – 300)	59 – 140 (27 – 64)
5	100	33 – 39 (840 – 990)	2900 – 4850 (1300 – 2200)
	85	23 – 28 (580 – 710)	990 – 1800 (450 – 820)
	50	17 – 20 (430 – 510)	400 – 650 (180 – 290)
	15	11 – 15 (280 – 380)	110 – 270 (50 – 120)
6	100	39 – 45 (990 – 1140)	4850 – 7400 (2200 – 3350)
	85	28 – 32 (710 – 810)	1800 – 2650 (820 – 1200)
	50	20 – 23 (510 – 580)	650 – 990 (290 – 450)
	15	13 – 17 (330 – 430)	180 – 400 (82 – 180)
7	100	45 – 54 (1140 – 1370)	7400 – 12,800 (3350 – 5800)
	85	32 – 38 (810 – 970)	2650 – 4450 (1200 – 2000)
	50	23 – 28 (580 – 710)	990 – 1800 (450 – 820)
	15	15 – 20 (380 – 510)	270 – 650 (120 – 290)
8	100	54 – 66 (1370 – 1680)	12,800 – 23,400 (5800 – 10,600)
	85	38 – 47 (970 – 1190)	4450 – 8450 (2000 – 3850)
	50	28 – 35 (710 – 890)	1800 – 3500 (820 – 1600)
	15	19 – 25 (480 – 640)	560 – 250 (250 – 570)
9	100	66 – 78 (1680 – 1980)	23,400 – 38,600 (10,600 – 17,500)
	85	47 – 55 (1190 – 1400)	8450 – 13,500 (3850 – 6100)
	50	35 – 41 (890 – 1040)	3500 – 5600 (1600 – 2550)
	15	22 – 30 (560 – 760)	870 – 2200 (390 – 1000)
10	100	78 – 90 (1980 – 2290)	38,600 – 59,300 (17,500 – 26,900)
	85	55 – 64 (1400 – 1630)	13,500 – 21,300 (6100 – 9650)
	50	41 – 48 (1040 – 1220)	5600 – 9000 (2550 – 4100)
	15	26 – 36 (660 – 910)	1450 – 3800 (660 – 1700)

(1) Gradation includes spalls and rock fragments to provide a stable, dense mass.

(2) The intermediate dimension is the longest straight-line distance across the rock that is perpendicular to the rock's longest axis on the rock face with the largest projection plane.

(3) Rock mass is based on a specific gravity of 2.65 and 85 percent of the cubic volume as calculated using the intermediate dimension.

705.03 Rock for Masonry Structures. Use local stone acquired from the designated areas, splitting and tooling to conform to the size and shape specified. Stone materials shall be sound, durable rock with texture and color to match the range of appearance of existing in-place stonework. Do not furnish rock containing reeds, rifts, seams, laminations, and minerals that may cause discoloration or deterioration from weathering.

705.04 Rock for Special Rock Embankment. Furnish angular stone acquired from the designated areas, splitting and tooling to conform to the sizes specified on project detail drawings. For hand-placed embankments at breast walls, furnish rock conforming to Table 705-3.

Table 705-2
Range of Hand-Placed Rock

Percent of Rock Fragments by Mass	Range of Intermediate Dimensions,(1) inches (millimeters)	Range of Rock Mass,(2) pounds (kilograms)
75	> 14 (350)	> 165 (75)
25	10 – 14 (250 – 350)	90 – 165 (40 – 75)

(1) The intermediate dimension is the longest straight-line distance across the rock that is perpendicular to the rock's longest axis on the rock face with the largest projection plane.
(2) Rock mass is based on a specific gravity of 2.65.

705.05 Rock for Buttresses. Section not used.

705.06 Rock for Rockeries. Section not used.

705.07 Rock Mulch. Section not used.

Section 706. — CONCRETE PIPE

SECTION NOT USED

Section 707. — METAL PIPE

SECTION NOT USED

Section 708. — PLASTIC PIPE

SECTION NOT USED

Section 709. — REINFORCING STEEL AND WIRE ROPE

SECTION NOT USED

Section 710. — FENCE AND GUARDRAIL

Section 711. — CONCRETE CURING MATERIAL AND ADMIXTURES

SECTION NOT USED

Section 712. — JOINT MATERIAL

SECTION NOT USED

Section 713. — ROADSIDE IMPROVEMENT MATERIAL

SECTION NOT USED

Section 714. — GEOSYNTHETIC MATERIAL

714.01 Geotextile. Use long-chain synthetic polymers composed of at least 95 percent by mass of polyolefins or polyesters to manufacture geotextile and the threads used in joining geotextile by sewing. Form the geotextile, including selvedges, into a stable network such that the filaments or yarns retain their dimensional stability relative to each other.

(a) Physical requirements. Conform to the following tables for the type of geotextile specified:

(1) Type I (A - F) Subsurface drainage	Table 714-1
(2) Type II (A - C) Separation	Table 714-2
(3) Type III (A - B) Stabilization geotextile	Table 714-3
(4) Type IV (A - F) Permanent erosion control	Table 714-4
(5) Type V (A - C) Temporary silt fence	Table 714-5
(6) Type VI Paving fabric	Table 714-6

All property values, with the exception of apparent opening size (AOS), in these specifications represent minimum average roll value (MARV) in the weakest principal direction (that is average test results of any roll in a lot sampled for conformance or quality assurance testing must meet or exceed the specified values). Values for AOS represent maximum average roll values.

Conform to the following physical requirements:

(a) Separation and stabilization geotextile and geotextile filter. Conform to Table 714-1.

Table 714-1
Separation and Stabilization Geotextile and Geotextile Filter Requirements (1)

Strength and Durability Properties						
Property	**Test Method ASTM**	**Units**	**Class 1**		**Class 2**	
Type of Geotextile			**Woven**	**Nonwoven**	**Woven**	**Nonwoven**
Elongation at break	D4632	%	< 50	≥ 50	< 50	≥ 50
Minimum grab strength	D4632	lb (N)	320 (1420)	200 (890)	250 (1110)	160 (710)
Minimum sewn seam strength	D4632	lb (N)	290 (1290)	180 (800)	220 (980)	140 (620)
Minimum tear strength	D4533	lb (N)	110 (490)	80 (360)	90 (400)	55 (240)
Minimum puncture strength	D6241	lb (N)	620 (2760)	430 (1910)	500 (2220)	310 (1380)
Minimum ultraviolet stability	D4355	%	50% retained strength after 500 hours of exposure			

Hydraulic Properties							
Property	**Test Method ASTM**	**Units**	**Type A**	**Type B**	**Type C**	**Type D**	**Type E**
Minimum permittivity	D4491	s^{-1}	0.7	0.5	0.2	0.1	0.1
Maximum apparent opening size (AOS)	D4751	Sieve size U.S. (mm)	No. 40 (0.425)	No. 40 (0.425)	No. 60 (0.250)	No. 40 (0.425)	No. 70 (0.212)

(1) Do not use woven slit film geotextile.

(b) Paving geotextile. Furnish nonwoven geotextile conforming to Table 714-2.

Table 714-2
Paving Geotextile Requirements

Property	**Test Method ASTM**	**Units**	**Specifications**
Grab strength	D4632	lb (N)	110 (490)
Elongation at break	D4632	%	≥ 50
Asphalt retention	D6140	gal/yd^2 (L/m^2)	See Note (1)
Mass per unit area	D5261	oz/yd^2 (g/m^2)	4 - 6 (135 - 200)
Melting point	D276	ºF (ºC)	300 (150)

(1) Asphalt required to saturate fabric only. Value supplied by manufacturer in material certification. Value does not indicate the asphalt application rate required for construction. Product asphalt retention property must meet the MARV provided by the manufacturer’s certification.

714.02 Geosynthetic Clay Liner. Furnish high performance Geosynthetic Clay Liners (GCL) consisting of two layers of geotextiles surrounding a layer of low permeability sodium bentonite that are needle punched together to increase internal shear resistance. GCL shall conform to Table 714-3.

Table 714-3
Geosynthetic Clay Liner Requirements

Property	Test Method ASTM	Units	Specifications
Grab strength	D6768	lbs/in (N/cm)	50 (88)
Peel strength	D6496	lbs/in (N/cm)	3.5 (6.1)
Hydraulic conductivity	D5887	cm/sec	5×10^{-9} max
Hydrated internal shear strength	D5321 D6243	psf (kPa)	500 (24)

714.03 Stabilization Geogrid. Section not used.

714.04 Reinforcement Geotextile. Furnish reinforcement geotextile manufactured using long-chain, synthetic polymers, composed at least 95 percent by mass of polyolefins or polyesters. Form the geotextile, including selvedges, into a stable network such that the filaments or yarns retain their dimensional stability relative to each other.

Conform to Tables 714-5 and Table 714-6. Property values represent MARV (that is average test results of any roll in a lot sampled for conformance or quality assurance testing must meet or exceed the minimum specified values).

The nominal long-term strength (T_{al}) is based on:

$T_{al} = T_{ult}/RF$

where $RF = RF_{ID} \times RF_{CR} \times RF_D$.

RF_{ID}, RF_{CR}, and RF_D values must be substantiated by evaluation of independent test results by Highway Innovative Technology Evaluation Center (HITEC), AASHTO National Transportation Product Evaluation Program (NTPEP), or an equivalent third party report. Provide a copy of the report to the CO. Determine RF_{ID}, RF_{CR}, and RF_D according to the following:

(a) RF_{ID}: Determine the reduction factor for installation damage from the results of full scale construction damage tests conducted according to ASTM D5818. Conduct the tests with a soil having the same maximum particle size, D50, and angularity as the soil to be used for construction. Tests using coarser soils (same or larger maximum particle size and D50) may be an acceptable substitution. The NFF will make the final determination as to whether the test data based on the substitute soil is acceptable. Interpolation of RFID will not be allowed, the results for the coarser soils will be used. The Contractor may elect to perform a test using project specific fill, placement, and compaction techniques and equipment to determine the RFID. Use a default value of 3.0 if no installation damage testing has been conducted. The minimum value for RFID is 1.1.

(b) RF_{CR}. Determine the creep reduction factor according to one of the following:

(1) Conventional creep testing according to ASTM D5262; or

(2) A combination of Stepped Isothermal Method (SIM) according to ASTM D6992 and conventional creep testing. Perform testing and determine creep reduction factors for a 75 year design life according to the procedures in Appendix D of FHWA-NHI-10-025, *Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes – Volume II*. If testing has not been conducted, default values for RF_{CR} are 2.5 for polyester polymer, and 5.0 for polypropylene or polyethylene polymer.

(c) RF_D. For polypropylene or polyethylene geosynthetics conforming to the requirements of Table 714-5, a default reduction factor of 1.1 may be used for RF_D. For polyester geosynthetics conforming to the requirements of Table 714-5, a default reduction factor of 1.15 may be used for RF_D if the soil has a pH between 5 and 8; and a reduction factor of 1.3 may be used if the soil pH is between 3 and 5 or between 8 and 9.

Table 714-5
Reinforcement Geotextile and Geogrid Polymer Requirements

Polymer Type	Property	Test Method	Specifications
Polypropylene and polyethylene	Thermo-oxidation resistance	ENV ISO 13438, Method A (polypropylene) or Method B (polyethylene)	Minimum 50% retained strength after 28 days (polypropylene) or 56 days (polyethylene)
Polyester	Hydrolysis resistance	Inherent Viscosity Method ASTM D4603 & GRI [(1)] GG8	Minimum number average molecular weight (M_n) of 25,000
	"	GRI [(1)] GG7	Maximum carboxyl end group (CEG) of 30
All polymers	Ultraviolet stability	ASTM D4355	Minimum 70% retained strength after 500 hours of exposure
	Mass per unit area	ASTM D5261	Minimum 8 oz/yd^2 (270 g/m^2)
	Percent post consumer recycled material by mass	Certification of material used	Maximum 0%

(1) Geosynthetic Research Institute.

Table 714-6
Reinforcement Geotextile and Geogrid Strength Requirements

Property	Test Method ASTM	Units	Specifications[1][2]					
			Type I	Type II	Type III	Type IV	Type V	Type VI
Ultimate strength [3] (T_{ult})	D4595 or D6637 [4]	lb/ft (kN/m)	2000 (29.2)	3000 (43.8)	4000 (58.4)	5000 (73.0)	6000 (87.6)	8000 (116.8)
Nominal long-term strength (T_{al})	See Note (5)	lb/ft (kN/m)	1000 (14.6)	1500 (21.9)	2000 (29.2)	2500 (36.5)	3000 (43.8)	4000 (58.4)

(1) For reinforcement geotextile, also meet the Class 1 strength requirements in Table 714-1 and the ultraviolet stability requirements in Table 714-5.

(2) The specified strength is in the principal direction of reinforcement (that is perpendicular to the wall or slope face).

(3) Based on MARV.

(4) ASTM D4595 is for reinforcement geotextile and ASTM D6637 is for geogrid.

(5) See the nominal long-term strength (T_{al}) formula above.

714.05 Geomembrane. Furnish geomembrane that consists of textured (roughened) surface polyvinyl chloride, high density polyethylene, or linear low density polyethylene geomembrane with a thickness of 28.5 to 31.5 mils (0.72 to 0.80 millimeters). Glue or weld seams of the geomembrane to prevent leakage.

Conform to Table 714-7.

Table 714-7
Geomembrane Requirements

Geomembrane Type	Test Method
Polyvinyl chloride (PVC)	ASTM D7176[1]
High density polyethylene (HDPE)	GRI[2] Test Method GM13
Linear low density polyethylene (LLDPE)	GRI[2] Test Method GM17

(1) The minimum average asperity height is 10 mils (0.25 millimeters). Of 10 readings, 8 of 10 must be greater than or equal to 7 mils (0.18 millimeters) and the lowest individual reading must be greater than or equal to 5 mils (0.12 millimeters).

(2) Geosynthetic Research Institute.

Section 715. — PILING

SECTION NOT USED

Section 716. — MATERIAL FOR TIMBER STRUCTURES

SECTION NOT USED

Section 717. — STRUCTURAL METAL

SECTION NOT USED

Section 718. — TRAFFIC SIGNING AND MARKING MATERIAL

SECTION NOT USED

Section 719. — PAINT

SECTION NOT USED

Section 720. — STRUCTURAL WALL AND STABILIZED EMBANKMENT MATERIAL

SECTION NOT USED

Section 721. — ELECTRICAL AND ILLUMINATION MATERIAL

SECTION NOT USED

Section 722. — ANCHOR MATERIAL

SECTION NOT USED

Section 723. — RESERVED

Section 724. — RESERVED

Section 725. — MISCELLANEOUS MATERIAL

725.01 Water. Conform to the following:

(a) Water for earthwork and pavement courses. Furnish water free of substances detrimental to the work.

Appendix C

THE SECRETARY OF THE INTERIOR'S **STANDARDS** FOR THE TREATMENT OF HISTORIC PROPERTIES

WITH

GUIDELINES FOR PRESERVING, REHABILITATING, RESTORING & RECONSTRUCTING HISTORIC BUILDINGS

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

Under the National Historic Preservation Act (NHPA), the Secretary of the Interior is responsible for establishing professional standards and for providing guidance on the preservation of the nation's historic properties. *The Secretary of the Interior's Standards for the Treatment of Historic Properties* apply to all grants-in-aid projects assisted through the Historic Preservation Fund (authorized by the NHPA) and are intended to be applied to a wide variety of resource types, including buildings, sites, structures, objects, and districts. The Standards address four treatments: preservation, rehabilitation, restoration, and reconstruction. The treatment Standards, developed in 1992, were codified as 36 CFR Part 68 in the July 12, 1995, Federal Register (Vol. 60, No. 133). They replaced the 1978 and 1983 versions of 36 CFR Part 68, entitled *The Secretary of the Interior's Standards for Historic Preservation Projects.* The revised Guidelines herein replace the Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings, published in 1995 to accompany the treatment Standards.

The Secretary of the Interior's Standards for the Treatment of Historic Properties are regulatory only for projects receiving Historic Preservation Fund grant assistance and other federally-assisted projects. Otherwise, these Guidelines are intended to provide general guidance for work on any historic building.

Another regulation, 36 CFR Part 67, focuses on "certified historic structures" as defined by the Internal Revenue Service Code of 1986. The Standards for Rehabilitation cited in 36 CFR Part 67 should always be used when property owners are seeking certification for federal tax benefits.

THE SECRETARY OF THE INTERIOR'S **STANDARDS** FOR THE TREATMENT OF HISTORIC PROPERTIES WITH **GUIDELINES** FOR PRESERVING, REHABILITATING, RESTORING & RECONSTRUCTING HISTORIC BUILDINGS

Revised by Anne E. Grimmer

from *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings*
Kay D. Weeks and Anne E. Grimmer (1995)

U.S. Department of the Interior
National Park Service
Technical Preservation Services
Washington, D.C.

2017

CONTENTS

Contents Restoration (cont.)

PHOTO CREDITS

Front Cover: Spooner Hall, University of Kansas, Lawrence, KS, Henry van Brunt, 1894.

HISTORICAL OVERVIEW

Masonry. Detail, decorative sandstone door surround.

Wood. Detail, Pope-Leighey House, Alexandria, VA, Frank Lloyd Wright, 1940. Photo: Courtesy National Trust for Historic Preservation, Paul Burk, photographer.

Metals. Detail, Dunbar Molasses Factory, New Orleans, LA, c. 1920.

Glass. Detail, St. John's Abbey, Collegeville, MN, Marcel Breuer, 1958-61.

Paint and Other Coatings. Interior detail, Mabel Tainter Memorial Theater, Menomonie, WI, Harvey Ellis, 1889. Photo: Miller Dunwiddie Architecture.

Composite Materials. Composite siding, Private Residence, Washington, DC, William Lescaze, 1940.

Simulative Materials. Detail, wood used to simulate cut stone.

Roofs. Asphalt roof shingles on a 1920s-era house.

Windows. Paired wood windows with stained glass lunette on a Romanesque revival-style rowhouse.

Entrances and Porches. Decorative stone entrance with etched-glass revolving door on early-20th century office building.

Storefronts. Ellicott City, MD.

Curtain Walls. Simms Building, Albuquerque, NM, Flatow & Moore, 1954. Photo: Harvey M. Kaplan.

Structural Systems. Boiler Maker Shops, Navy Yard Annex, Washington, DC, 1919.

Mechanical Systems. Historic Radiator.

Spaces, Features, and Finishes. Interior, Saenger Theater, New Orleans, LA, Emile Weil, 1927. Photo: Courtesy Saenger Theater.

Site. Vineyard, Charles Krug Winery, St. Helena, CA. Photo: Rocco Ceselin. Inset: Redwood Cellar, 1872, Charles Krug Winery. Photo: Rien van Rijthoven.

Setting. Late-19th-century residential historic district.

Accessibility. Gradual slope added to sidewalk and paving for accessibility. Schmidt Brewery, St. Paul, MN, late 19th–early 20th century.

Life Safety. Code-required, supplemental stair railing.

Resilience to Natural Hazards. Farnsworth House, Plano, IL, Mies van der Rohe, 1951. Photo: Courtesy Farnsworth, A Site of the National Trust for Historic Preservation.

Sustainability. Traditional sustainable features include deep porches and window shutters in southern architecture.

New Additions and Related New Construction. Private Residence, Washington, DC, Cunningham/Quill Architects. Photo: © Maxwell MacKenzie.

CHAPTER HEADS

Preservation. Old Santa Fe Trail Building (National Park Service Intermountain Regional Office), Santa Fe, NM. This adobe building was designed by John Gaw Meem in the Spanish-Pueblo Revival style, and constructed for the National Park Service through the auspices of the Civilian Conservation Corps (CCC) and the Works Project Administration (WPA) in 1939. Photo: MRWM Landscape Architects.

Rehabilitation. The Arcade, Providence, RI, 1828. Photo: Northeast Collaborative Architects, Ben Jacobson, photographer.

Restoration. Montpelier, Montpelier Station, VA. National Trust for Historic Preservation, Administered by The Montpelier Foundation. Photo: Courtesy The Montpelier Foundation.

Reconstruction. The Cathedral of Saint Michael the Archangel, Sitka, AK, built early 1840s, reconstructed 1961. Photo: Barek at Wikimedia Commons.

Photographs not individually credited are from National Park Service files.

ACKNOWLEDGEMENTS

This edition of *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings* has been produced in part to ensure that the National Park Service continues to fulfill its responsibility to promote the preservation of the historic buildings that are part of the nation's cultural heritage. This has been a collaborative effort undertaken by the office of Technical Preservation Services (TPS) in the National Park Service, with the assistance of other National Park Service programs, State Historic Preservation Offices (SHPO), the Advisory Council on Historic Preservation, Federal Agency Historic Preservation Officers, the National Trust for Historic Preservation, and others. The comments and suggestions provided by these agencies and organizations, together with important contributions from the TPS professional staff, have been invaluable in the development of this revised and updated guidance on preserving, rehabilitating, restoring, and reconstructing historic buildings that accompany *The Secretary of the Interior's Standards for the Treatment of Historic Properties.*

PREFACE

The year 2016 was significant as the Centennial of the National Park Service, which was established as a new bureau within the Department of the Interior by the Organic Act on August 25, 1916. As directed in this legislation, the National Park Service has served for one hundred years as steward of the "Federal areas known as national parks, monuments and reservations...to conserve the scenery and the natural and historic objects and the wild life therein and to...leave them unimpaired for the enjoyment of future generations."

The year 2016 also marked the 50th anniversary of the passage of the National Historic Preservation Act on October 15, 1966. The Act increased the scope and responsibilities of the National Park Service with regard to the preservation of cultural resources. The National Historic Preservation Act charges the National Park Service (through authority delegated by the Secretary of the Interior) to establish and administer a national historic preservation program and to develop and promulgate standards and guidelines for the treatment of historic properties.

The Secretary of the Interior's Standards for Historic Preservation Projects were first issued in 1978. In 1979 they were published with Guidelines for Applying the Standards and reprinted in 1985. The Standards were revised in 1992, when they were retitled *The Secretary of the Interior's Standards for the Treatment of Historic Properties*. The Standards were codified in the Federal Register in 1995, the same year that they were published with guidelines as *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings*. These Standards and Guidelines provide a critical part of the framework of the national preservation program. They are widely used at the federal, state, and local levels to guide work on historic buildings, and they also have been adopted by Certified Local Governments and historic preservation commissions across the nation.

In 2010 the National Park Service issued *A Call to Action: Preparing for a Second Century of Stewardship and Engagement*, a plan to chart a path for its next 100 years. This plan identified a number of actions with the goal to "preserve America's special places in the next century," which included updating National Park Service policies and guidance. The project to update *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings* was undertaken as part of this broader effort.

Since these Guidelines were first published in 1995, a greater number of buildings and building types, telling a broader range of stories that are part of the nation's heritage, have been recognized as "historic" and eligible for listing in the National Register of Historic Places. These guidelines have been updated and expanded to address the treatment of these buildings constructed with newer materials and systems from the mid- and late-20th century.

The updated Guidelines have the same organization as the prior version, beginning with an introduction and a historical overview, followed by chapters that focus on each of the four treatments: preservation, rehabilitation, restoration, and reconstruction. The historical overview has been expanded; not only has the information on historic materials, systems, features, and special issues that comprised the previous edition been more fully developed, but new entries have been added on glass, paint and other coatings, composite materials, imitative materials, and curtain walls.

In each of the four chapters, the "Recommended" and "Not Recommended" treatments have been updated and revised throughout to ensure that they continue to promote the best practices in preservation. The section on exterior additions to historic buildings in the Rehabilitation Guidelines has been broadened also to address related new construction on a building site. A section on code-required work is now included in all of the chapters. "Energy Efficiency" has been eliminated, since it is more fully covered by the guidance provided on sustainability in *The Secretary of the Interior's Standards for Rehabilitation and Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings* (published in 2011), which has general applicability to all the treatments and is incorporated here by reference. Sections on "Resilience to Natural Hazards" have been added, but these topics will be more fully addressed in separate documents and web features. Finally, the updated Guidelines feature all new, and many more, illustrations in color.

Herewith Technical Preservation Services issues the National Park Service Centennial edition of *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings*, updated and revised in recognition of the 50th anniversary of the National Historic Preservation Act, to ensure that the preservation guidance for historic buildings provided by the National Park Service continues to be meaningful and relevant in the 21st century.

Technical Preservation Services
National Park Service

Technical Preservation Services
National Park Service

The office of Technical Preservation Services (TPS) in the Cultural Resources directorate of the National Park Service is responsible for developing and promulgating preservation standards and guidance specifically as it relates to historic buildings. TPS has produced an extensive amount of technical, educational, and policy guidance on the maintenance and preservation of historic buildings. TPS developed the original and current versions of *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings*. The many technical publications and web features on preserving historic buildings prepared by TPS are well known, especially the *Preservation Briefs* and the *Preservation Tech Notes* series. It is not feasible to include a complete list here of all the materials available from TPS because of the sheer volume of information. Materials developed by TPS are available in printed form and/or online from the TPS website at https://www.nps.gov/tps (or search for Technical Preservation Services at https://www.nps.gov). TPS also administers the Federal Historic Preservation Tax Incentives Program, which encourages private sector investment in the rehabilitation and reuse of historic buildings.

INTRODUCTION

Using the Standards and Guidelines for Preservation, Rehabilitation, Restoration, and Reconstruction Projects

The Secretary of the Interior's Standards for the Treatment of Historic Properties address four treatments: preservation, rehabilitation, restoration, and reconstruction. As stated in the regulations (36 CFR Part 68) promulgating the Standards, "one set of standards ...will apply to a property undergoing treatment, depending upon the property's significance, existing physical condition, the extent of documentation available, and interpretive goals, when applicable. The Standards will be applied taking into consideration the economic and technical feasibility of each project." These Standards apply not only to historic buildings but also to a wide variety of historic resource types eligible to be listed in the National Register of Historic Places. This includes buildings, sites, structures, objects, and districts.

Guidelines, however, are developed to help apply the Standards to a specific type of historic resource. Thus, in addition to these Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings, there are also guidelines for cultural landscapes, historic lighthouses, historic vessels, historic furnished interiors, and historic covered bridges.

The purpose of *The Secretary of the Interior's Standards for the Treatment of Historic Properties and Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings* is to provide guidance to historic building owners and building managers, preservation consultants, architects, contractors, and project reviewers prior to beginning work. It is always recommended that preservation professionals be consulted early in any project.

The Guidelines are intended as an aid to assist in applying the Standards to all types of historic buildings. They are not meant to give case-specific advice or address exceptions or unusual conditions. They address both exterior and interior work on historic buildings. Those approaches to work treatments and techniques that are consistent with The Secretary of the Interior's Standards for the Treatment of Historic Properties are listed in the "Recommended" column on the left; those which are inconsistent with the Standards are listed in the "Not Recommended" column on the right.

There are four sections, each focusing on one of the four treatment Standards: Preservation, Rehabilitation, Restoration, and Reconstruction. Each section includes one set of Standards with accompanying Guidelines that are to be used throughout the course of a project.

Preservation *is defined as the act or process of applying measures necessary to sustain the existing form, integrity, and materials of an historic property. Work, including preliminary measures to protect and stabilize the property, generally focuses upon the ongoing maintenance and repair of historic materials and features rather than extensive replacement and new construction. The limited and sensitive upgrading of mechanical, electrical, and plumbing systems and other code-required work to make properties functional is appropriate within a preservation project. However, new exterior additions are not within the scope of this treatment.* The Standards for Preservation require retention of the greatest amount of historic fabric along with the building's historic form.

Rehabilitation *is defined as the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values.* The Rehabilitation Standards acknowledge the need to alter or add to a historic building to meet continuing or new uses while retaining the building's historic character.

Restoration *is defined as the act or process of accurately depicting the form, features, and character of a property as it appeared at a particular period of time by means of the removal of features from other periods in its history and reconstruction of missing features from the restoration period. The limited and sensitive upgrading of mechanical, electrical, and plumbing systems and other code-required work to make properties functional is appropriate within a restoration project.* The Restoration Standards allow for the depiction of a building at a particular time in its history by preserving materials, features, finishes, and spaces from its period of significance and removing those from other periods.

Reconstruction *is defined as the act or process of depicting, by means of new construction, the form, features, and detailing of a non-surviving site, landscape, building, structure, or object for the purpose of replicating its appearance at a specific period of time and in its historic location.* The Reconstruction Standards establish a limited framework for recreating a vanished or non-surviving building with new materials, primarily for interpretive purposes.

The Guidelines are introduced with a brief overview of the primary materials used in historic buildings; the exterior and interior architectural features and systems; the building's site and setting; code-compliance requirements regarding accessibility and life-safety resilience to natural hazards; sustainability; and new additions and related new construction. This overview establishes the format of the Guidelines that follow.

Choosing an Appropriate Treatment for the Historic Building

The Guidelines are intended to promote responsible preservation practices that help protect the nation's irreplaceable cultural resources. For example, they cannot, in and of themselves, be used to make essential decisions about which features of the historic building should be saved and which can be changed. But, once a treatment is selected, the Standards and Guidelines provide a consistent philosophical approach to the work.

Choosing the most appropriate treatment for a building requires careful decision making about a building's historical significance, as well as taking into account a number of other considerations:

Level of Significance. National Historic Landmarks, designated for their "exceptional significance in American history," and other properties important for their interpretive value may be candidates for *Preservation* or *Restoration*. *Rehabilitation*, however, is the most commonly used treatment for the majority of historic buildings *Reconstruction* has the most limited application because so few resources that are no longer extant can be documented to the degree necessary to accurately recreate the property in a manner that conveys its appearance at a particular point in history.

Physical condition. *Preservation* may be appropriate if distinctive materials, features, and spaces are essentially intact and convey the building's historical significance. If the building requires more extensive repair and replacement, or if alterations or a new addition are necessary for a new use, then *Rehabilitation* is probably the most appropriate treatment.

Proposed use. Many historic buildings can be adapted for a new use or updated for a continuing use without seriously impacting their historic character. However, it may be very difficult or impossible to convert some special-use properties for new uses without major alterations, resulting in loss of historic character and even integrity.

Code and other regulations. Regardless of the treatment, regulatory requirements must be addressed. But without a sensitive design approach such work may damage a building's historic materials and negatively impact its character. Therefore, because the ultimate use of the building determines what requirements will have to be met, some potential uses of a historic building may not be appropriate if the necessary modifications would not preserve the building's historic character. This includes adaptations to address natural hazards as well as sustainability.

HISTORICAL OVERVIEW

Masonry

Stone is one of the more lasting masonry building materials and has been used throughout the history of American building construction. Stones most commonly used in historic buildings in the U.S. are quarried stone, including sandstone, limestone, marble, granite, slate, basalt, and coral stone, and gathered stone, such as fieldstone, river rock, and boulders. Types of stone differ considerably in hardness, durability, and other qualities. Building stones were usually laid with mortar, but sometimes they were laid without mortar using a dry-stack method of construction. Brick varies in size and permanence. Before 1870, brick clays were pressed into molds and were often unevenly fired. The quality of historic brick depended on the type of clay available and the brick-making technique; by the 1870s, with the perfection of an extrusion process, bricks became more uniform and durable. ***Architectural terra cotta*** is also a kiln-fired clay product popular from the late 19th century until the 1930s. Its use became more widespread with the development of steel-frame, high-rise office buildings in the early 20th century. ***Glazed ceramic architectural siding*** was also used as cladding in high-rise buildings somewhat later. ***Adobe,*** which consists of sun-dried earthen bricks, was one of the earliest building materials used in the U.S., primarily in the Southwest where it is still popular.

Mortar is used to bond together masonry units. Historic mortar was generally quite soft, consisting primarily of lime and sand with other additives. Portland cement, which creates a more rigid mortar, was first manufactured in the U.S. in the early 1870s, but it was not in common use throughout the country until the early 20th century. Thus, mortar used in buildings from around 1873 until the 1930s ranged from a traditional lime-cement mix to a variety of sand and Portland cement combinations. After this time, most mortar mixes were based on Portland cement. Like historic mortar, early ***stucco*** was also heavily lime based, increasing in hardness with the addition of Portland cement in the late 19th century.

Concrete has a long history. It is composed of sand, crushed stone, or gravel bound together with lime and, sometimes, natural hydraulic cements. As a construction material concrete is used in a variety of forms, including blocks or units, poured or cast-in-place, and precast panels. ***Cast stone*** and other manufactured products began to be used around the 1860s as substitutes for natural stone. There are also cementitious materials specific to certain regions, such as ***tabby,*** which includes crushed shells and is found primarily in coastal areas in the southeastern part of the country. In the 20th century, ***reinforced concrete*** was developed and has since become one of the most commonly used materials in modern building construction.

While masonry is one of the most durable historic building materials, it is also very susceptible to damage by exposure, improper maintenance or repairs, abrasive cleaning, or the application of non-permeable coatings.

Wood

Wood is one of the most essential materials used in American buildings of every period and style. Its many and varied attributes make it suitable for multiple uses, including structural members, siding, roofing, interior finishes, and decorative features. Many of the first structures in the earliest settlements were built with logs, which were readily available, did not require much finishing, and could be quickly erected with basic tools.

Water-powered sawmills cut logs into timbers and boards, but detailed ornamental features were generally crafted on site using hand tools until after the Civil War. Mechanized production increased the efficiency of cutting logs into timbers, boards, and more intricate components, and the structural and decorative potential of wood's use in building construction expanded. With more efficient production came lower costs, but also the standardization of ready-made moldings and assemblies for windows, doors, and decorative features. Initially, wood was primarily sourced locally, but improved transportation systems made a greater variety of wood species more accessible all over the country. With broader availability, a particular wood could be selected for its suitability in a specific application; however, local species were used most often.

The extensive use of wood in buildings can be attributed to its many properties that include strength in both tension and compression; ease with which it can be cut and shaped; capability to be connected using a variety of fasteners and adhesives; ability to be painted or varnished; and resistance to wear and weather. All of these characteristics, and some more than others, vary according to the species of wood. Although many types and species of wood used historically are no longer available, wood selection and construction practices have always capitalized on its attributes and compensated for it is weaknesses. Their resistance to decay made white oak and cedar common choices for roofing shingles, while oak and maple were frequently chosen for flooring because of their hardness. Pine and yellow poplar have often been used for siding and trim because of their straight grain and ease of milling, but they must be painted to protect them from decay.

Plywood is an engineered product formed by laminating thin sheets of wood together; it was introduced to the U.S. building industry in the early 20th century. Because plywood has greater structural potential than wood, and as a sheet can be installed more efficiently, it soon replaced boards as sheathing before being replaced itself by less-expensive ***particle board*** for many applications. By applying surface veneers and adhesives, plywood can also be used as siding or for fine interior finishes on paneling or cabinetry. ***Glued laminated timber*** (glulam), first manufactured in the 1930s, is another engineered wood material. It is an important material in mid-20th-century buildings and often used for massive arches and trusses in sports arenas and similar large, open, column-free spaces.

Many historic buildings have wood structural systems and features, such as stairs or columns. The majority of both practical and decorative features, particularly on the interior, are made of wood, such as flooring and paneling.

Metals

Metal features—including steps, porches, railings, balconies, and entire facades; cornices, siding, cladding, roofs, roof cresting, and storefronts; and doors, window sash, entablatures, and hardware—are often highly decorative as well as practical and are important in defining the overall character of historic American buildings.

Metals commonly used in historic buildings include ***lead, tinplate, terneplate, zinc, copper, bronze, brass, iron, steel, aluminum, stainless steel,*** and a variety of other ***alloys.*** Historic metal building components were often designed by highly-skilled artisans. By the late 19th century, many of these components were prefabricated and available from catalogues in standardized sizes and designs.

Wrought iron is the form in which iron was first used in America. In the beginning, most wrought-iron architectural elements were small, such as nails, tie rods, straps, and hardware. Wrought-iron features

gradually increased in size to include balconies, railings, porches, steps, and fencing. It was not used for structural components until around the mid 19th century, when manufacturing equipment became more sophisticated. ***Cast iron*** was initially imported from England. Although there were some iron-casting works established before the Revolution, by the early 19th century production had expanded to make a variety of cast-iron features. Structural cast-iron columns were first used in the 1820s, and cast-iron building fronts and decorative structural and ornamental features followed soon after. Cast and wrought iron are often used on the interior of historic buildings as both structural and decorative features, such as columns, staircases, railings, and light fixtures.

Steel, which is an alloy of iron and usually carbon, increased in popularity as manufacturing processes and production improved in the mid-19th century. Structural steel played an important role in the development of high-rise buildings and the skyscraper.

Lead was first used in historic buildings for roofing. ***Tinplate or terneplate,*** which was made by applying a lead and tin coating to sheet metal or steel, became a common roofing material after it was first produced in the 1820s. (Pure tin was rarely used as a building material because it is so soft.) The application of a ***zinc coating*** on sheet metal created ***galvanized iron***, which was used for roofing and decorative roofing features, such as steeples and roof cresting, as well as other ornamental architectural features, such as door and window hood molds, lintels, and oriel and bay windows. Prefabricated Quonset huts constructed of ***corrugated galvanized steel*** began to be manufactured during World War II for the military on the battlefield for housing, storage, and other uses.

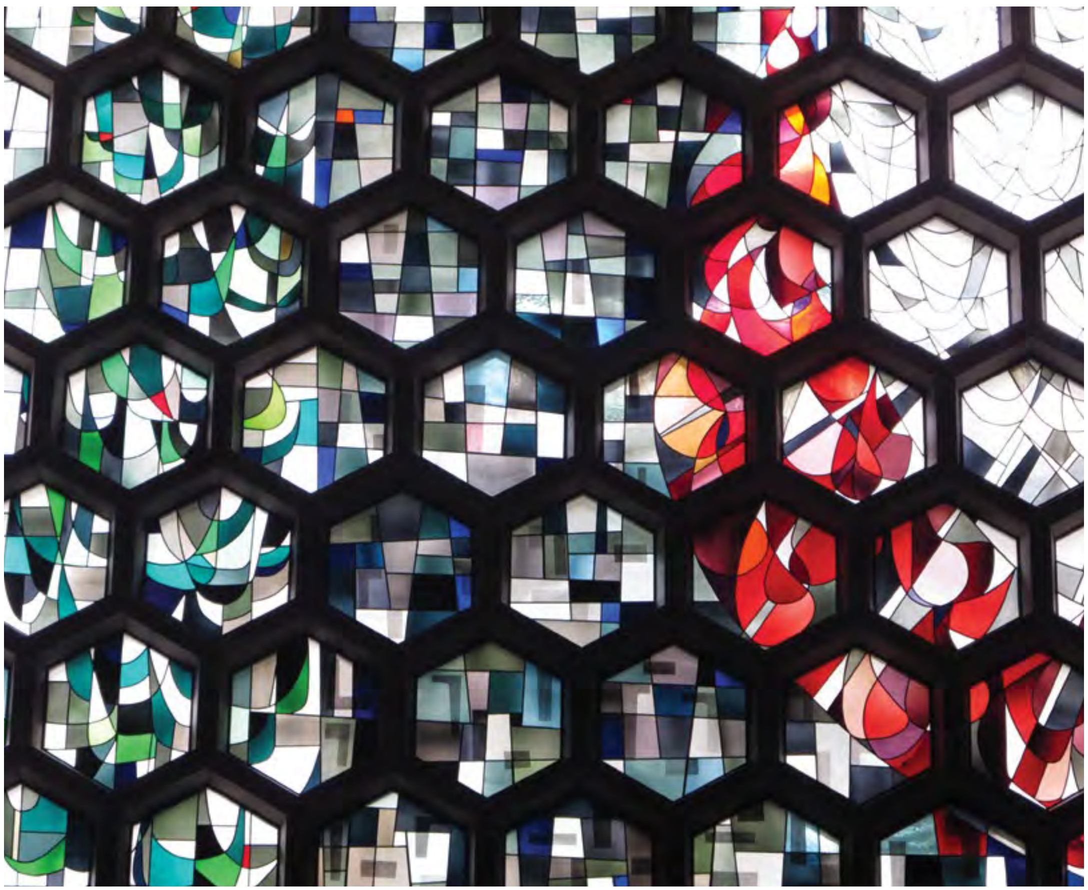
Entire pressed-metal and galvanized-iron storefronts and individual decorative features were manufactured to simulate wood, stone, or cast iron from the latter part of the 19th century into the early years of the 20th century. ***Copper*** roofs were installed on many public buildings from the 1790s through the first quarter of the 19th century. Copper continues to be used, often for porch roofs as well as gutters, downspouts, and flashing. ***Bronze*** and ***brass*** are both alloys of copper. Bronze, which weathers well, appears as entrance doors and historic storefronts. Brass, usually polished, is used for decorative interior features, such as grilles and elevator doors. **Nickel**, when employed as a building component, is in the form of an alloy, usually ***nickel silver, Monel,*** or some ***stainless steel***. In comparison to other construction metals, stainless steel is quite new, essentially only coming into use in the 1920s when it became a favorite material for Art Deco-style buildings.

Aluminum—lightweight and corrosion-resistant—was not utilized much in buildings because it was so expensive until the 1920s, when expanded production reduced its cost. Aluminum siding, which was advertised as maintenance free, became a popular siding material for single-family residences after it was introduced in the late 1930s. Some of the uses of aluminum include roofing and roofing features, such as gutters, downspouts, and flashing, as well as windows and storefront surrounds.

Porcelain enamel, or ***vitreous enamel,*** is composed of a thin coating of glass fused to cast-iron or steel sheets, panels, tiles, or shingles. Although developed in the late 19th century, it was not commonly used in buildings until the late 1920s and 1930s for Art Deco and Art Moderne storefronts. Lustron houses, constructed of prefabricated, enameled steel panels and intended for mass production, were introduced in the late 1940s in anticipation of the need for housing after the war. These houses were promoted for their low maintenance, in part because the walls, ceilings, and other interior surfaces were also enameled steel panels and easily washable.

Glass

For centuries, only blown ***cylinder*** and ***crown*** glass in small pieces was available and it was expensive. Thus, the glass in early windows in American buildings consisted of small panes which gradually increased in size over the years. With the invention of cast plate glass in 1848, large plates of glass could be manufactured which were strong and inexpensive. ***Plate glass*** was first used in the early 1850s as the primary exterior material (with a cast-iron framework) for such structures as international exhibition buildings, worlds' fair pavilions, and greenhouses and conservatories. In the early 20th century, architects began using glass curtain walls in Art Moderne-style architecture and, most notably, the International Style. ***Tempered glass*** is a hardened or toughened glass which began to be used in building construction around 1940. By the middle of the 20th century, glass as a cladding system became synonymous with curtain wall systems.



In addition to clear glass—flat or sometimes curved—there is also stained glass, tinted, patterned, textured, etched, frosted, leaded, painted, colored opaque glass and spandrel glass, prism glass, decorative Val de Verre glass (colored art glass), ceramic frit (pigmented glass enamel fused to a glass surface), and glass block. Many of these types of glass can be found in windows, transoms, doors and entrances, and storefront display windows, whereas some of them—especially opaque, pigmented structural glass with trade names such as Vitrolite, Carrara Glass, and Sani Onyx—are more likely to appear as exterior cladding on Art Deco-style or Art Moderne storefronts. ***Spandrel glass*** was first introduced on mid-20th-century buildings, particularly in storefront and curtain wall systems. Glass was also used historically in skylights and monitors; in theater, hotel, and apartment building marquees and canopies; and as a component of lightning rods and weathervanes, address plates, and signage.

Glass features on the interior of historic buildings include transoms, windows, privacy screens, office dividers, wall partitions for borrowed light in office corridors, teller windows in banks, ticket windows in train stations and movie theaters, doorknobs, light fixtures, mirrored wall inlay, and also, beginning in the latter part of the 20th century, wall mosaics. Pigmented structural glass can be found in bathrooms and some kitchens because of its sanitary qualities.

Low-e (low emissivity) ***glass***, which is primarily used in windows to minimize solar gain, was developed in the last quarter of the 20th century. ***Impact-resistant glass*** is another more-recently developed type of glass designed to withstand hurricane-force wind and which can also be installed as a blast-resistant security feature.

Paint and Other Coatings

Paints and paint-like coatings have been used on historic buildings in America as protective coatings and for decorative treatments. What is commonly considered to be paint is a liquid consisting of a pigment which makes it opaque and colors it, a binder or base to hold it together, and sometimes a vehicle to carry the pigment. Many historic paints contained lead in the form of lead white, included as a "concealing" pigment that provided opacity, although zinc oxide was also used as an alternative. Lead increased durability and prevented mold and mildew. Titanium dioxide was sometimes used as a substitute for lead in the early 20th century, but lead continued to be an ingredient in most paints until it was banned as a hazardous substance in the U.S. in 1978. Traditional paints had an oil base, usually linseed, and the earliest paint colors were, for the most part, derived from natural pigments. Like today, both glossy and flat (or matte-finish) paints were used historically on the exterior and the interior of a building. After 1875, factory-made paints were readily available. Masonry and wood stains are traditional coatings which also consist of a pigment, a solvent, and little, if any, binder. They have a flat finish and are transparent rather than opaque so that the substrate is still visible.

Other historic paints, such as ***whitewash***, are water based and have a flat finish. In addition to water, whitewash is composed of hydrated (slaked) lime, salt, and various other materials and sometimes includes a natural pigment. Whitewash was used on interior plaster, in cellars, and on wood structural components, but not on wood doors, windows, or trim because its flat finish easily rubs off. Whitewash was also used on the exterior of brick or stone buildings, wood fences, and farm outbuildings as a protective coating. Often it was reapplied on an annual basis when it got dirty or if it wore off due to exposure to the weather. ***Calcimine*** (or ***kalsomine***) and ***distemper*** paints were also water based and included natural glues, gelatin, gums, and whiting to which colored pigments could be added. They were used only on the interior and usually on plaster surfaces. ***Casein*** is a milk-based paint composed of hydrated lime, pigment, often oil, and a variety of additives to increase its durability. It was used on both the exterior and the interior of buildings.

The interiors of historic buildings can exhibit a multitude of decorative painted treatments. Marbleized and grained finishes were applied to wood, stone, and plaster to give them the appearance of more exotic and costly materials. Other interior painted treatments, such as murals and stencils, are purely decorative. ***Tempera*** and ***gouache*** are traditional water-based paints used almost exclusively for decorative painting.

Experimentation that began early in the 20th century resulted in the development of acrylic water-based paint, commonly known as ***latex paint***. ***Oil-based/alkyd paint*** continues to be used in the 21st century and is still preferred for certain applications. Latex paint tends to be more popular not only because it is water-based (making clean up easy during and after painting), but it also has fewer toxic vapors and, like solvent-based oil/alkyd paints, is very durable.

Varnish, which is used primarily on interior wood features but also on exterior entrance doors, is another traditional coating. Unlike paint, varnish is transparent, composed of a resin, a drying oil, and a solvent. It has a glossy finish, which dulls over time.

Composite Materials: Plastic, Resin, and Vinyl; Fiber-Reinforced Cement Siding; Fiberboard; and Floor Coverings

Plastic is a malleable material composed of synthetic or natural organic materials made from various organic polymers, such as ***polyethylene*** and ***polyvinyl chloride*** (**PVC**), which can be poured into molds or rolled in sheets. It is generally agreed that the term ***plastic*** was introduced into popular usage in 1907 to describe the first fully synthetic plastic. Improved plastics were available in America by World War I. Production soared during World War II because plastics were needed to make up for the shortage of other materials. In mass production by the 1950s, the industry continued to expand with the development of increasingly more sophisticated plastics.

Vinyl siding came on the market in the late 1950s, and its use, primarily in residential construction, increased as the product improved over the years. Coating canvas awnings with vinyl helped to extend their lifespan, evolving, eventually, into awnings manufactured solely of vinyl. Plastic signs on the exterior of historic commercial buildings changed and radically expanded the role of signage as advertising as well as being important design features themselves. Plastic was used sometimes for decorative trim on storefronts. Vinyl-coated wallpaper was used as early as the 1920s and is still selected for restaurants, commercial spaces, and hospitals because it is durable and washable. Other plastic materials became popular in the 1950s in the form of plastic-laminate sheeting and wall tiles.

Fiber-reinforced plastic (***FRP***), is made of a polymer matrix mixed with fiber, usually ***fiberglass***, to add strength; it is noted for its ability to be molded in thin shells. FRP is sometimes used as a substitute material to recreate missing or deteriorated architectural features in historic buildings. ***Acrylic plastic*** is a transparent synthetic plastic, generally identified by one of its trade names—***Plexiglass*** or ***Lucite***—which was patented in the 1950s as an alternative to glass. ***Foamed polystyrene***, better known as ***Styrofoam***, was first used in the mid-1950s as building insulation.

Fiber-Reinforced Cement Siding is a composite material made of sand, cement, and cellulose fibers. It was developed in the latter part of the 20th century as a less-hazardous replacement for asbestos cement siding, which preceded it, and was used for siding and roofing shingles from the early 20th century to the 1970s. Fiber-reinforced cement siding is frequently installed in the form of horizontal boards or vertical panels as exterior siding. Fiber-reinforced cement is used on both residential and commercial buildings.

Fiberboard is a composite hardboard material made from pressure-molded wood fibers. It had early precedents in the late 18th century, but was first manufactured in large quantities in the 1920s, with its use expanding in the 1930s and 40s. Fiberboard (or wallboard, as it is commonly known) was marketed by various companies, such as ***Masonite***. It was used as sheathing for roofing and siding on the exterior, for insulation, and for interior walls.

The first composite floor covering was ***Linoleum***, made from oxidized linseed oil and ground cork or wood flour. Its manufacture in the U.S. began in the late 19th century, about the same time synthetic ***rubber floor tile*** was also introduced. ***Asphalt floor tiles*** were first used in the 1920s and remained popular into the 1950s. ***Plastic/vinyl*** replaced asphalt as a binder in floor tiles in the late 1920s, in part because plastic, unlike asphalt, could be made in lighter colors and a greater variety of colors. Semi-flexible vinyl flooring, manufactured in the form of tiles or rolled sheets, was developed by the 1930s. After the war, it became more affordable and frequently was chosen for both residential and commercial interiors.

Imitative Materials

Imitative building materials are generally common and readily available materials used to simulate a more expensive material. They have a long history in American building construction. ***Wood***, cut and planed and sometimes coated with a sand paint, has been used since the 18th century to replicate cut blocks of stone and quoins on the exterior of a building. ***Stucco***, applied over any kind of construction (from log to rubble masonry) and scored to resemble stone, could make even a log house look elegant. ***Cast iron*** and ***pressed metal***, whether as a complete façade, a storefront, or an individual feature such as a window hood, cornice, or decorative pilaster, were also used on the exterior of buildings to replicate stone. Not only ***architectural terra cotta***, but ***cast stone*** served as a substitute for stone. ***Metal*** and ***concrete*** roofing tiles were used as less-costly alternatives to clay roofing tiles.

In the 20th century, the use of exterior imitative materials expanded as new products were developed. ***Asphalt roll siding*** that resembled brick could be applied to a wood building, and ***asbestos composite shingles*** were produced to replace not only wood shingle siding, but also slate roofing shingles. ***Aluminum siding*** has been used as a replacement for wood siding, followed by ***vinyl siding, pressed wood siding,*** and, more recently, ***composite*** or ***fiber-cement siding***. Manufactured ***faux slate roofing*** became popular because it costs less than slate and is lighter weight. Over the years, imitative materials have increased in variety as synthetic materials continue to be introduced, including a substitute, an ***exterior insulation and finish system*** (***EIFS***), for another imitative material—stucco. Imitative materials are also used to recreate missing or deteriorated architectural features in historic buildings.

On the interior, imitative materials, such as ***scored plaster***, were historically applied to walls to give the appearance of stone. ***Painted*** or ***marbleized finishes*** on plaster or wood could further simulate stone, and ***decorative graining*** could transform the surface of a common wood into a more exotic species. ***Scagliola***, which is often applied to brick columns, is a very old technique that uses a plaster-like composite material to simulate marble. ***Lincrusta***, an embossed wall covering, was developed in the late 19th century to simulate pressed metal. ***Embossed wall coverings*** continue to be produced in the 21st century. Concrete, vinyl, and other manufactured flooring materials are designed in many patterns and colors to replicate brick, stone, clay tile, and wood.

Roofs

The roof—with its form; features such as cresting, dormers, cupolas, and chimneys; and the size, color, and patterning of the roofing material—is an important design element of many historic buildings. In addition, a weathertight roof is essential to the long-term preservation of the entire structure. Historic roofing reflects availability of materials, levels of construction technology, climate, and cost.

Throughout all periods of American history, with only minor exception, ***wood*** has been used for roofing; despite the early use of many other materials, wood shingles remained the most common roofing material throughout much of the 19th century. Initially the species of wood used would have been specific to a region, but the quality and design of a building were usually the prime determinants in the way wood was used, ranging from wide, lapped boards to small, uniform, geometrically-shaped shingles.

Clay tile was used at least in a limited way in the first settlements on the East coast and it was manufactured in America by the mid 17th century. The Spanish influence in the use of clay roofing tiles is apparent in buildings in the south, southwest, and western parts of the country. ***Slate*** was also an early roofing material, but it was imported until the end of the 18th century when the first slate quarry opened. Both slate and tile roofs provided fire protection, especially important in urban areas. The use of slate expanded quickly in the second half of the 19th century with the development of the railroads, and it remained a preferred roofing material until the middle of the 20th century.

Lead and ***copper*** were the first metals used for roofing, later joined by ***zinc*** and ***iron*** in the beginning of the 19th century. Lead was used in the mid 19th century for flashing and sometimes for the roofs of bay windows, domed, or steeply-pitched sections of a larger roof, and steeples. Copper has continued in use for roofing, gutters, downspouts, and flashing.

Painted iron was initially used in large sheets, but it was replaced with smaller sheets of iron plated with ***tin*** or ***terne***—a lead-tin mix—which were a more successful roofing material. As plated iron and, later, ***steel*** became widely available, their light weight, fire resistance, and low cost made them the ideal alternative to wood shingles. ***Galvanized metal***—base steel coated with an alloy of zinc—gained widespread popularity in the 20th century. Galvanizing not only protects metal from rusting, but it also adds strength; corrugated sheet metal, when galvanized, became the preferred metal roofing material because it reduced the need for sheathing. Galvanized steel also could be stamped into sheets simulating shingles and clay tiles.

In the late 19th century, ***concrete*** roofing tiles began to be produced as a substitute for clay tiles. At about the same time, ***composition*** roofing (built-up or roll roofing) was developed. This is a layered assembly of felt sheets and coal tar or asphalt, topped with gravel that is suitable for waterproofing flat and low-sloped roofs. Shortly after the start of the 20th century, ***asbestos fiber cement*** and ***asphalt*** shingles came into use as less-expensive alternatives to slate. Later in the 20th century, sheets of ***modified bitumen*** and ***synthetic rubber*** provided more options for a flat roof. By the end of the 20th century, ***liquid*** and ***vinyl membranes*** were also installed on flat roofs, and ***synthetic recycled materials*** were used increasingly for both new and replacement roofs.

Windows

Technology and prevailing architectural styles shaped the history of windows in America. The earliest windows were essentially medieval in their form. Small panes of glass, usually diamond-shaped and held together with lead, were set in a hinged casement sash of wood or iron. By the beginning of the 18th century, the glass had increased in size and had become rectangular, with putty holding it in place. Wood muntins replaced lead cames between the panes, and two sashes were placed in a frame where the lower one could slide vertically. Such simple windows remained common in utilitarian buildings well into the 20th century. With the introduction of iron pulleys, the sash could be hung from cords connected to counterweights, which resulted in single-hung windows, or double hung when both sashes were counterbalanced.

Sash increased in depth as it evolved, providing additional strength that allowed narrower muntins. As the production of glass (blown initially as a disk and later as a cylinder) improved, larger pieces of glass became more affordable, resulting in fewer panes of glass in a window. A sash that would have had twelve panes of glass in the 18th century often had only two by the mid 19th century. After about 1850, with the advent of mass-produced millwork, standard profiles and sizes of windows were established with a wide variety of designs and glazing configurations that could be purchased from catalogues. The Chicago window, which featured a large fixed pane of glass in the center with a narrow, double-hung, operable sash window on either side of it, was introduced in the last decades of the 19th century as a feature of the Chicago School-style of architecture. The picture window, popular in ranch-style houses in the mid 20th century, evolved from this.

Steel was employed beginning at the end of the 19th century to build fire-resistant windows in tight urban environments. These hollow-core windows were frequently galvanized. Windows with solid, rolled steel sections were first produced in the first decade of the 20th century in many forms, ranging from casements (especially popular in domestic construction) to large, multi-pane units that provided whole walls of natural light in industrial and warehouse buildings. Operable vents in these large windows pivoted on simple pins. Their relatively small panes and the fact that they were puttied in from the interior made the inevitable breakage easy and inexpensive to repair. Rolled steel was also used for double-hung windows, which were common in high-rise buildings in the 1920s and beyond. Aluminum windows were developed in the 1930s and, by the 1970s, rivaled wood in popularity, particularly in commercial and institutional buildings. They were produced in a variety of styles and functionality, including casement, hopper, awning, and double-hung sash.

Metal-clad (initially copper) wood windows appeared early in the 20th century but were not common until the later part of the century, when enameled aluminum cladding replaced copper. Although used primarily as replacements in older buildings, vinyl windows were developed in the latter part of the 20th century and marketed as inexpensive and thermally efficient. Modern windows are also made of fiberglass and polymer-based composites.

Storm windows were used historically and are still used to help regulate interior temperatures. Limited commercial use of thermal-pane or insulated glass in windows began in the 1930s, but it was not readily available until about 1950. Tempered glass also came into use about this time. Since then, work has continued to improve its efficiency and to reduce the effect of ultra-violet rays with tinted and low-e (low emissivity) glass. Impact-resistant glass is not new, but its use in windows continues to expand to meet modern hurricane code requirements as well as protection and security requirements.

Entrances and Porches

Entrances and porches are often the focus of historic American buildings. With their functional and decorative features (such as doors, steps, balustrades, columns, pilasters, and entablatures), they can be extremely important in defining the historic character of a building. In many cases, porches were also energy-saving features and remain so today, shading southern and western elevations. Usually, entrances and porches were integral components of a historic building's design; for example, porches on Greek Revival houses, with pediments and Doric or Ionic columns, echoed the architectural elements and features of the building itself. Center, single-bay porches or arcaded porches are evident in Italianate-style buildings of the 1860s. Doors of Renaissance Revival-style buildings frequently featured entablatures or pediments. Porches characterized by lathe-turned porch posts, railings, and balusters were especially prominent and decorative features of Eastlake, Queen Anne, and Stick-style houses. Deep porches on bungalows and Craftsman-style houses of the early 20th century feature tapered posts, exposed posts and beams, rafter tails, and low-pitched roofs with wide overhangs.

Late 19th- and early 20th-century high-rise buildings are often distinguished by highly-ornamented entrances, some with revolving doors, which were introduced around the turn of the 20th century. Some commercial structures in the early- to mid-20th century have recessed entrances with colorful terrazzo flooring. Entrances to Art Deco-style residential and commercial buildings often feature stylized glass and stainless-steel doors with geometric designs. Entrances on modernist buildings may have simple glazing and, frequently, projecting concrete or metal canopies.

Porches can have regional variations, not only in style, but also in nomenclature. For instance, in Hawaii, ***lanai*** is used to describe a type of porch which might be known as a ***veranda*** in some parts of the South, a ***piazza*** in Charleston, or a ***gallery*** in New Orleans.

Storefronts

The storefront is often the most prominent feature of a historic commercial building, playing a crucial role in a store's advertising and merchandising strategy. The earliest storefronts in America, dating from the late 18th and early 19th centuries, had small, residential-style windows with limited display space. A few featured oriel windows or glass vitrine cases (sometimes added later) that projected out from the façade. Early storefront systems were frequently wood. In the 19th century, storefront display windows progressively increased in size as plate glass became available in larger units. This reflected the fact that cast-iron columns and lintels were thinner, allowing larger sheets of glazing that became available at about the same time. In some regions, storefronts and the entire building façade were constructed entirely of cast iron, later followed by galvanized metal, copper, bronze, and aluminum.

Historic storefront systems have many different configurations: they may have multiple entrance doors (including one to access an upstairs apartment if one exists); they may be symmetrical or asymmetrical; and entrances may be flush or recessed from the shop's windows. Transoms, sometimes with prism glass, are often a component of storefronts. In the 19th century, awnings added another feature to the storefront. Permanent metal canopies attached to the façade or supported by free-standing posts or columns, as well as retractable canvas awnings, provided shelter for customers and merchandise alike. As the 20th century progressed, new storefront designs were introduced, some with deeply recessed entrances with expanded display cases or "floating display islands." In the 1920s, 1930s, and later, structural pigmented glass such as Carrara Glass, Vitrolite, and Sani Onyx; aluminum and stainless steel; porcelain enamel; glass block; neon signs; and other new materials were introduced in Art Deco-style and Art Moderne storefronts. Modular storefront systems were introduced after World War II.

Storefronts are typically altered more than any other building feature to reflect the latest architectural styles and appear up-to-date to attract customers. Older storefronts were often remodeled with a new design and materials by installing pigmented structural glass, for instance, and other 20th-century materials. These altered storefronts may have acquired significance in their own right and, in this case, should be retained.

Curtain Walls

Curtain wall construction was originally based on a steel framework. Today, most curtain wall construction utilizes an extruded aluminum framework, which became popular in the 1930s in the U.S. and came into its own after World War II. A curtain wall is not a structural system and, although it is self supporting, does not carry the weight of the building. Rather, it is an exterior wall hung or attached to the structural system. Curtain wall construction most frequently employs glass, metal panels, thin stone veneer, and other cladding materials, although louvers and vents, like glass panels, can also be set into the metal framework. Newer curtain wall systems may incorporate rain screens and glass fiber reinforced concrete panels (GFRC). Because curtain wall construction uses relatively lightweight and less expensive materials, it reduces building costs, which, in part, explains its popularity.

There are essentially two types of curtain wall systems: ***stick*** systems and ***unitized*** or ***modular*** systems. A ***stick*** system is a framing system composed of long metal pieces (sticks) put together individually using vertical pieces (mullions) between floors and horizontal pieces between the vertical members. The framing members may sometimes be assembled in a factory, but the installation and glazing is done on site. A ***unitized*** or ***modular*** curtain wall system consists of ready-to-hang, pre-assembled modules which already include glazing or other panel infill. These modular units are usually one story in height and approximately five- to six-feet wide. Both types of curtain walls are attached to floor slabs or columns with field-drilled bolts in mated, adjustable anchor brackets.

Glass panels in curtain wall systems can be fixed or operable and can include spandrel glass, clear, or tinted glass. Stone veneer panels may be slate, granite, marble, travertine, or limestone. Metal panels can be aluminum plate, stainless steel, copper, or other non-corrosive types of metal. Other materials used in curtain wall systems include composite panels (such as honeycomb composite panels, consisting of two thin sheets of aluminum bonded to a thin plastic layer or rigid insulation in the middle); architectural terra cotta; glazed ceramic tile; and fiber-reinforced plastic (FRP).

Structural Systems

Numerous types of structural systems have been employed in the construction of buildings throughout American history. Some systems and building methods overlapped, and many remained in use for years. These systems—listed according to the period when they were first introduced—include but are not limited to: ***wood-frame*** construction (17th century), ***load-bearing masonry*** construction (18th century), ***balloon-frame*** construction (19th century), ***brick cavity-wall*** construction (19th century), ***heavy-timber post and beam*** industrial construction (19th century), ***fireproof iron*** construction (19th century), ***heavy masonry and steel*** construction (19th century), ***skeletal steel construction*** (19th century), ***light frame and veneer brick*** construction (20th century), and ***cast-in-place concrete, concrete block,*** and ***slab and post*** construction (20th century).

Exposed iron and steel structural systems are character defining in many utilitarian and industrial structures of the late 19th and early 20th centuries that have large open interior spaces, such as train sheds and armories. Exposed wood structural systems became an important interior decorative element during the Arts and Crafts period and in Craftsman-style bungalows in the early 20th century. Exposed cast-concrete structural systems and system components define the character of many industrial interiors and, later, other interior spaces in 20th-century buildings.

If features of the historic structural system are exposed (such as load-bearing brick walls, cast-iron columns, roof trusses, posts and beams, vigas, and outriggers, or masonry foundation walls), they are likely to be important in defining the building's overall historic character. A concealed structural system, although not character defining, may still be significant as an example of historic building technology.

Mechanical Systems

Mechanical, lighting, and plumbing systems improved significantly with the onset of the Industrial Revolution. The 19th-century interest in hygiene, personal comfort, and reducing the spread of disease resulted in the development of central heating, piped water, piped gas, and networks of underground cast-iron sewers in urban areas. The mass production of cast-iron radiators made central heating affordable to many. By the turn of the 20th century, it was common for heating, lighting, and plumbing to be an integral part of most buildings.

The increasing availability of electricity as the 20th century progressed had a tremendous effect on the development of mechanical systems and opened up a new age of technology. Electric lighting brightened the interiors of all types of buildings, as well as building exteriors, their sites, and settings. Electricity not only improved heating systems, but in the 1920s it also brought central air conditioning to movie theaters and auditoriums, where it was first installed. By the middle of the 20th century, forced-air systems provided both heat and cooling in many buildings. In the late 20th century, as HVAC systems increased in efficiency, they decreased in size, with smaller components, such as split ductless systems with wall-mounted air handlers, cassette ceiling-mounted diffusers, or high-velocity mini duct systems. These systems can be especially useful for retrofitting historic buildings because they are small and unobtrusive. Heat pumps, another late-20th century invention, can help to supplement existing HVAC systems.

Replacing hydraulic elevators, which were invented in the mid-19th century, with electric elevators in the early decades of the 20th century resulted in a boom in the construction of taller high-rise buildings and skyscrapers. Escalators, also invented in the mid 19th century, became more and more common as the 20th century advanced. By the latter part of the century, moving walkways helped facilitate travelers' passage from one place to another in transportation centers, such as airports.

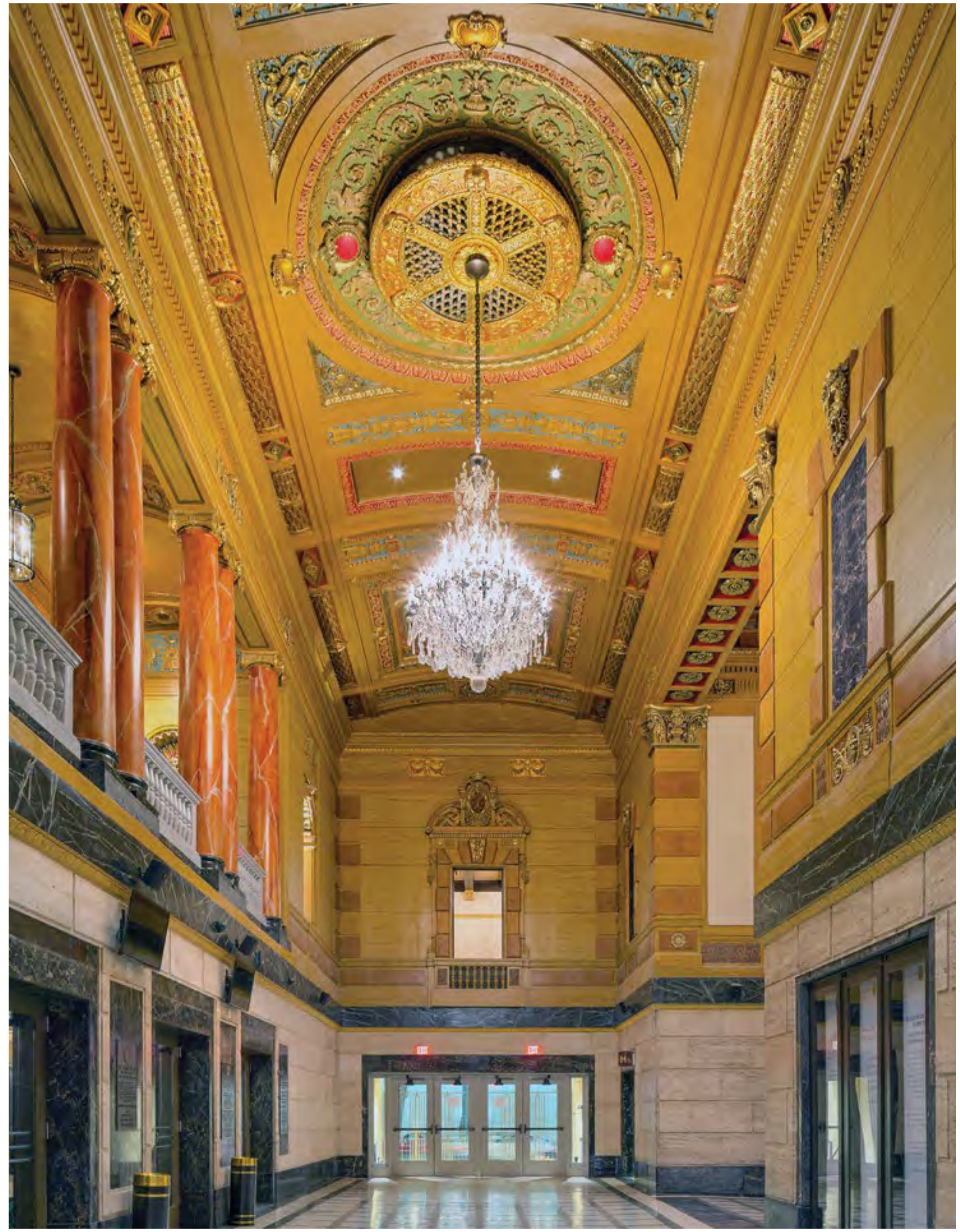
The visible decorative features that remain of historic mechanical systems (such as grilles, lighting fixtures, elevator doors, and escalators) themselves may contribute to the overall historic character of the building and should be retained when feasible. Reusing an existing, functioning system and upgrading it as needed, should always be considered when feasible. However, because a mechanical system needs to work efficiently, most historic or older systems will likely need to be replaced to meet modern requirements.

INTERIOR SPACES, FEATURES, AND FINISHES

Spaces

The earliest buildings in America were very basic and likely to have only one or, perhaps, two rooms. As communities became more established and prosperous, buildings—houses in particular—increased in size, and construction became more elaborate and sophisticated, reflecting the wealth and tastes of individual owners. Larger buildings inevitably included multiple rooms designed to accommodate a variety of purposes. Thus, the interior floor plan, the arrangement and sequence of spaces, and built-in features and applied finishes are individually and collectively important in defining the historic character of the building. With the exception of most historic utilitarian buildings, manufacturing and industrial buildings, garages, and maintenance facilities, interiors are typically composed of a series of primary and secondary spaces. This succession of spaces is applicable to many historic buildings, from courthouses to cathedrals to cottages and commercial structures. Primary spaces, including entrance halls, lobbies, double parlors, living rooms, corridors, and assembly spaces, are defined not only by their function, but also by their location, features, finishes, size, and proportion.

Secondary spaces in historic interiors are generally more functional than decorative and, depending on the building's use, may include kitchens, bathrooms, utility rooms, attics, basements, mail rooms, rear hallways, and most office spaces. Although these spaces were important to how the building functioned historically, they are generally less significant than primary spaces and, thus, are usually the most appropriate places to make changes which may be necessary in a historic building, such as those required to meet code or to install mechanical equipment. The traditional sequence of interior spaces in late 19th- through early 20th-century high-rise buildings went from public areas (such as the lobby) on the first floor



and corridors on upper floors to the private spaces behind them (i.e., offices, apartments, or hotel rooms). This hierarchy of spaces continues to define the historic character of many high-rise buildings. However, in commercial structures built on speculation with open floor plans, the upper floors, especially, are likely to have been reconfigured many times. In some cases, these interiors may have little historic character but, in others, the spaces and their appearance may have acquired significance because of a specific tenant, use (such as a boardroom or executive office), or an event.

Features and Finishes

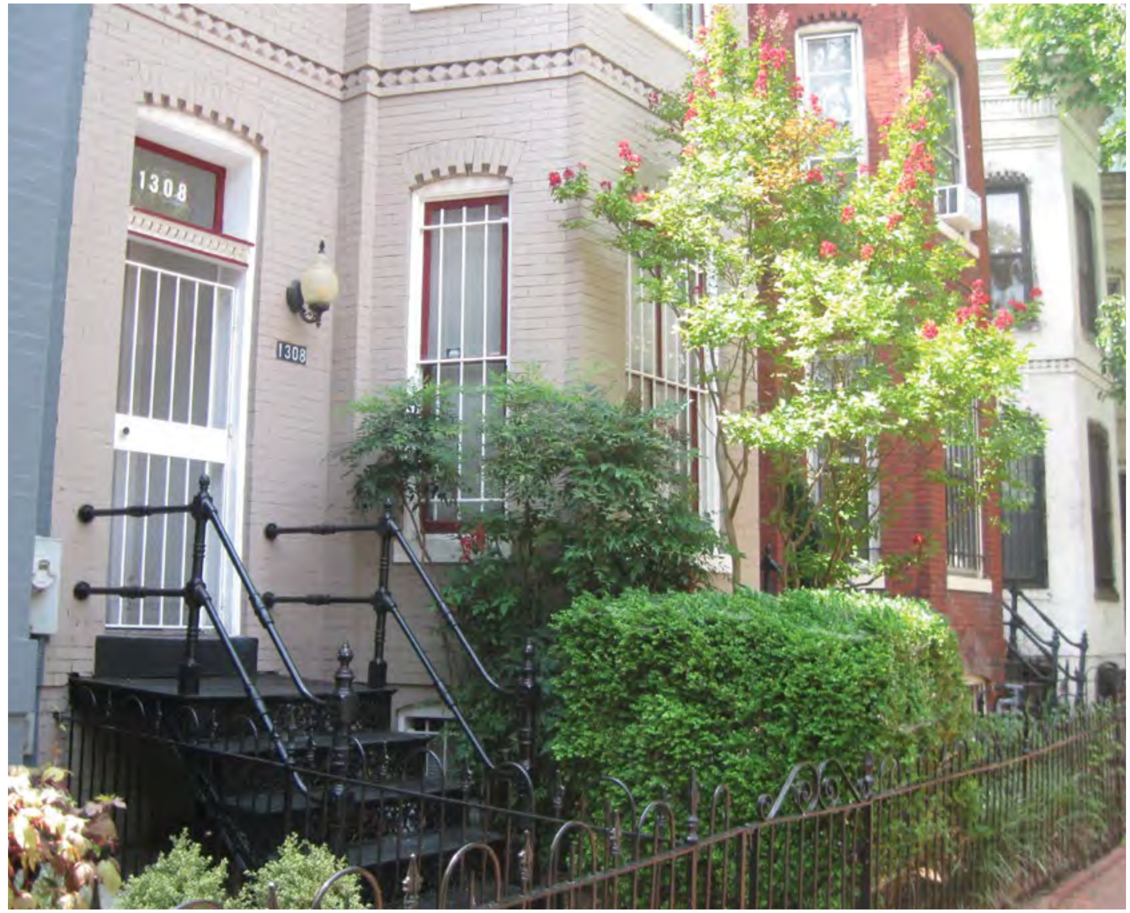
Historic character-defining features and finishes can range from very elaborate to very simple and plain, or from formal to utilitarian. The interior features that are important to a particular building generally reflect its original or historic use. Thus, the interior features and finishes of industrial and factory buildings are basic and practical, with exposed structural systems; wood, brick, or concrete walls and floors; large windows or monitors with clerestory windows to provide natural light; and minimal or no door and window surrounds. Commercial, office, hotel, and high-rise apartment buildings have public spaces that often include highly-decorated lobbies, elevator lobbies with marble flooring, wood or marble wainscoting in the upper corridors and, particularly in office buildings, offices separated from hallways by heavy doors with glass transoms and glass wall partitions for borrowed light. The repetitive pattern itself of the corridors on the upper floors in these multi-story buildings is also often significant in defining their historic character. Individual historic residential structures frequently have painted plaster walls and ceilings, door and window trim, fireplaces with mantels, wood flooring, and a staircase if the house has more than one story. Some mid-to late-20th-century houses that are less traditional in design have simpler and less-ornamented interiors.

Building Site

The building site consists of a historic building or buildings, structures, and associated landscape features and their relationship within a designed or legally-defined parcel of land. A site may be significant in its own right or because of its association with the historic building or buildings.

Setting (District/Neighborhood)

The setting is the larger area or environment in which a historic building is located. It may be an urban, suburban, or rural neighborhood or a natural landscape in which buildings have been constructed. The relationship of buildings to each other, setbacks, fence patterns, views, driveways and walkways, and street trees and other landscaping together establish the character of a district or neighborhood.



Special Requirements: Code-Required Work

Sensitive solutions to meeting code requirements are an important part of protecting the historic character of the building. Thus, work that must be done to meet accessibility and life-safety requirements must always be assessed for its potential impact on the historic building.

Accessibility

It is often necessary to make modifications to a historic building to make it compliant with accessibility code requirements. Federal rules, regulations, and standards provide guidance on how to make historic buildings accessible. Work must be carefully planned and undertaken in a manner that results in minimal or no loss of historic exterior and interior character-defining spaces, features, or finishes. The goal should be to provide the highest level of access with the least impact to the historic building.

Life Safety

When undertaking work on historic buildings, it is also necessary to consider the impact that meeting life-safety codes (public health, occupational health, life safety, electrical, seismic, structural, and building codes) will have on both exterior and interior spaces, features, and finishes. Historic building materials that are hazardous, such as lead paint and asbestos, will require abatement or encapsulation. Some newer life-safety codes are more flexible and allow greater leniency for historic buildings when making them code compliant. It is also possible that there may be an alternative approach to meeting codes that will be less damaging to the historic building. Coordinating with code officials early in project planning will help ensure that code requirements can be met in a historic building without negatively impacting its character.

Resilience to Natural Hazards

The potential future impacts of natural hazards on a historic building should be carefully evaluated and considered. If foreseeable loss, damage, or destruction to the building or its features can be reasonably anticipated, treatments should be undertaken to avoid or minimize the impacts and to ensure the continued preservation of the building and its historic character. In some other instances, the effects may be minimal or more gradual and the impacts unknown or not anticipated to affect the property until sometime in the future. In all instances, a building should be maintained in good condition and monitored regularly, and historic documentation should be prepared as a record of the building and to help guide future treatments.

Some impacts of natural hazards may be particularly sudden and destructive to a historic building (such as riverine flash flooding, coastal storm surge, an earthquake, or a tornado) and may require adaptive treatments that are more invasive. When a treatment is proposed for a building that addresses such potential impacts and will affect the building's historic character, other feasible alternatives that would require less change should always be considered first. In some instances, a certain degree of impact on a building's historic character may be necessary to ensure its retention and continued preservation. In other instances, a proposed treatment may have too great an impact to preserve the historic character of the building. A historic building may have existing characteristics or features that help to address or minimize the impacts of natural hazards. Some historic buildings may have been altered previously or be in regions where it has been traditional to adapt buildings frequently subject to damage from natural hazards, such as flooding. All these factors should be taken into consideration when planning preventive treatments. The goal should always be to minimize the impacts to the building's historic character to the greatest extent possible in adapting the building to be more resilient.

Sustainability

Before implementing any energy improvements to enhance the sustainability of a historic building, the existing energy-efficient characteristics of the building should be evaluated. Historic building construction methods and materials often maximized natural sources of heating, lighting, and ventilation to respond to local climatic conditions. The key to a successful project is to identify and understand any lost original and existing energy-efficient aspects of the historic building, as well as to identify and understand its character-defining features to ensure they are taken into account. The most sustainable building may be one that already exists. Thus, good preservation practice is very often synonymous with sustainability. There are numerous treatments—traditional as well as new technological innovations—that may be used to upgrade a historic building to help it operate more efficiently while retaining its character.

The topic of sustainability is addressed in detail in *The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings.* Although specifically developed for the treatment Rehabilitation, the Sustainability Guidelines can be used to help guide the other treatments.

New Exterior Additions and Related New Construction

A new exterior addition to a historic building should be considered in a rehabilitation project only after determining that requirements for a new or continuing use cannot be successfully met by altering non-significant interior spaces. If the existing building cannot accommodate such requirements in this way, then an exterior addition or, in some instances, separate new construction on a site may be acceptable alternatives.

A new addition must preserve the building's historic character, form, significant materials, and features. It must be compatible with the massing, size, scale, and design of the historic building while differentiated from the historic building. It should also be designed and constructed so that the essential form and integrity of the historic building would remain if the addition were to be removed in the future. There is no formula or prescription for designing a compatible new addition or related new construction on a site, nor is there generally only one possible design approach that will meet the Standards.

New additions and related new construction that meet the Standards can be any architectural style—traditional, contemporary, or a simplified version of the historic building. However, there must be a balance between differentiation and compatibility to maintain the historic character and the identity of the building being enlarged.

New additions and related new construction that are either identical to the historic building or in extreme contrast to it are not compatible. Placing an addition on the rear or on another secondary elevation helps to ensure that it will be subordinate to the historic building. New construction should be appropriately scaled and located far enough away from the historic building to maintain its character and that of the site and setting. In urban or other built-up areas, new construction that appears as infill within the existing pattern of development can also preserve the historic character of the building, its site, and setting.

STANDARDS FOR PRESERVATION & GUIDELINES FOR PRESERVING HISTORIC BUILDINGS

Preservation

Preservation is defined as the act or process of applying measures necessary to sustain the existing form, integrity, and materials of an historic property. Work, including preliminary measures to protect and stabilize the property, generally focuses upon the ongoing maintenance and repair of historic materials and features rather than extensive replacement and new construction. New exterior additions are not within the scope of this treatment; however, the limited and sensitive upgrading of mechanical, electrical, and plumbing systems and other code-required work to make properties functional is appropriate within a preservation project.

Standards for Preservation

1. A property will be used as it was historically, or be given a new use that maximizes the retention of distinctive materials, features, spaces and spatial relationships. Where a treatment and use have not been identified, a property will be protected and, if necessary, stabilized until additional work may be undertaken.
2. The historic character of a property will be retained and preserved. The replacement of intact or repairable historic materials or alteration of features, spaces and spatial relationships that characterize a property will be avoided.
3. Each property will be recognized as a physical record of its time, place and use. Work needed to stabilize, consolidate and conserve existing historic materials and features will be physically and visually compatible, identifiable upon close inspection and properly documented for future research.
4. Changes to a property that have acquired historic significance in their own right will be retained and preserved.
5. Distinctive materials, features, finishes and construction techniques or examples of craftsmanship that characterize a property will be preserved.
6. The existing condition of historic features will be evaluated to determine the appropriate level of intervention needed. Where the severity of deterioration requires repair or limited replacement of a distinctive feature, the new material will match the old in composition, design, color and texture.
7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.
8. Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.

GUIDELINES FOR PRESERVING HISTORIC BUILDINGS

INTRODUCTION

Preservation is the appropriate treatment when the objective of the project is to retain the building as it currently exists. This means that not only the original historic materials and features will be preserved, but also later changes and additions to the original building. The expressed goal of the **Standards for Preservation and Guidelines for Preserving Historic Buildings** is retention of the building's existing form, features, and materials. This may be as simple as maintaining existing materials and features or may involve more extensive repair. Protection, maintenance, and repair are emphasized while replacement is minimized.

Identify, Retain, and Preserve Historic Materials and Features

The guidance for the treatment **Preservation** begins with recommendations to identify the form and detailing of those architectural materials and features that are important in defining the building's historic character and which must be retained to preserve that character. Therefore, guidance on ***identifying, retaining, and preserving*** character-defining features is always given first.

Stabilize Deteriorated Historic Materials and Features as a Preliminary Measure

Deteriorated portions of a historic building may need to be protected through preliminary stabilization measures until additional work can be undertaken. ***Stabilizing*** may begin with temporary structural reinforcement and progress to weatherization or correcting unsafe conditions. Although it may not be necessary in every preservation project, stabilization is nonetheless an integral part of the treatment **Preservation**; it is equally applicable to the other treatments if circumstances warrant.

Protect and Maintain Historic Materials and Features

After identifying those materials and features that are important and must be retained in the process of **Preservation** work, then ***protecting and maintaining*** them are addressed. Protection generally involves the least degree of intervention and is preparatory to other work. Protection includes the maintenance of historic materials and features as well as ensuring that the property is protected before and during preservation work.

Repair (Stabilize, Consolidate, and Conserve) Historic Materials and Features

Next, when the physical condition of character-defining materials and features warrants additional work, ***repairing*** by ***stabilizing, consolidating, and conserving*** is recommended. The intent of **Preservation** is to retain existing materials and features while introducing as little new material as possible. Consequently, guidance for repairing a historic material, such as masonry, begins with the least degree of intervention possible, such as strengthening materials through consolidation, when necessary, or repointing with mortar of an appropriate strength. Repairing masonry, as well as wood and metal features, may include patching, splicing, or other treatments using recognized preservation methods. All work should be physically and visually compatible.

Limited Replacement in Kind of Extensively Deteriorated Portions of Historic Features

The greatest level of intervention in this treatment is the ***limited replacement in kind*** of extensively deteriorated or missing components of features when there are surviving prototypes or when the original features can be substantiated by documentary and physical evidence. The replacement material must match the old, both physically and visually (e.g., wood with wood). Thus, with the exception of hidden structural reinforcement, such as steel rods, substitute materials are not appropriate in the treatment **Preservation.** If prominent features are missing, such as an interior staircase or an exterior cornice, then a Rehabilitation or Restoration treatment may be more appropriate.

Code-Required Work: Accessibility and Life Safety

These sections of the **Preservation** guidance address work that must be done to meet accessibility and life-safety requirements. This work may be an important aspect of preservation projects, and it, too, must be assessed for its potential negative impact on the building's character. For this reason, particular care must be taken not to obscure, damage, or destroy character-defining materials or features in the process of undertaking work to meet code requirements.

Resilience to Natural Hazards

Resilience to natural hazards should be addressed as part of a **Preservation** project. A historic building may have existing characteristics or features that help to address or minimize the impacts of natural hazards. These should always be used to best advantage when planning new adaptive treatments so as to have the least impact on the historic character of the building, its site, and setting.

Sustainability

Sustainability should be addressed as part of a **Preservation** project. Good preservation practice is often synonymous with sustainability. Existing energy-efficient features should be retained and repaired. New sustainability treatments should generally be limited to updating existing features and systems so as to have the least impact on the historic character of the building.

The topic of sustainability is addressed in detail in *The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings*. Although specifically developed for the treatment Rehabilitation, the Sustainability Guidelines can be used to help guide the other treatments.

Preservation as a Treatment. *When the property's distinctive materials, features, and spaces are essentially intact and thus convey the historic significance without extensive repair or replacement; when depiction at a particular period of time is not appropriate; and when a continuing or new use does not require additions or extensive alterations, Preservation may be considered as a treatment. Prior to undertaking work, a documentation plan for Preservation should be developed.*

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving masonry features that are important in defining the overall historic character of the building (such as walls, brackets, railings, cornices, window and door surrounds, steps, and columns) and decorative ornament and other details, such as tooling and bonding patterns, coatings, and color.	Altering masonry features which are important in defining the overall historic character of the building so that, as a result, the character is diminished. Replacing historic masonry features instead of repairing or replacing only the deteriorated masonry. Applying paint or other coatings (such as stucco) to masonry that has been historically unpainted or uncoated. Removing paint from historically-painted masonry.
Stabilizing deteriorated or damaged masonry as a preliminary measure, when necessary, prior to undertaking preservation work.	Failing to stabilize deteriorated or damaged masonry until additional work is undertaken, thereby allowing further damage to occur to the historic building
Protecting and maintaining masonry by ensuring that historic drainage features and systems that divert rainwater from masonry surfaces (such as roof overhangs, gutters, and downspouts) are intact and functioning properly.	Failing to identify and treat the causes of masonry deterioration, such as leaking roofs and gutters or rising damp.
Cleaning masonry only when necessary to halt deterioration or remove heavy soiling.	Cleaning masonry surfaces when they are not heavily soiled to create a "like-new" appearance, thereby needlessly introducing chemicals or moisture into historic materials.
Carrying out masonry cleaning tests when it has been determined that cleaning is appropriate. Test areas should be examined to ensure that no damage has resulted and, ideally, monitored over a sufficient period of time to allow long-range effects to be predicted.	Cleaning masonry surfaces without testing or without sufficient time for the testing results to be evaluated.

[1] A test patch should always be done before using a chemical cleaner to ensure that it will not damage historic masonry, as in this instance, terra cotta.

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Cleaning soiled masonry surfaces with the gentlest method possible, such as using low-pressure water and detergent and natural bristle or other soft-bristle brushes.	Cleaning or removing paint from masonry surfaces using most abrasive methods (including sandblasting, other media blasting, or high-pressure water) which can damage the surface of the masonry and mortar joints. Using a cleaning or paint-removal method that involves water or liquid chemical solutions when there is any possibility of freezing temperatures. Cleaning with chemical products that will damage some types of masonry (such as using acid on limestone or marble), or failing to neutralize or rinse off chemical cleaners from masonry surfaces.
Using biodegradable or environmentally-safe cleaning or paint-removal products.	
Using paint-removal methods that employ a poultice to which paint adheres, when possible, to neatly and safely remove old lead paint.	
Using coatings that encapsulate lead paint, when possible, where the paint is not required to be removed to meet environmental regulations.	
Allowing only trained conservators to use abrasive or laser-cleaning methods, when necessary, to clean hard-to-reach, highly-carved, or detailed decorative stone features.	

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Removing damaged or deteriorated paint only to the next sound layer using the gentlest method possible (e.g., hand scraping) prior to repainting.	Removing paint that is firmly adhered to masonry surfaces.
Applying compatible paint coating systems to historically-painted masonry following proper surface preparation.	Failing to follow manufacturers' product and application instructions when repainting masonry features.
Repainting historically-painted masonry features with colors that are appropriate to the building and district.	Using paint colors on historically-painted masonry features that are not appropriate to the building or district.
Protecting adjacent materials when working on masonry features.	Failing to protect adjacent materials when working on masonry features.
Evaluating the overall condition of the masonry to determine whether more than protection and maintenance, such as repairs to masonry features, will be necessary.	Failing to undertake adequate measures to ensure the protection of masonry features.
Repairing masonry by patching, splicing, consolidating, or otherwise reinforcing the masonry using recognized preservation methods.	Removing masonry that could be stabilized, repaired, and conserved, or using untested consolidants, improper repair techniques, or unskilled personnel, potentially causing further damage to historic materials.
Repairing masonry walls and other masonry features by repointing the mortar joints where there is evidence of deterioration, such as disintegrating mortar, cracks in mortar joints, loose bricks, or damaged plaster on the interior.	Removing non-deteriorated mortar from sound joints and then repointing the entire building to achieve a more uniform appearance.
Removing deteriorated lime mortar carefully by hand raking the joints to avoid damaging the masonry.	

[2] **Not Recommended:** The use of inappropriate Portland cement mortar to repoint these soft 19th-century bricks has caused some of them to spall. *Photo: Courtesy Nebraska State Historic Preservation Office.*

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Using power tools only on horizontal joints on brick masonry in conjunction with hand chiseling to remove hard mortar that is deteriorated or that is a non-historic material which is causing damage to the masonry units. Mechanical tools should be used only by skilled masons in limited circumstances and generally not on short, vertical joints in brick masonry.	Allowing unskilled workers to use masonry saws or mechanical tools to remove deteriorated mortar from joints prior to repointing.
Duplicating historic mortar joints in strength, composition, color, and texture when repointing is necessary. In some cases, a lime-based mortar may also be considered when repointing Portland cement mortar because it is more flexible.	Repointing masonry units with mortar of high Portland cement content (unless it is the content of the historic mortar).
Duplicating historic mortar joints in width and joint profile when repointing is necessary.	Using "surface grouting" or a "scrub" coating technique, such as a "sack rub" or "mortar washing," to repoint exterior masonry units instead of traditional repointing methods. Changing the width or joint profile when repointing.
Repairing stucco by removing the damaged material and patching with new stucco that duplicates the old in strength, composition, color, and texture.	Removing sound stucco or repairing with new stucco that is different in composition from the historic stucco. Patching stucco or concrete without removing the source of deterioration. Replacing deteriorated stucco with synthetic stucco, an exterior insulation and finish system (EIFS), or other non-traditional materials.
Using mud plaster or a compatible lime-plaster adobe render, when appropriate, to repair adobe.	Applying cement stucco, unless it already exists, to adobe.
Sealing joints in concrete with appropriate flexible sealants and backer rods, when necessary.	Repointing masonry units (other than concrete) with a synthetic caulking compound instead of mortar.

[3] **Not Recommended:** Cracks in the stucco have not been repaired, thereby allowing ferns to grow in the moist substrate which will cause further damage to the masonry.

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Cutting damaged concrete back to remove the source of deterioration, such as corrosion on metal reinforcement bars. The new patch must be applied carefully so that it will bond satisfactorily with, and match, the historic concrete.	Patching damaged concrete without first removing the source of deterioration.
Using a non-corrosive, stainless-steel anchoring system when replacing damaged stone, concrete, or terra-cotta units that have failed.	

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Applying non-historic surface treatments, such as water-repellent coatings, to masonry only after repointing and only if masonry repairs have failed to arrest water penetration problems.	Applying waterproof, water-repellent, or non-original historical coatings (such as stucco) to masonry as a substitute for repointing and masonry repairs.
Applying permeable, anti-graffiti coatings to masonry when appropriate.	Applying water-repellent or anti-graffiti coatings that change the appearance of the masonry or that may trap moisture if the coating is not sufficiently permeable.
*The following work is highlighted to indicate that it represents the greatest degree of intervention generally recommended within the treatment **Preservation**, and should only be considered after protection, stabilization, and repair concerns have been addressed.*	
Limited Replacement in Kind	
Replacing in kind extensively deteriorated or missing components of masonry features when there are surviving prototypes, such as terra-cotta brackets or stone balusters, or when the replacement can be based on documentary or physical evidence. The new work should match the old in material, design, scale, color, and finish.	Replacing an entire masonry feature, such as a column or stairway, when limited replacement of deteriorated and missing components is appropriate. Using replacement material that does not match the historic masonry feature.

WOOD: CLAPBOARD, WEATHERBOARD, SHINGLES, AND OTHER FUNCTIONAL AND DECORATIVE ELEMENTS

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving wood features that are important in defining the overall historic character of the building (such as siding, cornices, brackets, window and door surrounds, and steps) and their paints, finishes, and colors.	Altering wood features which are important in defining the overall historic character of the building so that, as a result, the character is diminished. Replacing historic wood features instead of repairing or replacing only the deteriorated wood. Changing the type of finish, coating, or historic color of wood features

[4] Hand scraping to remove peeling paint from wood siding in preparation for repainting is an important part of regularly-scheduled maintenance.

WOOD: CLAPBOARD, WEATHERBOARD, SHINGLES, AND OTHER FUNCTIONAL AND DECORATIVE ELEMENTS

RECOMMENDED	NOT RECOMMENDED
Stabilizing deteriorated or damaged wood as a preliminary measure, when necessary, prior to undertaking preservation work.	Failing to stabilize deteriorated or damaged wood until additional work is undertaken, thereby allowing further damage to occur to the historic building.
Protecting and maintaining wood features by ensuring that historic drainage features that divert rainwater from wood surfaces (such as roof overhangs, gutters, and downspouts) are intact and functioning properly. Finding and eliminating sources of moisture that may damage wood features, such as clogged gutters and downspouts, leaky roofs, or moisture-retaining soil that touches wood around the foundation.	Failing to identify and treat the causes of wood deterioration, such as faulty flashing, leaking gutters, cracks and holes in siding, deteriorated caulking in joints and seams, plant material growing too close to wood surfaces, or insect or fungal infestation.
Finding and eliminating sources of moisture that may damage wood features, such as clogged gutters and downspouts, leaky roofs, or moisture-retaining soil that touches wood around the foundation.	
Applying chemical preservatives or paint to wood features that are subject to weathering, such as exposed beam ends, outriggers, or rafter tails.	Using chemical preservatives (such as creosote) which, unless they were used historically, can change the appearance of wood features.

[5] Rotted wood shingles have been replaced in kind with matching wood shingles.

WOOD: CLAPBOARD, WEATHERBOARD, SHINGLES, AND OTHER FUNCTIONAL AND DECORATIVE ELEMENTS

RECOMMENDED	NOT RECOMMENDED
Implementing an integrated pest management plan to identify appropriate preventive measures to guard against insect damage, such as installing termite guards, fumigating, and treating with chemicals. Retaining coatings (such as paint) that protect the wood from moisture and ultraviolet light. Paint removal should be considered only when there is paint surface deterioration and as part of an overall maintenance program which involves repainting or applying other appropriate coatings	Stripping paint or other coatings from wood features without recoating.
Removing damaged or deteriorated paint to the next sound layer using the gentlest method possible (e.g., hand scraping and hand sanding) prior to repainting.	Using potentially-damaging paint-removal methods on wood surfaces, such as open-flame torches, orbital sanders, abrasive methods (including sandblasting, other media blasting, or high-pressure water), or caustic paint-removers. Removing paint that is firmly adhered to wood surfaces.
Using chemical strippers primarily to supplement other methods such as hand scraping, hand sanding, and thermal devices.	Failing to neutralize the wood thoroughly after using chemical paint removers so that new paint may not adhere. Removing paint from detachable wood features by soaking them in a caustic solution which can roughen the surface, split the wood, or result in staining from residual acid leaching out through the wood.
Using biodegradable or environmentally-safe cleaning or paint-removal products.	
Using paint-removal methods that employ a poultice to which paint adheres, when possible, to neatly and safely remove old lead paint.	Using a thermal device to remove paint from wood features without first checking for and removing any flammable debris behind them.
Using thermal devices (such as infrared heaters) carefully to remove paint when it is so deteriorated that total removal is necessary prior to repainting.	Using thermal devices without limiting the amount of time the wood feature is exposed to heat.

WOOD: CLAPBOARD, WEATHERBOARD, SHINGLES, AND OTHER FUNCTIONAL AND DECORATIVE ELEMENTS

RECOMMENDED	NOT RECOMMENDED
Using coatings that encapsulate lead paint, when possible, where the paint is not required to be removed to meet environmental regulations.	
Applying compatible paint coating systems to historically-painted wood following proper surface preparation.	Failing to follow manufacturers' product and application instructions when repainting wood features.
Repainting historically-painted wood features with colors that are appropriate to the building or district.	Using paint colors on historically-painted wood features that are not appropriate to the building or district.
Protecting adjacent materials when working on wood features.	Failing to protect adjacent materials when working on wood features.
Evaluating the overall condition of the wood to determine whether more than protection and maintenance, such as repairs to wood features, will be necessary.	Failing to undertake adequate measures to ensure the protection of wood features.
Repairing wood by patching, splicing, consolidating, or otherwise reinforcing the wood using recognized preservation methods.	Removing wood that could be stabilized, repaired, and conserved, or using untested consolidants, improper repair techniques, or unskilled personnel, potentially causing further damage to historic materials.
*The following work is highlighted to indicate that it represents the greatest degree of intervention generally recommended within the treatment **Preservation**, and should only be considered after protection, stabilization, and repair concerns have been addressed.*	
Limited Replacement in Kind	
Replacing in kind (i.e., with wood, but not necessarily the same species) extensively deteriorated or missing components of wood features when there are surviving prototypes, such as brackets, molding, or sections of siding, or when the replacement can be based on documentary or physical evidence. The new work should match the old in material, design, scale, color, and finish	Replacing an entire wood feature, such as a column or stairway, when limited replacement of deteriorated and missing components is appropriate. Using replacement material that does not match the historic wood feature.

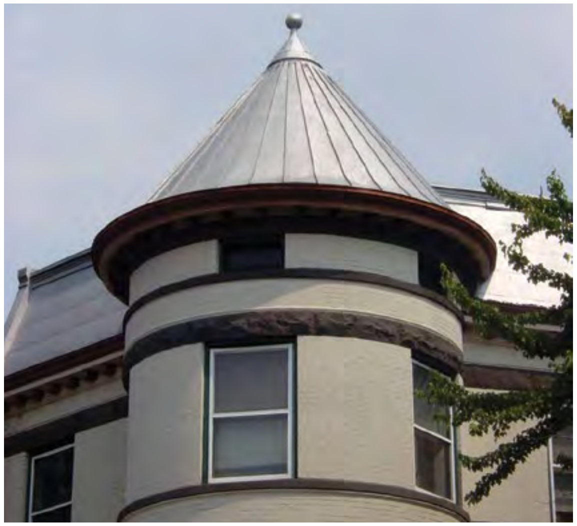
METALS: WROUGHT AND CAST IRON, STEEL, PRESSED METAL, TERNEPLATE, COPPER, ALUMINUM, AND ZINC

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving metal features that are important in defining the overall historic character of the building (such as columns, capitals, pilasters, spandrel panels, or stairways) and their paint, finishes, and colors. The type of metal should be identified prior to work because each metal has its own properties and may require a different treatment.	Altering metal features which are important in defining the overall historic character of the building so that, as a result, the character is diminished. Replacing historic metal features instead of repairing or replacing only the deteriorated metal. Changing the type of finish, coating, or historic color of metal features.
Stabilizing deteriorated or damaged metal as a preliminary measure, when necessary, prior to undertaking preservation work.	Failing to stabilize deteriorated or damaged metals until additional work is undertaken, thereby allowing further damage to occur to the historic building.
Protecting and maintaining metals from corrosion by providing proper drainage so that water does not stand on flat, horizontal surfaces or accumulate in curved decorative features.	Failing to identify and treat the causes of corrosion, such as moisture from leaking roofs or gutters. Placing incompatible metals together without providing an appropriate 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).
Cleaning metals, when necessary, to remove corrosion prior to repainting or applying other appropriate protective coatings.	Failing to reapply coating systems after cleaning metals that require protection from corrosion. Removing the patina from historic metals. The patina may be a protective layer on some metals (such as bronze or copper) as well as a distinctive finish.
Identifying the particular type of metal prior to any cleaning procedure and then testing to ensure that the gentlest cleaning method possible is selected; or, alternatively, determining that cleaning is inappropriate for the particular 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 particular metal.

METALS: WROUGHT AND CAST IRON, STEEL, PRESSED METAL, TERNEPLATE, COPPER, ALUMINUM, AND ZINC

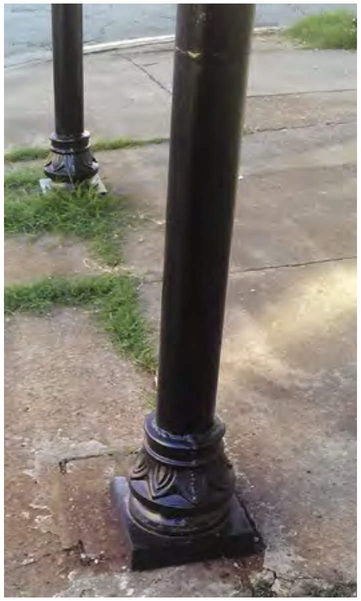
RECOMMENDED	NOT RECOMMENDED
Using non-corrosive chemical methods to clean soft metals (such as lead, tinplate, terneplate, copper, and zinc) whose finishes can be easily damaged by abrasive methods.	Cleaning soft metals (such as lead, tinplate, terneplate, copper, and zinc) with abrasive methods (including sandblasting, other media blasting, or high-pressure water) which will damage the surface of the metal.
Using the least abrasive cleaning method for hard metals (such as cast iron, wrought iron, and steel) to remove paint buildup and corrosion. If hand scraping and wire brushing have proven ineffective, low-pressure abrasive methods may be used as long as they do not damage the surface.	Using high-pressure abrasive techniques (including sandblasting, other media blasting, or high-pressure water) without first trying gentler cleaning methods prior to cleaning cast iron, wrought iron, or steel.
Applying appropriate paint or other coating systems to historically-coated metals after cleaning to protect them from corrosion.	Applying paint or other coatings to metals (such as copper, bronze or stainless steel) if they were not coated historically.
Repainting historically-painted metal features with colors that are appropriate to the building and district.	Using paint colors on historically-painted metal features that are not appropriate to the building or district.
Applying an appropriate protective coating (such as lacquer or wax) to a metal feature that was historically unpainted, such as a bronze door, which is subject to heavy use.	

[6] A standing-seam sheet metal roof, like the one on the turret of this late 19th century row house, must be kept painted to ensure its preservation.



METALS: WROUGHT AND CAST IRON, STEEL, PRESSED METAL, TERNEPLATE, COPPER, ALUMINUM, AND ZINC

RECOMMENDED	NOT RECOMMENDED
Protecting adjacent materials when working on metal features.	Failing to protect adjacent materials when working on metal features.
Evaluating the overall condition of metals to determine whether more than protection and maintenance, such as repairs to metal features, will be necessary.	Failing to undertake adequate measures to ensure the protection of metal features.
Repairing, stabilizing, and reinforcing metal by using recognized preservation methods	Removing metals that could be stabilized, repaired, and conserved, or using improper repair techniques, or untrained personnel, potentially causing further damage to historic materials.
The following work is highlighted to indicate that it represents the greatest degree of intervention generally recommended within the treatment Preservation, and should only be considered after protection, stabilization, and repair concerns have been addressed.	
Limited Replacement in Kind	
Replacing in kind extensively deteriorated or missing components of metal features when there are surviving prototypes, such as porch balusters, column capitals or bases, or porch cresting, or when the replacement can be based on documentary or physical evidence. The new work should match the old in material, design, scale, color, and finish.	Replacing an entire metal feature, such as a column or balustrade, when limited replacement of deteriorated or missing components is appropriate. Using replacement material that does not match the historic metal feature.



[7] (a) After the damaged portions of the base were repaired, (b) the cast-iron columns were cleaned and repainted to protect the metal from rusting.

[8] Regular maintenance includes removing leaves that can clog gutters and cause water damage to the exterior and interior walls of a house.

ROOFS

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving roofs and their functional and decorative features that are important in defining the overall historic character of the building. The form of the roof (gable, hipped, gambrel, flat, or mansard) is significant, as are its decorative and functional features (such as cupolas, cresting, parapets, monitors, chimneys, weather vanes, dormers, ridge tiles, and snow guards), roofing material (such as slate, wood, clay tile, metal, roll roofing, or asphalt shingles), and size, color, and patterning.	Altering the roof and roofing materials which are important in defining the overall historic character of the building so that, as a result, the character is diminished. Replacing historic roofing material instead of repairing or replacing only the deteriorated material. Changing the type or color of roofing materials.
Stabilizing deteriorated or damaged roofs as a preliminary measure, when necessary, prior to undertaking preservation work.	Failing to stabilize a deteriorated or damaged roof until additional work is undertaken, thereby allowing further damage to occur to the historic building
Protecting and maintaining a roof by cleaning gutters and downspouts and replacing deteriorated flashing. Roof sheathing should also be checked for indications of moisture due to leaks or condensation.	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
Providing adequate anchorage for roofing material to guard against wind damage and moisture penetration.	Allowing flashing, caps, and exposed roof fasteners to corrode, which accelerates deterioration of the roof.
Protecting a leaking roof with a temporary waterproof membrane with a synthetic underlayment, roll roofing, plywood, or a tarpaulin until it can be repaired.	Leaving a leaking roof unprotected so that accelerated deterioration of historic building materials (such as masonry, wood, plaster, paint, and structural members) occurs.
Repainting a roofing material that requires a protective coating and was painted historically (such as a terneplate metal roof or gutters) as part of regularly-scheduled maintenance.	Failing to repaint a roofing material that requires a protective coating and was painted historically as part of regularly-scheduled maintenance.
Protecting a roof covering when working on other roof features.	Failing to protect roof coverings when working on other roof features.
Evaluating the overall condition of the roof to determine whether more than protection and maintenance, such as repairs to roof features, will be necessary.	Failing to undertake adequate measures to ensure the protection of roof features.
Repairing a roof by ensuring that the existing historic roof or compatible non-historic roof covering is sound and waterproof.	Removing historic materials that could be repaired or using improper repair techniques. Failing to reuse intact slate or tile when only the roofing substrate or fasteners need replacement.

ROOFS

RECOMMENDED	NOT RECOMMENDED
Using corrosion-resistant roof fasteners (e.g., nails and clips) to repair a roof to help extend its longevity.	
The following work is highlighted to indicate that it represents the greatest degree of intervention generally recommended within the treatment ***Preservation****, and should only be considered after protection, stabilization, and repair concerns have been addressed.*	
Limited Replacement in Kind	
Replacing in kind extensively deteriorated or missing components of roof features when there are surviving prototypes, such as ridge tiles, roof cresting, or dormer trim, slates, or tiles, or when the replacement can be based on documentary or physical evidence. The new work should match the old in material, design, scale, color, and finish.	Replacing an entire roof feature, such as a chimney or dormer, when limited replacement of deteriorated or missing components is appropriate. Using replacement material that does not match the historic roof feature.

[9] Distinctively-shaped roofs are important in defining the historic character of these early 20th-century structures: (a) an asphalt shingle roof on a house; (b) and a concrete roof on Fonthill, Doylestown, PA (1908-1912), designed and built by Henry Chapman Mercer.

WINDOWS

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving windows and their functional and decorative features that are important to the overall historic character of the building. The window material and how the window operates (e.g., double hung, casement, awning, or hopper) are significant, as are its components (including sash, muntins, ogee lugs, glazing, pane configuration, sills, mullions, casings, or brick molds) and related features, such as shutters.	Altering windows or window features which are important in defining the historic character of the building so that, as a result, the character is diminished. Changing the appearance of windows that contribute to the historic character of the building by replacing 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 wood window trim with metal or other material.
Stabilizing deteriorated or damaged windows as a preliminary measure, when necessary, prior to undertaking preservation work.	Failing to stabilize deteriorated or damaged windows as a preliminary measure, when necessary, prior to undertaking preservation work.
Protecting and maintaining the wood or metal which comprises the window jamb, sash, and trim through appropriate surface treatments, such as cleaning, paint removal, and reapplication of the same protective coating systems.	Failing to protect and maintain materials on a cyclical basis so that deterioration of the window results.
Protecting windows against vandalism before work begins by covering them and by installing alarm systems that are keyed into local protection agencies.	Leaving windows unprotected and subject to vandalism before work begins, thereby also allowing the interior to be damaged if it can be accessed through unprotected windows.
Installing impact-resistant glazing, when necessary for security, so that it is compatible with the historic windows and does not damage them or negatively impact their character.	Installing impact-resistant glazing, when necessary for security, that is not compatible with the historic windows and damages them or negatively impacts their character.
Making windows weathertight by recaulking gaps in fixed joints and replacing or installing weatherstripping.	Replacing windows rather than maintaining the sash, frame, or glazing.
Protecting windows from chemical cleaners, paint, or abrasion during work on the exterior of the building.	Failing to protect historic windows from chemical cleaners, paint, or abrasion when work is being done on the exterior of the building.
Protecting and retaining historic glass when replacing putty or repairing other components of the window.	Failing to protect the historic glass when making repairs.

[10] Historic exterior storm windows preserve and help to insulate wood windows.

[11] Old and brittle glazing putty should be removed carefully before reputtying to keep window glazing weathertight.

WINDOWS

RECOMMENDED	NOT RECOMMENDED
Sustaining the historic operability of windows by lubricating friction points and replacing broken components of the operating system (such as hinges, latches, sash chains or cords) or replacing deteriorated gaskets or insulating units.	Failing to maintain windows and window components so that windows are inoperable, or sealing operable sash permanently. Failing to repair and reuse window hardware such as sash lifts, latches, and locks
Adding storm windows with a matching or a one-over-one pane configuration that will not obscure the characteristics of the historic windows. Storm windows improve energy efficiency and are especially beneficial when installed over wood windows because they also protect them from accelerated deterioration.	
Protecting adjacent materials when working on windows.	Failing to protect adjacent materials when working on windows.
Evaluating the overall condition of windows to determine whether more than protection and maintenance, such as repairs to windows and window features, will be necessary.	Failing to undertake adequate measures to ensure the protection of windows.
Repairing window frames and sash by patching, splicing, consolidating, or otherwise reinforcing them using recognized preservation methods.	Removing window frames or sash that could be stabilized, repaired, and conserved, or using untested consolidants, improper repair techniques, or untrained personnel, potentially causing furthur damage to historic buildings.
Using corrosion-resistant roof fasteners (e.g., nails and clips) to repair a roof to help extend its longevity.	
*The following work is highlighted to indicate that it represents the greatest degree of intervention generally recommended within the treatment **Preservation**, and should only be considered after protection, stabilization, and repair concerns have been addressed.*	
Limited Replacement in Kind	
Replacing in kind extensively deteriorated or missing components of windows when there are surviving prototypes, such as frames or sash, or when the replacement can be based on documentary or physical evidence. The new work should match the old in material, design, scale, color, and finish.	Replacing an entire window when limited replacement of deteriorated or missing components is appropriate. Using replacement material that does not match the historic window.

ENTRANCES AND PORCHES

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving entrances and porches and their functional and decorative features that are important in defining the overall historic character of the building. The materials themselves (including wood, masonry, and metal) are significant, as are the features, such as doors, transoms, pilasters, columns, balustrades, stairs, roofs, and projecting canopies.	Altering entrances and porches which are important in defining the overall historic character of the building so that, as a result, the character is diminished. Replacing historic entrance and porch features instead of repairing or replacing only the deteriorated material.
Stabilizing deteriorated or damaged entrances and porches as a preliminary measure, when necessary, prior to undertaking preservation work.	Failing to stabilize a deteriorated or damaged entrance or porch until additional work is undertaken, thereby allowing further damage to occur to the historic building.

[13] It is important that exposed swallow tail porch rafters be kept painted to protect them from water damage.

[12] Repair and limited replacement in kind to match deteriorated wood porch features is always a recommended preservation treatment.

ENTRANCES AND PORCHES

RECOMMENDED	NOT RECOMMENDED
Protecting and maintaining the masonry, wood, and metals which comprise entrances and porches through appropriate surface treatments, such as cleaning, paint removal, and reapplication of protective coating systems.	Failing to protect and maintain historic materials on a cyclical basis so that deterioration of entrances and porches results.
Protecting entrances and porches against arson and vandalism before work begins by covering them and by installing alarm systems keyed into local protection agencies.	Leaving entrances and porches unprotected and subject to vandalism before work begins, thereby also allowing the interior to be damaged if it can be accessed through unprotected entrances.
Protecting entrance and porch features when working on other features of the building.	Failing to protect historic entrances and porches when working on other features of the building.
Evaluating the overall condition of entrances and porches to determine whether more than protection and maintenance, such as repairs to entrance and porch features, will be necessary.	Failing to undertake adequate measures to ensure the protection of entrance and porch features.
Repairing entrances and porches by patching, splicing, consolidating, or otherwise reinforcing them using recognized preservation methods.	Removing entrances and porches or their features that could be stabilized, repaired, and conserved, or using untested consolidants, improper repair techniques, or untrained personnel, potentially causing further damage to historic materials.
The following work is highlighted to indicate that it represents the greatest degree of intervention generally recommended within the treatment Preservation, and should only be considered after protection, stabilization, and repair concerns have been addressed.	
Limited Replacement in Kind	
Replacing in kind extensively deteriorated or missing components of entrance and porch features when there are surviving prototypes, such as railings, balustrades, cornices, columns, sidelights, stairs, and roofs, or when the replacement can be based on documentary or physical evidence. The new work should match the old in material, design, scale, color, and finish.	Replacing an entire entrance or porch feature when limited replacement of deteriorated and missing components is appropriate. Using replacement material that does not match the historic entrance or porch feature.

STOREFRONTS

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving storefronts and their functional and decorative features that are important in defining the overall historic character of the building. The storefront materials (including wood, masonry, metals, ceramic tile, clear glass, and pigmented structural glass) and the configuration of the storefront are significant, as are features, such as display windows, base panels, bulkheads, signs, doors, transoms, kick plates, corner posts, piers, and entablatures.	Altering storefronts and their features which are important in defining the overall historic character of the building so that, as a result, the character is diminished. Replacing historic storefront features instead of repairing or replacing only the deteriorated material.
Stabilizing deteriorated or damaged storefronts as a preliminary measure, when necessary, prior to undertaking preservation work.	Failing to stabilize a deteriorated or damaged storefront until additional work is undertaken, thereby allowing further damage to occur to the historic building.
Protecting and maintaining masonry, wood, glass, ceramic tile, and metals which comprise storefronts through appropriate treatments, such as cleaning, paint removal, and reapplication of protective coating systems.	Failing to protect and maintain historic materials on a cyclical basis so that deterioration of storefront features results.
Protecting storefronts against arson and vandalism before work begins by covering windows and doors and by installing alarm systems keyed into local protection agencies.	Leaving the storefront unprotected and subject to vandalism before work begins, thereby also allowing the interior to be damaged if it can be accessed through an unprotected storefront.
Protecting the storefront when working on other features of the building.	Failing to protect the storefront when working on other features of the building.

[14] The signage is an original and integral part of this historic Carrara glass storefront.

STOREFRONTS

RECOMMENDED	NOT RECOMMENDED
Evaluating the overall condition of the storefront to determine whether more than protection and maintenance, such as repairs to storefront features, will be necessary.	Failing to undertake adequate measures to ensure the protection of storefront features.
Repairing storefronts by patching, splicing, consolidating, or otherwise reinforcing them using recognized preservation methods.	Removing historic material that could be stabilized, repaired, and conserved, or using untested consolidants, improper repair techniques, or untrained personnel, potentially causing further damage to historic materials.
*The following work is highlighted to indicate that it represents the greatest degree of intervention generally recommended within the treatment **Preservation**, and should only be considered after protection, stabilization, and repair concerns have been addressed.*	
Limited Replacement in Kind	
Replacing in kind extensively deteriorated or missing components of storefronts when there are surviving prototypes, such as doors, transoms, kick plates, base panels, bulkheads, piers, or signs, or when the replacement can be based on documentary or physical evidence. The new work should match the old in material, design, scale, color, and finish.	Replacing an entire feature or storefront when limited replacement of deteriorated and missing components is appropriate. Using replacement material that does not match the historic storefront feature.

[15] Regular maintenance has helped to preserve this historic storefront, which retains all of its character-defining features, including the granite bulkhead, multi-paned transom glazing, and recessed entrance.

CURTAIN WALLS

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving curtain wall systems and their components that are important in defining the overall historic character of the building. The design of the curtain wall is significant, as are its component materials (metal stick framing and panel materials, such as clear or spandrel glass, stone, terra cotta, metal, and fiber-reinforced plastic), appearance (e.g., glazing color or tint, transparency, and reflectivity), and whether the glazing is fixed, operable, or louvered glass panels. How a curtain wall is engineered and fabricated, and the fact that it expands and contracts at a different rate from the building's structural system, are important to understand when undertaking the preservation of a curtain wall system.	Altering curtain wall components which are important in defining the overall historic character of the building so that, as a result, the character is diminished. Replacing historic curtain wall features instead of repairing or replacing only the deteriorated components.
Stabilizing deteriorated or damaged curtain walls as a preliminary measure, when necessary, prior to undertaking preservation work.	Failing to stabilize deteriorated or damaged curtain walls until additional work is undertaken, thereby allowing further damage to occur to the historic building.
Protecting and maintaining curtain walls and their components through appropriate surface treatments, such as cleaning and reapplication of protective coating systems; and by making them watertight and ensuring that sealants and gaskets are in good condition.	Failing to protect and maintain curtain wall components on a cyclical basis so that deterioration of curtain walls results. Failing to identify and treat the various causes of curtain wall failure, such as open gaps between components where sealants have deteriorated or are missing.
Protecting ground-level curtain walls from vandalism before work begins by covering them, while ensuring adequate ventilation, and by installing alarm systems keyed into local protection agencies.	Leaving ground-level curtain walls unprotected and subject to vandalism before work begins, thereby also allowing the interior to be damaged if it can be accessed through unprotected entrances.
Installing impact-resistant glazing in a curtain wall system, when necessary for security or to meet code requirements, so that it is compatible with the historic curtain walls and does not damage them or negatively impact their character.	Installing impact-resistant glazing in a curtain wall system, when necessary for security, that is not compatible with the historic curtain walls and damages them or negatively impacts their character.

CURTAIN WALLS

RECOMMENDED	NOT RECOMMENDED
Cleaning curtain wall systems only when necessary to halt deterioration or to remove heavy soiling.	Cleaning curtain wall systems when they are not heavily soiled, thereby needlessly introducing chemicals or moisture into historic materials.
Carrying out cleaning tests, when it has been determined that cleaning is appropriate, using only cleaning materials that will not damage components of the system, including factory-applied finishes. Test areas should be examined to ensure that no damage has resulted.	Cleaning curtain wall systems without testing first or using cleaning materials that may damage components of the system.
Evaluating the overall condition of curtain walls to determine whether more than protection and maintenance, such as repairs to curtain wall components, will be necessary.	Failing to undertake adequate measures to ensure the protection of curtain wall components.
Repairing curtain walls by ensuring that they are watertight by augmenting existing components or replacing deteriorated or missing sealants or gaskets, where necessary, to seal any gaps between system components.	Removing curtain wall components that could be stabilized, repaired, and conserved, or using improper repair techniques, or untrained personnel, potentially causing further damage to historic materials.
*The following work is highlighted to indicate that it represents the greatest degree of intervention generally recommended within the treatment **Preservation**, and should only be considered after protection, stabilization, and repair concerns have been addressed.*	
Limited Replacement in Kind	
Replacing in kind extensively deteriorated or missing components of a curtain wall system when there are surviving prototypes or when the replacement can be based on documentary or physical evidence. The new work should match the old in material, design, scale, color, and finish.	Replacing an entire curtain wall feature when limited replacement of deteriorated and missing components is appropriate. Using replacement material that does not match the historic curtain wall feature.

[16] Plywood provides temporary protection for an opening where a damaged spandrel panel was removed until a matching replacement panel can be installed.

STRUCTURAL SYSTEMS

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving structural systems and visible features of systems that are important in defining the overall historic character of the building. This includes the materials that comprise the structural system (i.e., wood, metal, and masonry), the type of system, and its features, such as posts and beams, trusses, summer beams, vigas, cast-iron or masonry columns, above-grade stone foundation walls, or load-bearing masonry walls.	Altering visible features of historic structural systems which are important in defining the overall historic character of the building so that, as a result, the character is diminished. Overloading the existing structural system, or installing equipment or mechanical systems which could damage the structure. Replacing a load-bearing masonry wall that could be augmented and retained. Leaving known structural problems untreated, such as deflected beams, cracked and bowed walls, or racked structural members.
Stabilizing deteriorated or damaged structural systems as a preliminary measure, when necessary, prior to undertaking preservation work.	Failing to stabilize a deteriorated or damaged structural system until additional work is undertaken, thereby allowing further damage to occur to the historic building. Failing to protect and maintain the structural system on a cyclical basis so that deterioration of the structural system results.
Protecting and maintaining the structural system by keeping gutters and downspouts clear and roofing in good repair; and by ensuring that wood structural members are free from insect infestation.	Using treatments or products that may retain moisture, which accelerates deterioration of structural members.

[17] Distinctive examples of traditional construction techniques should be preserved, such as this wooden peg, which is part of the structural system of this late-19th-century warehouse.

[18] A massive, exposed, concrete structural system defines the historic character of the interior of St. John's Abbey, Collegeville, MN, designed by Marcel Breuer and constructed in 1961.

STRUCTURAL SYSTEMS

RECOMMENDED	NOT RECOMMENDED
Evaluating the overall condition of the structural system to determine whether more than protection and maintenance, such as repairs to structural features, will be necessary.	Failing to undertake adequate measures to ensure the protection of structural systems.
Repairing the structural system by augmenting individual components, using recognized preservation methods. For example, weakened structural members (such as floor framing) can be paired or sistered with a new member, braced, or otherwise supplemented and reinforced.	Upgrading the building structurally in a manner that diminishes the historic character of the exterior (such as installing strapping channels or removing a decorative cornice) or that damages interior features or spaces. Replacing a structural member or other feature of the structural system when it could be augmented and retained.
*The following work is highlighted to indicate that it represents the greatest degree of intervention generally recommended within the treatment **Preservation**, and should only be considered after protection, stabilization, and repair concerns have been addressed.*	
Limited Replacement in Kind	
Replacing in kind those visible portions or features of the structural system that are either extensively deteriorated or missing when there are surviving prototypes, such as cast-iron columns and sections of load-bearing walls, or when the replacement can be based on documentary or physical evidence. The new work should match the old in material, design, scale, color, and finish.	Replacing an entire curtain wall feature when limited replacement of deteriorated and missing components is appropriate. Using replacement material that does not match the historic curtain wall feature.
Considering the use of substitute material to replace structural features that are not visible. Substitute material must be structurally sufficient and physically compatible with the rest of the system.	Using substitute material that does not equal the load-bearing capabilities of the historic material or is physically incompatible with the structural system.

MECHANICAL SYSTEMS:
HEATING, AIR CONDITIONING, ELECTRICAL, AND PLUMBING

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving visible features of early mechanical systems that are important in defining the overall historic character of the building, such as radiators, vents, fans, grilles, and plumbing and lighting fixtures.	Removing or altering visible 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.
Stabilizing functioning mechanical systems as a preliminary measure, when necessary, prior to undertaking preservation work.	Failing to stabilize a functioning mechanical system and its visible features until additional work is undertaken.
Protecting and maintaining functioning mechanical, plumbing, and electrical systems and their features through cyclical maintenance.	Failing to protect and maintain functioning mechanical, plumbing, and electrical systems on a cyclical basis so that their deterioration results.
Improving the energy efficiency of existing mechanical systems to help reduce the need for a new system by installing storm windows, insulating attics and crawl spaces, or adding awnings, if appropriate.	
Evaluating the overall condition of functioning mechanical systems to determine whether more than protection and maintenance, such as repairs to mechanical system components, will be necessary.	Failing to undertake adequate measures to ensure the protection of structural systems.
Repairing mechanical systems by augmenting or upgrading system components (such as installing new pipes and ducts), rewiring, or adding new compressors or boilers.	Replacing a mechanical system when its components could be upgraded and retained.

MECHANICAL SYSTEMS: HEATING, AIR CONDITIONING, ELECTRICAL, AND PLUMBING

RECOMMENDED	NOT RECOMMENDED
The following work is highlighted to indicate that it represents the greatest degree of intervention generally recommended within the treatment ***Preservation****, and should only be considered after protection, stabilization, and repair concerns have been addressed.*	
Limited Replacement in Kind	
Replacing in kind those extensively deteriorated or missing visible features of mechanical systems when there are surviving prototypes, such as ceiling fans, radiators, grilles, or lighting fixtures.	Installing a visible replacement feature that does not convey the same appearance.
The following work should be considered in a ***Preservation*** *project when the installation of new mechanical equipment or an entire system is required to make the building functional.*	
Installing a new mechanical system, if required, so that it results in the least alteration possible to the historic building and its character-defining features.	Installing a new mechanical system so that character-defining structural or interior features are radically changed, damaged, or destroyed.
Providing adequate structural support for new mechanical equipment.	Failing to consider the weight and design of new mechanical equipment so that, as a result, historic structural members or finished surfaces are weakened or cracked.
Installing new mechanical and electrical systems and ducts, pipes, and cables in closets, service areas, and wall cavities to preserve the historic character of the interior space.	Installing ducts, pipes, and cables where they will obscure character-defining features or negatively impact the historic character of the interior. Concealing mechanical equipment in walls or ceilings in a manner that results in extensive loss or damage or otherwise obscures historic building materials and character-defining features.

INTERIOR SPACES, FEATURES, AND FINISHES

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving a floor plan or interior spaces, features, and finishes that are important in defining the overall historic character of the building. Significant spatial characteristics include the size, configuration, proportion, and relationship of rooms and corridors; the relationship of features to spaces; and the spaces themselves, such as lobbies, lodge halls, entrance halls, parlors, theaters, auditoriums, gymnasiums, and industrial and commercial interiors. Color, texture, and pattern are important characteristics of features and finishes, which can include such elements as columns, plaster walls and ceilings, flooring, trim, fireplaces and mantels, paneling, light fixtures, hardware, decorative radiators, ornamental grilles and registers, windows, doors, and transoms; plaster, paint, wallpaper and wall coverings, and special finishes, such as marbleizing and graining; and utilitarian (painted or unpainted) features, including wood, metal, or concrete exposed columns, beams, and trusses and exposed load-bearing brick, concrete, and wood walls.	Altering a floor plan, interior spaces (including individual rooms), features, or finishes which are important in defining the overall historic character of the building so that, as a result, the character is diminished. Replacing historic interior features and finishes instead of repairing or replacing only the deteriorated portion. Installing new material that obscures or damages character-defining interior features and finishes. Removing paint, plaster, or other finishes from historically-finished interior surfaces and leaving the features exposed (e.g., removing plaster to expose brick walls or a brick chimney breast, stripping paint from wood to stain or varnish it, or removing a plaster ceiling to expose unfinished beams). Applying paint, plaster, or other coatings to surfaces that have been unfinished historically, thereby changing their character. Changing the type of finish or its color, such as painting a historically-varnished wood feature, or removing paint from a historically-painted feature.
Stabilizing deteriorated or damaged interior features and finishes as a preliminary measure, when necessary, prior to undertaking preservation work.	Failing to stabilize a deteriorated or damaged interior feature or finish until additional work can be undertaken, thereby allowing further damage to occur to the interior.
Protecting and maintaining historic materials (including plaster, masonry, wood, and metals) which comprise interior features through appropriate surface treatments, such as cleaning, paint removal, and reapplication of protective coating systems.	Failing to protect and maintain interior materials and finishes on a cyclical basis so that deterioration of interior features results.

INTERIOR SPACES, FEATURES, AND FINISHES

RECOMMENDED	NOT RECOMMENDED
Protecting interior features and finishes against arson and vandalism before project work begins by erecting temporary fencing or by covering broken windows and open doorways, while ensuring adequate ventilation, and by installing alarm systems keyed into local protection agencies.	Leaving the building unprotected and subject to vandalism before work begins, thereby allowing the interior to be damaged if it can be accessed through unprotected openings.
Protecting interior features (such as a staircase, mantel, flooring, or decorative finishes) from damage during project work by covering them with plywood, heavy canvas, or plastic sheeting.	Failing to protect interior features and finishes when working on the interior.

[19] The sweeping staircase with its metal railing, chandelier, and terrazzo floor in the lobby of the 1954 Simms Building, Albuquerque, NM, are character-defining features. *Photo: Harvey M. Kaplan.*

[20] It is important to protect decorative interior features, such as this highly-glazed tile wainscoting in a historic train station, when painting the walls above it.

INTERIOR SPACES, FEATURES, AND FINISHES

RECOMMENDED	NOT RECOMMENDED
Removing damaged or deteriorated paint and finishes only to the next sound layer using the gentlest method possible prior to repainting or refinishing using compatible paint or other coating systems.	Removing paint that is firmly adhered to interior materials and features.
Using abrasive cleaning methods only on the interior of industrial or warehouse buildings with utilitarian, unplastered masonry walls and where wood features are not finished, molded, beaded, or worked by hand. Low-pressure abrasive cleaning (e.g., sand-blasting or other media blasting) should only be considered if test patches show no surface damage and after gentler methods have proven ineffective.	Using abrasive methods anywhere but utilitarian and industrial interior spaces or when there are other cleaning methods that are less likely to damage the surface of the material.
Evaluating the overall condition of the interior materials, features, and finishes to determine whether more than protection and maintenance, such as repairs to features and finishes, will be necessary.	Failing to undertake adequate measures to ensure the protection of interior materials, features, and finishes.
Repairing interior features and finishes by patching, splicing, consolidating, or otherwise reinforcing the materials using recognized preservation methods.	Removing interior features or finishes that could be stabilized, repaired, and conserved, or using untested consolidants, improper repair techniques, or untrained personnel, potentially causing further damage to historic materials.
The following work is highlighted to indicate that it represents the greatest degree of intervention generally recommended within the treatment ***Preservation****, and should only be considered after protection, stabilization, and repair concerns have been addressed.*	
Limited Replacement in Kind	
Replacing in kind extensively deteriorated or missing components of interior features when there are surviving prototypes (such as stairs, balustrades, wood paneling, columns, decorative wall finishes, and ornamental plaster or pressed-metal ceilings); or when the replacement can be based on documentary or physical evidence. The new work should match the old in material, design, scale, color, and finish.	Replacing an entire interior feature when limited replacement of deteriorated and missing components is appropriate. Using replacement material that does not match the historic interior feature or finish.

BUILDING SITE

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving features of the building site that are important in defining its overall historic character. Site features may include walls, fences, or steps; circulation systems, such as walks, paths, or roads; vegetation, such as trees, shrubs, grass, orchards, hedges, windbreaks, or gardens; landforms, such as hills, terracing, or berms; furnishings and fixtures, such as light posts or benches; decorative elements, such as sculpture, statuary, or monuments; water features, including fountains, streams, pools, lakes, or irrigation ditches; and subsurface archeological resources, other cultural or religious features, or burial grounds which are also important to the site.	Altering 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.
Retaining the historic relationship between buildings and the landscape.	Removing or relocating buildings or landscape features, thereby destroying the historic relationship between buildings and the landscape.

[21] (a) The formal garden on the property of the 1826 Beauregard-Keyes House in New Orleans (b) is integral to the character of the site.

BUILDING SITE

RECOMMENDED	NOT RECOMMENDED
Stabilizing deteriorated or damaged building and site features as a preliminary measure, when necessary, prior to undertaking preservation work.	Failing to stabilize a deteriorated or damaged building or site feature until additional work can be undertaken, thereby allowing further damage to occur to the building site.
Protecting and maintaining buildings and site features by providing proper drainage to ensure that water does not erode foundation walls, drain toward the building, or damage or erode the landscape.	Failing to ensure that site drainage is adequate so that buildings and site features are damaged or destroyed; or, alternatively, changing the site grading so that water does not drain properly.
Minimizing disturbance of the terrain around buildings or elsewhere on the site, thereby reducing the possibility of destroying or damaging important landscape features, archeological resources, other cultural or religious features, or burial grounds.	Using heavy machinery or equipment in areas where it may disturb or damage important landscape features, archeological resources, other cultural or religious features, or burial grounds.
Protecting (e.g., preserving in place) important site features, archeological resources, other cultural or religious features, or burial grounds.	Leaving known site features or archeological material unprotected so that it is damaged during preservation work.
Planning and carrying out any necessary investigation before preservation begins, using professional archeologists and methods when preservation in place is not feasible.	Allowing unqualified personnel to perform data recovery on archeological resources, which can result in damage or loss of important archeological material.
Preserving important landscape features through regularly-scheduled maintenance of historic plant material.	Allowing important landscape features or archeological resources to be lost, damaged, or to deteriorate due to inadequate protection or lack of maintenance.
Protecting the building site and landscape features against arson and vandalism before preservation work begins by erecting temporary fencing and by installing alarm systems keyed into local protection agencies.	Leaving the property unprotected and subject to vandalism before work begins so that the building site and landscape features, archeological resources, other cultural or religious features, or burial grounds can be damaged or destroyed.
Installing protective fencing, bollards, and stanchions on a building site, when necessary for security, that are as unobtrusive as possible.	Installing protective fencing, bollards, and stanchions on a building site, when necessary for security, without taking into consideration their location and visibility so that they negatively impact the historic character of the site.
Providing continued protection and maintenance of buildings and landscape features on the site through appropriate grounds or landscape management.	Removing or destroying features from the site, such as fencing, paths or walkways, masonry balustrades, or plant material.

BUILDING SITE

RECOMMENDED	NOT RECOMMENDED
Protecting building and landscape features when working on the site.	Failing to protect building and landscape features during work on the site.
Evaluating the overall condition of the site to determine whether more than protection and maintenance, such as repairs to materials and features, will be necessary.	Failing to undertake adequate measures to ensure the protection of the site.
Repairing building and site features which have damaged, deteriorated, or missing components to reestablish the whole feature and to ensure retention of the integrity of historic materials.	Failing to repair damaged or deteriorated site features.
*The following work is highlighted to indicate that it represents the greatest degree of intervention generally recommended within the treatment **Preservation**, and should only be considered after protection, stabilization, and repair concerns have been addressed.*	
Limited Replacement in Kind	
Replacing in kind extensively deteriorated or missing features of the site when there are surviving prototypes, such as part of a fountain, portions of a walkway, or a hedge, or when the replacement can be based on documentary or physical evidence. The new work should match the old in material, design, scale, and color.	Replacing an entire feature of the building or site when limited replacement of deteriorated or missing components is appropriate. Using replacement material that does not match the historic site feature.

[22 a-b] The 1907 Commander General's Quarters facing Continental Park is one of many important structures that contribute to the historic significance and character of Fort Monroe, a National Monument, in Hampton, VA.

SETTING (DISTRICT / NEIGHBORHOOD)

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving building and landscape features that are important in defining the overall historic character of the setting. Such features can include circulation systems, such as roads and streets; furnishings and fixtures, such as light posts or benches; vegetation, gardens, and yards; adjacent open space, such as fields, parks, commons, or woodlands; and important views or visual relationships.	Altering those building and landscape features of the setting which are important in defining its historic character so that, as a result, the character is diminished.
Retaining the historic relationship between buildings and landscape features in the setting. For example, preserving the relationship between a town common or urban plaza and the adjacent houses, municipal buildings, roads, and landscape and streetscape features.	Altering the relationship between the buildings and landscape features in the setting by widening existing streets, changing landscape materials, or locating new streets or parking areas where they may negatively impact the historic character of the setting. Removing or relocating historic buildings or landscape features, thereby destroying the historic relationship between buildings and the landscape in the setting.

[23] The city square is important in defining the character of the historic setting in this small town.

[24] Cast-iron porches and wrought-iron fences from the late 19th century typify this block in an urban historic district.

[25] Street names in tile set into the sidewalk are distinctive features in this historic district.

SETTING (DISTRICT / NEIGHBORHOOD)

RECOMMENDED	NOT RECOMMENDED
Stabilizing deteriorated or damaged building or landscape features in the setting as a preliminary measure, when necessary, prior to undertaking preservation work.	Failing to stabilize a deteriorated or damaged building or landscape feature in the setting until additional work can be undertaken, thereby allowing further damage to occur to the setting.
Protecting and maintaining historic features in the setting through regularly-scheduled maintenance and landscape management.	Failing to protect and maintain materials in the setting on a cyclical basis so that deterioration of building and landscape features results. Stripping or removing historic features from buildings or the setting, such as a porch, fencing, walkways, or plant material.
Installing protective fencing, bollards, and stanchions in the setting, when necessary for security, that are as unobtrusive as possible.	Installing protective fencing, bollards, and stanchions in the setting, when necessary for security, without taking into consideration their location and visibility so that they negatively impact the historic character of the setting.
Protecting building and landscape features when undertaking work in the setting.	Failing to protect building and landscape features during work in the setting.
Evaluating the overall condition of materials and features to determine whether more than protection and maintenance, such as repairs to materials and features in the setting, will be necessary.	Failing to undertake adequate measures to ensure the protection of materials and features of the setting.
Repairing features in the setting by reinforcing the historic materials, using recognized preservation methods.	Removing material that could be repaired or using improper repair techniques.
*The following work is highlighted to indicate that it represents the greatest degree of intervention generally recommended within the treatment **Preservation**, and should only be considered after protection, stabilization, and repair concerns have been addressed.*	
Limited Replacement in Kind	
Replacing in kind extensively deteriorated or missing components of building and landscape features in the setting when there are surviving prototypes, such as balustrades or paving materials, or when the replacement can be based on documentary or physical evidence. The new work should match the old in material, design, scale, and color.	Replacing an entire feature of the building or landscape when limited replacement of deteriorated or missing components is appropriate. Using replacement material that does not match the historic building or landscape feature.

CODE-REQUIRED WORK

RECOMMENDED	NOT RECOMMENDED
Sensitive solutions to meeting code requirements are an important part of protecting the historic character of the building and site. Thus, work that must be done to meet accessibility and life-safety requirements in the treatment ***Preservation*** *must also be assessed for its potential impact on the historic building and site.*	
ACCESSIBILITY	
Identifying the historic building's character-defining exterior features, interior spaces, features, and finishes, and features of the site and setting which may be affected by accessibility code-required work.	Undertaking accessibility code-required alterations before identifying those exterior features, interior spaces, features, and finishes, and features of the site and setting which are character defining and, therefore, must be preserved.
Complying with barrier-free access requirements in such a manner that the historic building's character-defining exterior features, interior spaces, features, and finishes, and features of the site and setting are preserved or impacted as little as possible.	Altering, damaging, or destroying character-defining exterior features, interior spaces, features, and finishes, or features of the site and setting while making modifications to a building, its site, or setting to comply with accessibility requirements.
Working with specialists in accessibility and historic preservation to determine the most sensitive solutions to comply with access requirements in a historic building, its site, and setting.	Making changes to historic buildings, their sites, and setting without first consulting with specialists in accessibility and historic preservation to determine the most appropriate solutions to comply with accessibility requirements.
Providing barrier-free access that promotes independence for the user while preserving significant historic features.	Making access modifications that do not provide independent, safe access or preserve historic features.
Finding solutions to meet accessibility requirements that minimize the impact of any necessary alteration for accessibility on the historic building, its site, or setting, such as compatible ramps, paths, and lifts.	Making modifications for accessibility without considering the impact on the historic building, its site, and setting.

CODE-REQUIRED WORK

RECOMMENDED	NOT RECOMMENDED
Using relevant sections of existing codes regarding accessibility for historic buildings that provide alternative means of compliance when code-required work would otherwise negatively impact the historic character of the property.	
Minimizing the visual impact of accessibility ramps by installing them on secondary elevations when it does not compromise accessibility or by screening them with plantings.	
Adding a gradual slope or grade to the sidewalk, if appropriate, to access the entrance rather than installing a ramp that would be more intrusive to the historic character of the building and the district.	
Installing a lift as inconspicuously as possible when it is necessary to locate it on a primary elevation of the historic building.	Installing a lift at a primary entrance without considering other options or locations.

[26] A temporary ramp–unobtrusive and easily removed–facilitates access to the entrance of this museum and does not affect its historic character.

[27] The access ramp at the left of the entrance is concealed by a hedge which minimizes its visibility and impact on the character of the historic apartment building.

CODE-REQUIRED WORK

RECOMMENDED	NOT RECOMMENDED
LIFE SAFETY	
Identifying the historic building's character-defining exterior features, interior spaces, features, and finishes, and features of the site and setting which may be affected by life-safety code-required work.	Undertaking life-safety code-required alterations before identifying those exterior features, interior spaces, features, and finishes, and features of the site and setting which are character defining and, therefore, must be preserved.
Complying with life-safety codes (including requirements for impact-resistant glazing, security, and seismic retrofit) in such a manner that the historic building's character-defining exterior features, interior spaces, features, and finishes, and features of the site and setting are preserved or impacted as little as possible.	Altering, damaging, or destroying character-defining exterior features, interior spaces, features, and finishes, or features of the site and setting while making modifications to a building, its site, or setting to comply with life-safety code requirements.
Removing building materials only after testing has been conducted to identify any hazardous materials, and using only the least damaging abatement methods.	Removing building materials without testing first to identify any hazardous materials, or using potentially damaging methods of abatement.
Providing workers with appropriate personal equipment for protection from hazards on the worksite.	Removing hazardous or toxic materials without regard for workers' health and safety or environmentally-sensitive disposal of the materials.
Working with code officials and historic preservation specialists to investigate systems, methods, or devices to make the building compliant with life-safety codes to ensure that necessary alterations will be compatible with the historic character of the building.	Making life-safety code-required changes to the building without consulting code officials and historic preservation specialists, with the result that alterations negatively impact the historic character of the building.
Using relevant sections of existing codes regarding life safety for historic buildings that provide alternative means of code compliance when code-required work would otherwise negatively impact the historic character of the building.	
Upgrading historic stairways and elevators to meet life-safety codes so that they are not damaged or otherwise negatively impacted.	Damaging or making inappropriate alterations to historic stairways and elevators or to adjacent spaces, features, or finishes in the process of doing work to meet code requirements.
Installing sensitively-designed fire-suppression systems, such as sprinklers, so that historic features and finishes are preserved.	Covering character-defining wood features with fire-retardant sheathing, which results in altering their appearance.
Applying fire-retardant coatings when appropriate, such as intumescent paint, to protect steel structural systems.	Using fire-retardant coatings if they will damage or obscure character-defining features.

[28] A simple railing added on the inner side of an elaborate wood and cast-iron stair railing meets life-safety code requirements without greatly impacting its historic character.

[29] A safety cone outside of a house where lead paint is being removed warns of the hazardous conditions on the site.

RESILIENCE TO NATURAL HAZARDS

RECOMMENDED	NOT RECOMMENDED
Resilience to natural hazards should be addressed as part of a ***Preservation*** *project. A historic building may have existing characteristics or features that help to address or minimize the impacts of natural hazards. These should always be used to best advantage when considering new adaptive treatments so as to have the least impact on the historic character of the building, its site, and setting.*	
Identifying the vulnerabilities of the historic property to the impacts of natural hazards (such as wildfires, hurricanes, or tornadoes) using the most current climate information and data available.	Failing to identify and periodically reevaluate the potential vulnerability of the building, its site, and setting to the impacts of natural hazards.
Assessing the potential impacts of known vulnerabilities on character-defining features of the building, its site, and setting, and reevaluating and reassessing potential impacts on a regular basis.	
Documenting the property and its character-defining features as a record and guide for future repair work, should it be necessary, and storing the documentation in a weatherproof location.	Failing to document the historic property and its character-defining features with the result that such information is not available in the future to guide repair or reconstruction work, should it be necessary.
Ensuring that historic resource inventories and maps are accurate, up to date, and accessible in an emergency.	
Maintaining the building, its site, and setting in good repair, and regularly monitoring character-defining features.	Failing to regularly monitor and maintain the property and building systems in good repair.
Using and maintaining existing characteristics and features of the historic building, its site, setting, and larger environment (such as shutters for storm protection or a site wall that keeps out flood waters) that may help to avoid or minimize the impacts of natural hazards.	
Undertaking work to prevent or minimize the loss, damage, or destruction of the historic property while retaining and preserving significant features and the overall historic character of the building, its site, and setting.	Allowing loss, damage, or destruction to occur to the historic building, its site, or setting by failing to evaluate potential future impacts of natural hazards or to plan and implement adaptive measures, if necessary to address possible threats.
Ensuring that, when planning work to adapt for natural hazards, all feasible alternatives are considered, and that options requiring the least alteration are considered first.	

RESILIENCE TO NATURAL HAZARDS

RECOMMENDED	NOT RECOMMENDED
Implementing local and regional traditions (such as elevating residential buildings at risk of flooding or reducing flammable vegetation around structures in fire-prone areas) for adapting buildings and sites to specific natural hazards, when appropriate. Such traditional methods may be appropriate if they are compatible with the historic character of the building, its site, and setting.	Implementing a treatment traditionally used in another region or one typically used for a different property type or architectural style which is not compatible with the historic character of the property.
Using special exemptions and variances when adaptive treatments to protect buildings from known hazards would otherwise negatively impact the historic character of the building, its site, or setting.	
Considering adaptive options, whenever possible, that would protect multiple historic resources, if the treatment can be implemented without negatively impacting the historic character of the setting or district, or archeological resources, other cultural or religious features, or burial grounds.	

[30] Historic window shutters still serve their original function as protection in hurricane-prone areas.

Sustainability

Sustainability should be addressed as part of a **Preservation** project. Good preservation practice is often synonymous with sustainability. Existing energy-efficient features should be retained and repaired. New sustainability treatments generally should be limited to updating existing features and systems to have the least impact on the historic character of the building.

The topic of sustainability is addressed in detail in ***The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings***. Although specifically developed for the treatment Rehabilitation, the Sustainability Guidelines can be used to help guide the other treatments.

[31] An interior screen door at the entrance to individual apartments is a historic feature traditionally used to help circulate air throughout the building.

STANDARDS FOR REHABILITATION & GUIDELINES FOR REHABILITATING HISTORIC BUILDINGS

Rehabilitation

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

Standards for Rehabilitation

1. A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces and spatial relationships.
2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces and spatial relationships that characterize a property will be avoided.
3. Each property will be recognized as a physical record of its time, place and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.
4. Changes to a property that have acquired historic significance in their own right will be retained and preserved.
5. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.
6. Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.
7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.
8. Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.
9. New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work will be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.
10. New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

GUIDELINES FOR REHABILITATING HISTORIC BUILDINGS

INTRODUCTION

In **Rehabilitation,** historic building materials and character-defining features are protected and maintained as they are in the treatment Preservation. However, greater latitude is given in the **Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings** to replace extensively deteriorated, damaged, or missing features using either the same material or compatible substitute materials. Of the four treatments, only **Rehabilitation** allows alterations and the construction of a new addition, if necessary for a continuing or new use for the historic building.

Identify, Retain, and Preserve Historic Materials and Features

The guidance for the treatment **Rehabilitation** begins with recommendations to identify the form and detailing of those architectural materials and features that are important in defining the building's historic character and which must be retained to preserve that character. Therefore, guidance on ***identifying, retaining, and preserving*** character-defining features is always given first.

Protect and Maintain Historic Materials and Features

After identifying those materials and features that are important and must be retained in the process of **Rehabilitation** work, then ***protecting and maintaining*** them are addressed. Protection generally involves the least degree of intervention and is preparatory to other work. Protection includes the maintenance of historic materials and features as well as ensuring that the property is protected before and during rehabilitation work. A historic building undergoing rehabilitation will often require more extensive work. Thus, an overall evaluation of its physical condition should always begin at this level.

Repair Historic Materials and Features

Next, when the physical condition of character-defining materials and features warrants additional work, ***repairing*** is recommended. **Rehabilitation** guidance for the repair of historic materials, such as masonry, again begins with the least degree of intervention possible. In rehabilitation, repairing also includes the limited replacement in kind or with a compatible substitute material of extensively deteriorated or missing components of features when there are surviving prototypes features that can be substantiated by documentary and physical evidence. Although using the same kind of material is always the preferred option, a substitute material may be an acceptable alternative if the form, design, and scale, as well as the substitute material itself, can effectively replicate the appearance of the remaining features.

Replace Deteriorated Historic Materials and Features

Following repair in the hierarchy, **Rehabilitation** guidance is provided for ***replacing*** an entire character-defining feature with new material because the level of deterioration or damage of materials precludes repair. If the missing feature is character defining or if it is critical to the survival of the building (e.g., a roof), it should be replaced to match the historic feature based on physical or historic documentation of its form and detailing. As with repair, the preferred option is always replacement of the entire feature in kind (i.e., with the same material, such as wood for wood). However, when this is not feasible, a compatible substitute material that can reproduce the overall appearance of the historic material may be considered.

It should be noted that, while the National Park Service guidelines recommend the replacement of an entire character-defining feature that is extensively deteriorated, the guidelines never recommend removal and replacement with new material of a feature that could reasonably be repaired and, thus, preserved.

Design for the Replacement of Missing Historic Features

When an entire interior or exterior feature is missing, such as a porch, it no longer plays a role in physically defining the historic character of the building unless it can be accurately recovered in form and detailing through the process of carefully documenting the historic appearance. If the feature is not critical to the survival of the building, allowing the building to remain without the feature is one option. But if the missing feature is important to the historic character of the building, its replacement is always recommended in the **Rehabilitation** guidelines as the first, or preferred, course of action. If adequate documentary and physical evidence exists, the feature may be accurately reproduced. A second option in a rehabilitation treatment for replacing a missing feature, particularly when the available information about the feature is inadequate to permit an accurate reconstruction, is to ***design*** a new feature that is compatible with the overall historic character of the building. The new design should always take into account the size, scale, and material of the building itself and should be clearly differentiated from the authentic historic features. For properties that have changed over time, and where those changes have acquired significance, reestablishing missing historic features generally should not be undertaken if the missing features did not coexist with the features currently on the building. Juxtaposing historic features that did not exist concurrently will result in a false sense of the building's history.

Alterations

Some exterior and interior alterations to a historic building are generally needed as part of a **Rehabilitation** project to ensure its continued use, but it is most important that such alterations do not radically change, obscure, or destroy character-defining spaces, materials, features, or finishes. Alterations may include changes to the site or setting, such as the selective removal of buildings or other features of the building site or setting that are intrusive, not character defining, or outside the building's period of significance.

Code-Required Work: Accessibility and Life Safety

Sensitive solutions to meeting code requirements in a **Rehabilitation** project are an important part of protecting the historic character of the building. Work that must be done to meet accessibility and life-safety requirements must also be assessed for its potential impact on the historic building, its site, and setting.

Resilience to Natural Hazards

Resilience to natural hazards should be addressed as part of a **Rehabilitation** project. A historic building may have existing characteristics or features that help to address or minimize the impacts of natural hazards. These should always be used to best advantage when considering new adaptive treatments so as to have the least impact on the historic character of the building, its site, and setting.

Sustainability

Sustainability should be addressed as part of a **Rehabilitation** project. Good preservation practice is often synonymous with sustainability. Existing energy-efficient features should be retained and repaired. Only sustainability treatments should be considered that will have the least impact on the historic character of the building.

The topic of sustainability is addressed in detail in *The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings.*

New Exterior Additions and Related New Construction

Rehabilitation is the only treatment that allows expanding a historic building by enlarging it with an addition. However, the **Rehabilitation** guidelines emphasize that new additions should be considered only after it is determined that meeting specific new needs cannot be achieved by altering non-character-defining interior spaces. If the use cannot be accommodated in this way, then an attached exterior addition may be considered. New additions should be designed and constructed so that the character-defining features of the historic building, its site, and setting are not negatively impacted. Generally, a new addition should be subordinate to the historic building. A new addition should be compatible, but differentiated enough so that it is not confused as historic or original to the building. The same guidance applies to new construction so that it does not negatively impact the historic character of the building or its site.

Rehabilitation as a Treatment. *When repair and replacement of deteriorated features are necessary; when alterations or additions to the property are planned for a new or continued use; and when its depiction at a particular time is not appropriate, Rehabilitation may be considered as a treatment. Prior to undertaking work, a documentation plan for Rehabilitation should be developed.*

[1] An alkaline-based product is appropriate to use to clean historic marble because it will not damage the marble, which is acid sensitive.

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

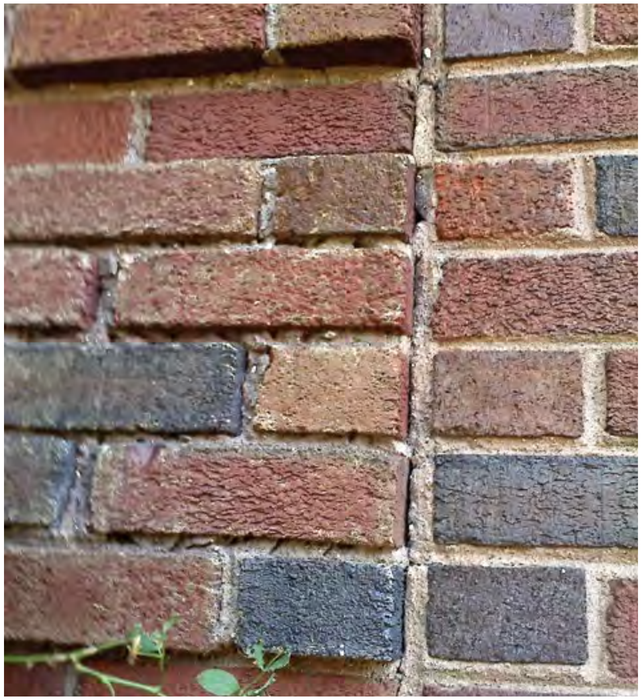
RECOMMENDED	NOT RECOMMENDED
Identifying, retaining and preserving masonry features that are important in defining the overall historic character of the building (such as walls, brackets, railings, cornices, window and door surrounds, steps, and columns) and decorative ornament and other details, such as tooling and bonding patterns, coatings, and color.	Removing or substantially changing masonry features which are important in defining the overall historic character of the building so that, as a result, the character is diminished. Replacing or rebuilding a major portion of exterior masonry walls that could be repaired, thereby destroying the historic integrity of the building. Applying paint or other coatings (such as stucco) to masonry that has been historically unpainted or uncoated to create a new appearance. Removing paint from historically-painted masonry.
Protecting and maintaining masonry by ensuring that historic drainage features and systems that divert rainwater from masonry surfaces (such as roof overhangs, gutters, and downspouts) are intact and functioning properly.	Failing to identify and treat the causes of masonry deterioration, such as leaking roofs and gutters or rising damp.
Cleaning masonry only when necessary to halt deterioration or remove heavy soiling.	Cleaning masonry surfaces when they are not heavily soiled to create a "like-new" appearance, thereby needlessly introducing chemicals or moisture into historic materials.
Carrying out masonry cleaning tests when it has been determined that cleaning is appropriate. Test areas should be examined to ensure that no damage has resulted and, ideally, monitored over a sufficient period of time to allow long-range effects to be predicted.	Cleaning masonry surfaces without testing or without sufficient time for the testing results to be evaluated.

[2] Mid-century modern building technology made possible the form of this parabola-shaped structure and its thin concrete shell construction. Built in 1961 as the lobby of the La Concha Motel in Las Vegas, it was designed by Paul Revere Williams, one of the first prominent African-American architects. It was moved to a new location and rehabilitated to serve as the Neon Museum, and is often cited as an example of Googie architecture. *Credit: Photographed with permission at The Neon Museum, Las Vegas, Nevada.*

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Cleaning soiled masonry surfaces with the gentlest method possible, such as using low-pressure water and detergent and natural bristle or other soft-bristle brushes.	Cleaning or removing paint from masonry surfaces using most abrasive methods (including sandblasting, other media blasting, or high-pressure water) which can damage the surface of the masonry and mortar joints. Using a cleaning or paint-removal method that involves water or liquid chemical solutions when there is any possibility of freezing temperatures. Cleaning with chemical products that will damage some types of masonry (such as using acid on limestone or marble), or failing to neutralize or rinse off chemical cleaners from masonry surfaces.

[3] **Not Recommended:** The white film on the upper corner of this historic brick row house is the result of using a scrub or slurry coating, rather than traditional repointing by hand, which is the recommended method.



[4] **Not Recommended:** The quoins on the left side of the photo show that high-pressure abrasive blasting used to remove paint can damage even early 20th-century, hard-baked, textured brick and erode the mortar, whereas the same brick on the right, which was not abrasively cleaned, is undamaged.

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Using biodegradable or environmentally-safe cleaning or paint-removal products.	
Using paint-removal methods that employ a poultice to which paint adheres, when possible, to neatly and safely remove old lead paint.	
Using coatings that encapsulate lead paint, when possible, where the paint is not required to be removed to meet environmental regulations.	
Allowing only trained conservators to use abrasive or laser-cleaning methods, when necessary, to clean hard-to-reach, highly-carved, or detailed decorative stone features.	
Removing damaged or deteriorated paint only to the next sound layer using the gentlest method possible (e.g., hand scraping) prior to repainting.	Removing paint that is firmly adhered to masonry surfaces, unless the building was unpainted historically and the paint can be removed without damaging the surface.
Applying compatible paint coating systems to historically-painted masonry following proper surface preparation.	Failing to follow manufacturers' product and application instructions when repainting masonry features.
Repainting historically-painted masonry features with colors that are appropriate to the historic character of the building and district.	Using paint colors on historically-painted masonry features that are not appropriate to the historic character of the building and district.
Protecting adjacent materials when cleaning or removing paint from masonry features.	Failing to protect adjacent materials when cleaning or removing paint from masonry features.
Evaluating the overall condition of the masonry to determine whether more than protection and maintenance, such as repairs to masonry features, will be necessary.	Failing to undertake adequate measures to ensure the protection of masonry features.
Repairing masonry by patching, splicing, consolidating, or otherwise reinforcing the masonry using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing parts of masonry features when there are surviving prototypes, such as terra-cotta brackets or stone balusters.	Removing masonry that could be stabilized, repaired, and conserved, or using untested consolidants and unskilled personnel, potentially causing further damage to historic materials. Replacing an entire masonry feature, such as a cornice or balustrade, when repair of the masonry and limited replacement of deteriorated or missing components are feasible.

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

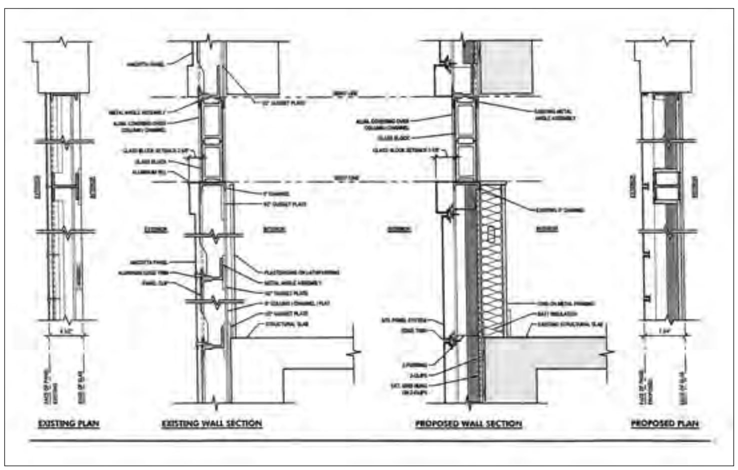
RECOMMENDED	NOT RECOMMENDED
Repairing masonry walls and other masonry features by repointing the mortar joints where there is evidence of deterioration, such as disintegrating mortar, cracks in mortar joints, loose bricks, or damaged plaster on the interior.	Removing non-deteriorated mortar from sound joints and then repointing the entire building to achieve a more uniform appearance.
Removing deteriorated lime mortar carefully by hand raking the joints to avoid damaging the masonry.	
Using power tools only on horizontal joints on brick masonry in conjunction with hand chiseling to remove hard mortar that is deteriorated or that is a non-historic material which is causing damage to the masonry units. Mechanical tools should be used only by skilled masons in limited circumstances and generally not on short, vertical joints in brick masonry.	Allowing unskilled workers to use masonry saws or mechanical tools to remove deteriorated mortar from joints prior to repointing.
Duplicating historic mortar joints in strength, composition, color, and texture when repointing is necessary. In some cases, a lime-based mortar may also be considered when repointing Portland cement mortar because it is more flexible.	Repointing masonry units with mortar of high Portland cement content (unless it is the content of the historic mortar). Using “surface grouting” or a “scrub” coating technique, such as a “sack rub” or “mortar washing,” to repoint exterior masonry units instead of traditional repointing methods. Repointing masonry units (other than concrete) with a synthetic caulking compound instead of mortar.
Duplicating historic mortar joints in width and joint profile when repointing is necessary.	Changing the width or joint profile when repointing.
Repairing stucco by removing the damaged material and patching with new stucco that duplicates the old in strength, composition, color, and texture.	Removing sound stucco or repairing with new stucco that is different in composition from the historic stucco. Patching stucco or concrete without removing the source of deterioration. Replacing deteriorated stucco with synthetic stucco, an exterior finish and insulation system (EFIS), or other non-traditional materials.

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Using mud plaster or a compatible lime-plaster adobe render, when appropriate, to repair adobe.	Applying cement stucco, unless it already exists, to adobe.
Sealing joints in concrete with appropriate flexible sealants and backer rods, when necessary.	
Cutting damaged concrete back to remove the source of deterioration, such as corrosion on metal reinforcement bars. The new patch must be applied carefully so that it will bond satisfactorily with and match the historic concrete.	Patching damaged concrete without removing the source of deterioration.

[5] Rebars in the reinforced concrete ceiling have rusted, causing the concrete to spall. The rebars must be cleaned of rust before the concrete can be patched.

[6] Some areas of the concrete brise soleil screen on this building constructed in 1967 are badly deteriorated. If the screen cannot be repaired, it may be replaced in kind or with a composite substitute material with the same appearance as the concrete.



[7] (a) J.W. Knapp's Department Store, built 1937-38, in Lansing, MI, was constructed with a proprietary material named "Maul Macotta" made of enameled steel and cast-in-place concrete panels. Prior to its rehabilitation, a building inspection revealed that, due to a flaw in the original design and construction, the material was deteriorated beyond repair. The architects for the rehabilitation project devised a replacement system (b) consisting of enameled aluminum panels that matched the original colors (c). Photos and drawing (a-b): Quinn Evans Architects; *Photo (c): James Haefner Photography.*

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Using a non-corrosive, stainless-steel anchoring system when replacing damaged stone, concrete, or terra-cotta units that have failed.	
Applying non-historic surface treatments, such as water-repellent coatings, to masonry only after repointing and only if masonry repairs have failed to arrest water penetration problems.	Applying waterproof, water-repellent, or non-original historic coatings (such as stucco) to masonry as a substitute for repointing and masonry repairs.
Applying permeable, anti-graffiti coatings to masonry when appropriate.	Applying water-repellent or anti-graffiti coatings that change the historic appearance of the masonry or that may trap moisture if the coating is not sufficiently permeable.
Replacing in kind an entire masonry 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 or when the replacement can be based on historic documentation. Examples can include large sections of a wall, a cornice, pier, or parapet. If using the same kind of material is not feasible, then a compatible substitute material may be considered.	Removing a masonry feature that is unrepairable and not replacing it, or replacing it with a new feature that does not match. Using substitute material for the replacement that does not convey the same appearance of the surviving components of the masonry feature.
The following work is highlighted to indicate that it is specific to **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.*	
Designing the Replacement for Missing Historic Features	
Designing and installing a replacement masonry feature, such as a step or door pediment, when the historic feature is completely missing. It may be an accurate restoration based on documentary and physical evidence, but only when the historic feature to be replaced coexisted with the features currently on the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building.	Creating an inaccurate appearance because the replacement for the missing masonry feature is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature to be replaced did not coexist with the features currently on the building. Introducing a new masonry feature that is incompatible in size, scale, material, or color.

WOOD: CLAPBOARD, WEATHERBOARD, SHINGLES, AND OTHER FUNCTIONAL AND DECORATIVE ELEMENTS

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining and preserving wood features that are important in defining the overall historic character of the building (such as siding, cornices, brackets, window and door surrounds, and steps) and their paints, finishes, and colors.	Removing or substantially changing wood features 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 historic wood from a façade instead of repairing or replacing only the deteriorated wood, then reconstructing the façade with new material to achieve a uniform or "improved" appearance. Changing the type of finish, coating, or historic color of wood features, thereby diminishing the historic character of the exterior. Failing to renew failing paint or other coatings that are historic finishes. Stripping historically-painted surfaces to bare wood and applying a clear finish rather than repainting. Stripping paint or other coatings to reveal bare wood, thereby exposing historically-coated surfaces to the effects of accelerated weathering. Removing wood siding (clapboards) or other covering (such as stucco) from log structures that were covered historically, which changes their historic character and exposes the logs to accelerated deterioration.
Protecting and maintaining wood features by ensuring that historic drainage features that divert rainwater from wood surfaces (such as roof overhangs, gutters, and downspouts) are intact and functioning properly.	Failing to identify and treat the causes of wood deterioration, such as faulty flashing, leaking gutters, cracks and holes in siding, deteriorated caulking in joints and seams, plant material growing too close to wood surfaces, or insect or fungal infestation.

WOOD: CLAPBOARD, WEATHERBOARD, SHINGLES, AND OTHER FUNCTIONAL AND DECORATIVE ELEMENTS

RECOMMENDED	NOT RECOMMENDED
Applying chemical preservatives or paint to wood features that are subject to weathering, such as exposed beam ends, outriggers, or rafter tails.	Using chemical preservatives (such as creosote) which, unless they were used historically, can change the appearance of wood features.
Implementing an integrated pest management plan to identify appropriate preventive measures to guard against insect damage, such as installing termite guards, fumigating, and treating with chemicals.	
Retaining coatings (such as paint) that protect the wood from moisture and ultraviolet light. Paint removal should be considered only when there is paint surface deterioration and as part of an overall maintenance program which involves repainting or applying other appropriate coatings.	Stripping paint or other coatings from wood features without recoating.

[8] Rotted clapboards have been replaced selectively with new wood siding to match the originals.

WOOD: CLAPBOARD, WEATHERBOARD, SHINGLES, AND OTHER FUNCTIONAL AND DECORATIVE ELEMENTS

RECOMMENDED	NOT RECOMMENDED
Removing damaged or deteriorated paint to the next sound layer using the gentlest method possible (e.g., hand scraping and hand sanding) prior to repainting.	Using potentially-damaging paint-removal methods on wood surfaces, such as open-flame torches, orbital sanders, abrasive methods (including sandblasting, other media blasting, or high-pressure water), or caustic paint-removers. Removing paint that is firmly adhered to wood surfaces.
Using chemical strippers primarily to supplement other methods such as hand scraping, hand sanding, and thermal devices.	Failing to neutralize the wood thoroughly after using chemical paint removers so that new paint may not adhere. Removing paint from detachable wood features by soaking them in a caustic solution, which may roughen the surface, split the wood, or result in staining from residual acids leaching out of the wood.
Using biodegradable or environmentally-safe cleaning or paint-removal products.	
Using paint-removal methods that employ a poultice to which paint adheres, when possible, to neatly and safely remove old lead paint.	
Using thermal devices (such as infrared heaters) carefully to remove paint when it is so deteriorated that total removal is necessary prior to repainting.	Using a thermal device to remove paint from wood features without first checking for and removing any flammable debris behind them. Using thermal devices without limiting the amount of time the wood feature is exposed to heat.
Using coatings that encapsulate lead paint, when possible, where the paint is not required to be removed to meet environmental regulations.	
Applying compatible paint coating systems to historically-painted wood following proper surface preparation.	Failing to follow manufacturers' product and application instructions when repainting wood features.
Repainting historically-painted wood features with colors that are appropriate to the building and district.	Using paint colors on historically-painted wood features that are not appropriate to the building or district.

WOOD: CLAPBOARD, WEATHERBOARD, SHINGLES, AND OTHER FUNCTIONAL AND DECORATIVE ELEMENTS

RECOMMENDED	NOT RECOMMENDED
Protecting adjacent materials when working on other wood features.	Failing to protect adjacent materials when working on wood features.
Evaluating the overall condition of the wood to determine whether more than protection and maintenance, such as repairs to wood features, will be necessary.	Failing to undertake adequate measures to ensure the protection of wood features.

[9] Smooth-surfaced cementitious siding (left) may be used to replace deteriorated wood siding only on secondary elevations that have minimal visibility.

[10] **Not Recommended:** Cementitious siding with a raised wood-grain texture is not an appropriate material to replace historic wood siding, which has a smooth surface when painted.

WOOD: CLAPBOARD, WEATHERBOARD, SHINGLES, AND OTHER FUNCTIONAL AND DECORATIVE ELEMENTS

RECOMMENDED	NOT RECOMMENDED
Repairing wood by patching, splicing, consolidating, or otherwise reinforcing the wood using recognized conservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing components of wood features when there are surviving prototypes, such as brackets, molding, or sections of siding.	Removing wood that could be stabilized, repaired, and conserved, or using untested consolidants and unskilled personnel, potentially causing further damage to historic materials. Replacing an entire wood feature, such as a cornice or balustrade, when repair of the wood and limited replacement of deteriorated or missing components is feasible.
Replacing in kind an entire wood feature that is too deteriorated to repair (if the overall form and detailing are still evident) using physical evidence as a model to reproduce the feature or when the replacement can be based on historic documentation. Examples of such wood features include a cornice, entablature, or a balustrade. If using wood is not feasible, then a compatible substitute material may be considered.	Removing a wood feature that is unrepairable and not replacing it, or replacing it with a new feature that does not match. Using substitute material for the replacement that does not convey the same appearance of the surviving components of the wood feature.
Replacing a deteriorated wood feature or wood siding on a *primary or other highly-visible* elevation with a new matching wood feature.	Replacing a deteriorated wood feature or wood siding on a *primary or other highly-visible elevation* with a composite substitute material.
The following work is highlighted to indicate that it is specific to **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.*	
Designing the Replacement for Missing Historic Features	
Designing and installing a replacement masonry feature, such as a step or door pediment, when the historic feature is completely missing. It may be an accurate restoration based on documentary and physical evidence, but only when the historic feature to be replaced coexisted with the features currently on the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building.	Creating an inaccurate appearance because the replacement for the missing masonry feature is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature to be replaced did not coexist with the features currently on the building. Introducing a new wood feature that is incompatible in size, scale, material, or color.

METALS: WROUGHT AND CAST IRON, STEEL, PRESSED METAL, TERNEPLATE, COPPER, ALUMINUM, AND ZINC

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving metal features that are important in defining the overall historic character of the building (such as columns, capitals, pilasters, spandrel panels, or stairways) and their paints, finishes, and colors. The type of metal should be identified prior to work because each metal has its own properties and may require a different treatment.	Removing or substantially changing metal features 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 historic metal from a façade instead of repairing or replacing only the deteriorated metal, then reconstructing the façade with new material to achieve a uniform or "improved" appearance.
Protecting and maintaining metals from corrosion by providing proper drainage so that water does not stand on flat, horizontal surfaces or accumulate in curved decorative features.	Failing to identify and treat the causes of corrosion, such as moisture from leaking roofs or gutters. Placing incompatible metals together without providing an appropriate 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).
Cleaning metals when necessary to remove corrosion prior to repainting or applying appropriate protective coatings.	Leaving metals that must be protected from corrosion uncoated after cleaning.

[11] The stainless steel doors at the entrance to this Art Deco apartment building are important in defining its historic character and should be retained in place.

METALS: WROUGHT AND CAST IRON, STEEL, PRESSED METAL, TERNEPLATE, COPPER, ALUMINUM, AND ZINC

RECOMMENDED	NOT RECOMMENDED
Identifying the particular type of metal prior to any cleaning procedure and then testing to ensure that the gentlest cleaning method possible is selected; or, alternatively, determining that cleaning is inappropriate for the particular metal.	Using cleaning methods which alter or damage the color, texture, or finish of the metal, or cleaning when it is inappropriate for the particular metal. Removing the patina from historic metals. The patina may be a protective layer on some metals (such as bronze or copper) as well as a distinctive finish.
Using non-corrosive chemical methods to clean soft metals (such as lead, tinplate, terneplate, copper, and zinc) whose finishes can be easily damaged by abrasive methods.	Cleaning soft metals (such as lead, tinplate, terneplate, copper, and zinc) with abrasive methods (including sandblasting, other abrasive media, or high-pressure water) which will damage the surface of the metal.
Using the least abrasive cleaning method for hard metals (such as cast iron, wrought iron, and steel) to remove paint buildup and corrosion. If hand scraping and wire brushing have proven ineffective, low-pressure abrasive methods may be used as long as they do not abrade or damage the surface.	Using high-pressure abrasive techniques (including sandblasting, other media blasting, or high-pressure water) without first trying gentler cleaning methods prior to cleaning cast iron, wrought iron, or steel.
Applying appropriate paint or other coatings to historically-coated metals after cleaning to protect them from corrosion.	Applying paint or other coatings to metals (such as copper, bronze or stainless steel) if they were not coated historically, unless a coating is necessary for maintenance.
Repainting historically-painted metal features with colors that are appropriate to the building and district.	Using paint colors on historically-painted metal features that are not appropriate to the building or district.
Applying an appropriate protective coating (such as lacquer or wax) to a metal feature that was historically unpainted, such as a bronze door, which is subject to heavy use.	

METALS: WROUGHT AND CAST IRON, STEEL, PRESSED METAL, TERNEPLATE, COPPER, ALUMINUM, AND ZINC

RECOMMENDED	NOT RECOMMENDED
Protecting adjacent materials when cleaning or removing paint from metal features.	Failing to protect adjacent materials when working on metal features.
Evaluating the overall condition of metals to determine whether more than protection and maintenance, such as repairs to metal features, will be necessary.	Failing to undertake adequate measures to ensure the protection of metal features.

[12] This historic steel window has been cleaned, repaired, and primed in preparation for painting and reglazing.

[13] The gold-colored, anodized aluminum geodesic dome of the former Citizen's State Bank in Oklahoma City, OK, built in 1958 and designed by Robert Roloff, makes this a distinctive mid-20th century building.

[14] Interior cast-iron columns have been cleaned and repainted as part of the rehabilitation of this historic market building for continuing use.

[15] New enameled-metal panels were replicated to replace the original panels, which were too deteriorated to repair, when the storefront of this early 1950s building was recreated.

METALS: WROUGHT AND CAST IRON, STEEL, PRESSED METAL, TERNEPLATE, COPPER, ALUMINUM, AND ZINC

RECOMMENDED	NOT RECOMMENDED
Repairing metal by reinforcing the metal using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing components of features when there are surviving prototypes, such as column capitals or bases, storefronts, railings and steps, or window hoods.	Removing metals that could be stabilized, repaired, and conserved, or using improper repair techniques, or unskilled personnel, potentially causing further damage to historic materials.
Replacing in kind an entire 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 or when the replacement can be based on historic documentation. Examples of such a feature could include cast-iron porch steps or steel-sash windows. If using the same kind of material is not feasible, then a compatible substitute material may be considered.	Replacing an entire metal feature, such as a column or balustrade, when repair of the metal and limited replacement of deteriorated or missing components are feasible. Removing a metal feature that is unrepairable and not replacing it, or replacing it with a new metal feature that does not match. Using a substitute material for the replacement that does not convey the same appearance of the surviving components of the metal feature or that is physically or chemically incompatible.
The following work is highlighted to indicate that it is specific to **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.*	
Designing the Replacement for Missing Historic Features	
Designing and installing a replacement metal feature, such as a metal cornice or cast-iron column, when the historic feature is completely missing. It may be an accurate restoration based on documentary and physical evidence, but only when the historic feature to be replaced coexisted with the features currently on the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building.	Creating an inaccurate appearance because the replacement for the missing metal feature is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature to be replaced did not coexist with the features currently on the building. Introducing a new metal feature that is incompatible in size, scale, material, or color.

ROOFS

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving roofs and their functional and decorative features that are important in defining the overall historic character of the building. The form of the roof (gable, hipped, gambrel, flat, or mansard) is significant, as are its decorative and functional features (such as cupolas, cresting, parapets, monitors, chimneys, weather vanes, dormers, ridge tiles, and snow guards), roofing material (such as slate, wood, clay tile, metal, roll roofing, or asphalt shingles), and size, color, and patterning.	Removing or substantially changing 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 historic roof or roofing material that is repairable, then rebuilding it with new material to achieve a more uniform or "improved" appearance. Changing the configuration or shape of a roof by adding highly visible new features (such as dormer windows, vents, skylights, or a penthouse). Stripping the roof of sound historic material, such as slate, clay tile, wood, or metal.
Protecting and maintaining a roof by cleaning gutters and downspouts and replacing deteriorated flashing. Roof sheathing should also be checked for indications of moisture due to leaks or condensation.	Failing to clean and maintain gutters and downspouts properly so that water and debris collect and cause damage to roof features, sheathing, and the underlying roof structure.
Providing adequate anchorage for roofing material to guard against wind damage and moisture penetration.	Allowing flashing, caps, and exposed fasteners to corrode, which accelerates deterioration of the roof.
Protecting a leaking roof with a temporary waterproof membrane with a synthetic underlayment, roll roofing, plywood, or a tarpaulin until it can be repaired.	Leaving a leaking roof unprotected so that accelerated deterioration of historic building materials (such as masonry, wood, plaster, paint, and structural members) occurs.
Repainting a roofing material that requires a protective coating and was painted historically (such as a terneplate metal roof or gutters) as part of regularly-scheduled maintenance.	Failing to repaint a roofing material that requires a protective coating and was painted historically as part of regularly-scheduled maintenance.
Applying compatible paint coating systems to historically-painted roofing materials following proper surface preparation.	Applying paint or other coatings to roofing material if they were not coated historically.
Protecting a roof covering when working on other roof features.	Failing to protect roof coverings when working on other roof features.
Evaluating the overall condition of the roof and roof features to determine whether more than protection and maintenance, such as repairs to roof features, will be necessary.	Failing to undertake adequate measures to ensure the protection of roof features.

ROOFS

RECOMMENDED	NOT RECOMMENDED
Repairing a roof by ensuring that the existing historic or compatible non-historic roof covering is sound and waterproof. Repair may include the limited replacement in kind or with a compatible substitute material of missing materials (such as wood shingles, slates, or tiles) on a main roof, as well as those extensively deteriorated or missing components of features when there are surviving prototypes, such as ridge tiles, dormer roofing, or roof monitors. Using corrosion-resistant roof fasteners (e.g., nails and clips) to repair a roof to help extend its longevity.	Replacing an entire roof feature when repair of the historic roofing materials and limited replacement of deteriorated or missing components are feasible.

[16] The deteriorated asphalt shingles of this porch roof are being replaced in kind with matching shingles.

ROOFS	
RECOMMENDED	**NOT RECOMMENDED**
Replacing in kind an entire roof covering or 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 or when the replacement can be based on historic documentation. Examples of such a feature could include a large section of roofing, a dormer, or a chimney. If using the same kind of material is not feasible, then a compatible substitute material may be considered.	Removing a feature of the roof that is unrepairable and not replacing it, or replacing it with a new roof feature that does not match. Using a substitute material for the replacement that does not convey the same appearance of the roof covering or the surviving components of the roof feature or that is physically or chemically incompatible.
Replacing only missing or damaged roofing tiles or slates rather than replacing the entire roof covering.	Failing to reuse intact slate or tile in good condition when only the roofing substrate or fasteners need replacement.
Replacing an incompatible roof covering or any deteriorated non-historic roof covering with historically-accurate roofing material, if known, or another material that is compatible with the historic character of the building.	
The following work is highlighted to indicate that it is specific to **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.*	
Designing the Replacement for Missing Historic Features	
Designing and installing a new roof covering for a missing roof or a new feature, such as a dormer or a monitor, when the historic feature is completely missing. It may be an accurate restoration based on documentary and physical evidence, but only when the historic feature to be replaced coexisted with the features currently on the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building.	Creating an inaccurate appearance because the replacement for the missing roof feature is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature to be replaced did not coexist with the features currently on the building. Introducing a new roof feature that is incompatible in size, scale, material, or color.

ROOFS

RECOMMENDED	NOT RECOMMENDED
Alterations and Additions for a New Use	
Installing mechanical and service equipment on the roof (such as heating and air-conditioning units, elevator housing, or solar panels) when required for a new use so that they are inconspicuous on the site and from the public right-of-way and do not damage or obscure character-defining historic features.	Installing roof-top mechanical or service equipment so that it damages or obscures character-defining roof features or is conspicuous on the site or from the public right-of-way.
Designing rooftop additions, elevator or stair towers, decks or terraces, dormers, or skylights when required by a new or continuing use so that they are inconspicuous and minimally visible on the site and from the public right-of-way and do not damage or obscure character-defining historic features.	Changing a character-defining roof form, or damaging or destroying character-defining roofing material as a result of an incompatible rooftop addition or improperly-installed or highly-visible mechanical equipment.
Installing a green roof or other roof landscaping, railings, or furnishings that are not visible on the site or from the public right-of-way and do not damage the roof structure.	Installing a green roof or other roof landscaping, railings, or furnishings that are visible on the site and from the public right-of-way.

[17] New wood elements have been used selectively to replace rotted wood on the underside of the roof in this historic warehouse.

WINDOWS

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving windows and their functional and decorative features that are important to the overall character of the building. The window material and how the window operates (e.g., double hung, casement, awning, or hopper) are significant, as are its components (including sash, muntins, ogee lugs, glazing, pane configuration, sills, mullions, casings, or brick molds) and related features, such as shutters.	Removing or substantially changing windows or window features which are important in defining the overall historic character of the building so that, as a result, the character is diminished. Changing the appearance of windows that contribute to the historic character of the building by replacing materials, finishes, or colors which noticeably change the sash, depth of the reveal, and muntin configurations; the reflectivity and color of the glazing; or the appearance of the frame. Obscuring historic wood window trim with metal or other material. Replacing windows solely because of peeling paint, broken glass, stuck sash, or high air infiltration. These conditions, in themselves, do not indicate that windows are beyond repair.
Protecting and maintaining the wood or metal which comprises the window jamb, sash, and trim through appropriate treatments, such as cleaning, paint removal, and reapplication of protective coating systems.	Failing to protect and maintain window materials on a cyclical basis so that deterioration of the window results.
Protecting windows against vandalism before work begins by covering them and by installing alarm systems that are keyed into local protection agencies.	Leaving windows unprotected and subject to vandalism before work begins, thereby also allowing the interior to be damaged if it can be accessed through unprotected windows.
Making windows weathertight by recaulking gaps in fixed joints and replacing or installing weatherstripping.	
Protecting windows from chemical cleaners, paint, or abrasion during work on the exterior of the building.	Failing to protect historic windows from chemical cleaners, paint, or abrasion when work is being done on the exterior of the building.
Protecting and retaining historic glass when replacing putty or repairing other components of the window.	Failing to protect the historic glass when making window repairs.

WINDOWS

RECOMMENDED	NOT RECOMMENDED
Sustaining the historic operability of windows by lubricating friction points and replacing broken components of the operating system (such as hinges, latches, sash chains or cords) and replacing deteriorated gaskets or insulating units.	Failing to maintain windows and window components so that windows are inoperable, or sealing operable sash permanently. Failing to repair and reuse window hardware such as sash lifts, latches, and locks.
Adding storm windows with a matching or a one-over-one pane configuration that will not obscure the characteristics of the historic windows. Storm windows improve energy efficiency and are especially beneficial when installed over wood windows because they also protect them from accelerated deterioration.	
Adding interior storm windows as an alternative to exterior storm windows when appropriate.	

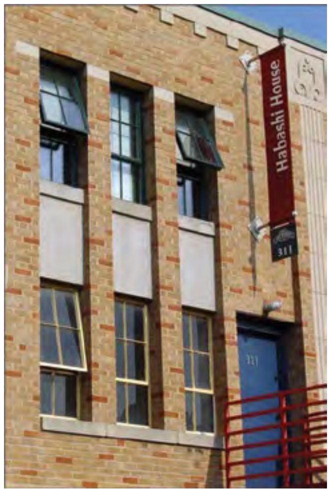
[18] The historic metal storm windows in this 1920s office building were retained and repaired during the rehabilitation project.

[19] Installing a mockup of a proposed replacement window can be helpful to evaluate how well the new windows will match the historic windows that are missing or too deteriorated to repair.

[20 a-d] The original steel windows in this industrial building were successfully repaired as part of the rehabilitation project (left).

WINDOWS

RECOMMENDED	NOT RECOMMENDED
Installing sash locks, window guards, removable storm windows, and other reversible treatments to meet safety, security, or energy conservation requirements.	
Evaluating the overall condition of the windows to determine whether more than protection and maintenance, such as repairs to windows and window features, will be necessary.	Failing to undertake adequate measures to ensure the protection of window features.
Repairing window frames and sash by patching, splicing, consolidating, or otherwise reinforcing them using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated, broken, or missing components of features when there are surviving prototypes, such as sash, sills, hardware, or shutters.	Removing window features that could be stabilized, repaired, or conserved using untested consolidants, improper repair techniques, or unskilled personnel, potentially causing further damage to the historic materials. Replacing an entire window when repair of the window and limited replacement of deteriorated or missing components are feasible.
Removing glazing putty that has failed and applying new putty; or, if glass is broken, carefully removing all putty, replacing the glass, and reputtying.	
Installing new glass to replace broken glass which has the same visual characteristics as the historic glass.	
Replacing in kind an entire window 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 or when the replacement can be based on historic documentation. If using the same kind of material is not feasible, then a compatible substitute material may be considered.	Removing a character-defining window that is unrepairable or is not needed for the new use and blocking up the opening, or replacing it with a new window that does not match. Using substitute material for the replacement that does not convey the same appearance of the surviving components of the window or that is physically incompatible.



[21] The windows on the lower floor, which were too deteriorated to repair, were replaced with new steel windows matching the upper-floor historic windows that were retained.

WINDOWS

RECOMMENDED	NOT RECOMMENDED
Modifying a historic single-glazed sash to accommodate insulated glass when it will not jeopardize the soundness of the sash or significantly alter its appearance.	Modifying a historic single-glazed sash to accommodate insulated glass when it will jeopardize the soundness of the sash or significantly alter its appearance.
Using low-e glass with the least visible tint in new or replacement windows.	Using low-e glass with a dark tint in new or replacement windows, thereby negatively impacting the historic character of the building.
Using window grids rather than true divided lights on windows on the upper floors of high-rise buildings if they will not be noticeable.	Using window grids rather than true divided lights on windows in low-rise buildings or on lower floors of high-rise buildings where they will be noticeable, resulting in a change to the historic character of the building.
Ensuring that spacer bars in between double panes of glass are the same color as the window sash.	Using spacer bars in between double panes of glass that are not the same color as the window sash.
Replacing all of the components in a glazing system if they have failed because of faulty design or materials that have deteriorated with new material that will improve the window performance without noticeably changing the historic appearance.	Replacing all of the components in a glazing system with new material that will noticeably change the historic appearance.
Replacing incompatible, non-historic windows with new windows that are compatible with the historic character of the building; or reinstating windows in openings that have been filled in.	
The following work is highlighted to indicate that it is specific to **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.*	
Designing the Replacement for Missing Historic Features	
Designing and installing a new window or its components, such as frames, sash, and glazing, when the historic feature is completely missing. It may be an accurate restoration based on documentary and physical evidence, but only when the historic feature to be replaced coexisted with the features currently on the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building.	Creating an inaccurate appearance because the replacement for the missing window is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature to be replaced did not coexist with the features currently on the building. Installing replacement windows made from other materials that are not the same as the material of the original windows if they would have a noticeably different appearance from the remaining historic windows.

(a)

(b)

(c)

[22] **Not Recommended:** (a-b) The original wood windows in this late-19th-century building, which were highly decorative, could likely have been repaired and retained. (c) Instead, they were replaced with new windows that do not match the detailing of the historic windows and, therefore, do not meet the Standards (above).

[23] (a)This deteriorated historic wood window was repaired and retained (b) in this rehabilitation project.

WINDOWS

RECOMMENDED	NOT RECOMMENDED
Alterations and Additions for a New Use	
Adding new window openings on rear or other secondary, less-visible elevations, if required by a new use. The new openings and the windows in them should be compatible with the overall design of the building but, in most cases, not duplicate the historic fenestration.	Changing the number, location, size, or glazing pattern of windows on primary or highly-visible elevations which will alter the historic character of the building. Cutting new openings on character-defining elevations or cutting new openings that damage or destroy significant features. Adding balconies at existing window openings or new window openings on primary or other highly-visible elevations where balconies never existed and, therefore, would be incompatible with the historic character of the building.
Replacing windows that are too deteriorated to repair using the same sash and pane configuration, but with new windows that operate differently, if necessary, to accommodate a new use. Any change must have minimal visual impact. Examples could include replacing hopper or awning windows with casement windows, or adding a realigned and enlarged operable portion of industrial steel windows to meet life-safety codes.	Replacing a window that contributes to the historic character of the building with a new window that is different in design (such as glass divisions or muntin profiles), dimensions, materials (wood, metal, or glass), finish or color, or location that will have a noticeably different appearance from the historic windows, which may negatively impact the character of the building.
Installing impact-resistant glazing, when necessary for security, so that it is compatible with the historic windows and does not damage them or negatively impact their character.	Installing impact-resistant glazing, when necessary for security, that is incompatible with the historic windows and that damages them or negatively impacts their character.
Using compatible window treatments (such as frosted glass, appropriate shades or blinds, or shutters) to retain the historic character of the building when it is necessary to conceal mechanical equipment, for example, that the new use requires be placed in a location behind a window or windows on a primary or highly-visible elevation.	Removing a character-defining window to conceal mechanical equipment or to provide privacy for a new use of the building by blocking up the opening.

[24] Rotted boards in the beaded-board porch ceiling are being replaced with new matching beaded board.

ENTRANCES AND PORCHES

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving entrances and porches and their functional and decorative features that are important in defining the overall historic character of the building. The materials themselves (including masonry, wood, and metal) are significant, as are their features, such as doors, transoms, pilasters, columns, balustrades, stairs, roofs, and projecting canopies.	Removing or substantially changing entrances and porches which are important in defining the overall historic character of the building so that, as a result, the character is diminished. Cutting new entrances on a primary façade. Altering utilitarian or service entrances so they compete visually with the historic primary entrance; increasing their size so that they appear significantly more important; or adding decorative details that cannot be documented to the building or are incompatible with the building's historic character.
Retaining a historic entrance or porch even though it will no longer be used because of a change in the building's function.	Removing a historic entrance or porch that will no longer be required for the building's new use.
Protecting and maintaining the masonry, wood, and metals which comprise entrances and porches through appropriate surface treatments, such as cleaning, paint removal, and reapplication of protective coating systems.	Failing to protect and maintain entrance and porch materials on a cyclical basis so that deterioration of entrances and porches results.
Protecting entrances and porches against arson and vandalism before work begins by covering them and by installing alarm systems keyed into local protection agencies.	Leaving entrances and porches unprotected and subject to vandalism before work begins, thereby also allowing the interior to be damaged if it can be accessed through unprotected entrances.
Protecting entrance and porch features when working on other features of the building.	Failing to protect materials and features when working on other features of the building.
Evaluating the overall condition of entrances and porches to determine whether more than protection and maintenance, such as repairs to entrance and porch features, will be necessary.	Failing to undertake adequate measures to ensure the protection of entrance and porch features.
Repairing entrances and porches by patching, splicing, consolidating, and otherwise reinforcing them using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated features or missing components of features when there are surviving prototypes, such as balustrades, columns, and stairs.	Removing entrances and porches that could be stabilized, repaired, and conserved, or using untested consolidants, improper repair techniques, or unskilled personnel, potentially causing further damage to historic materials. Replacing an entire entrance or porch feature when repair of the feature and limited replacement of deteriorated or missing components are feasible.

ENTRANCES AND PORCHES

RECOMMENDED	NOT RECOMMENDED
Replacing in kind an entire entrance or porch 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 or when the replacement can be based on historic documentation. If using the same kind of material is not feasible, then a compatible substitute material may be considered.	Removing an entrance or porch that is unrepairable and not replacing it, or replacing it with a new entrance or porch that does not match. Using a substitute material for the replacement that does not convey the same appearance of the surviving components of entrance or porch features or that is physically incompatible.

[25] The new infill designs for the garage door openings in this commercial building (a) converted for restaurant use and in this mill building (b) rehabilitated for residential use are compatible with the historic character of the buildings.

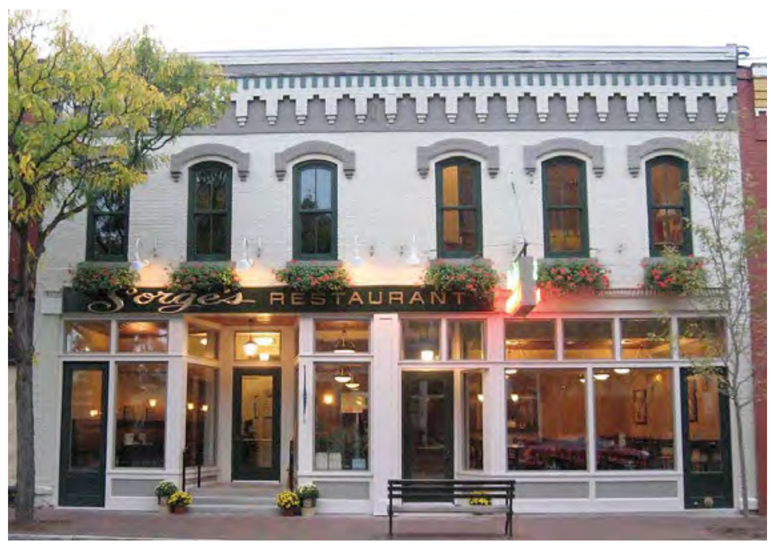
ENTRANCES AND PORCHES

RECOMMENDED	NOT RECOMMENDED
The following work is highlighted to indicate that it is specific to **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.*	
Designing the Replacement for Missing Historic Features	
Designing and installing a new entrance or porch when the historic feature is completely missing or has previously been replaced by one that is incompatible. It may be an accurate restoration based on documentary and physical evidence, but only when the historic entrance or porch to be replaced coexisted with the features currently on the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building.	Creating an inaccurate appearance because the replacement for the missing entrance or porch is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature to be replaced did not coexist with the features currently on the building.
Alterations and Additions for a New Use	
Enclosing historic porches on secondary elevations only, when required by a new use, in a manner that preserves the historic character of the building (e.g., using large sheets of glass and recessing the enclosure wall behind existing posts and balustrades).	Enclosing porches in a manner that results in a diminution or loss of historic character by using solid materials rather than clear glazing, or by placing the enclosure in front of, rather than behind, the historic features.
Designing and constructing additional entrances or porches on secondary elevations when required for the new use in a manner that preserves the historic character of the building (i.e., ensuring that the new entrance or porch is clearly subordinate to historic primary entrances or porches).	Constructing secondary or service entrances and porches that are incompatible in size and scale or detailing with the historic building or that obscure, damage, or destroy character-defining features.

[26] **Not Recommended:** Installing a screened enclosure is never recommended on a front or otherwise prominent historic porch. In limited instances, it may be possible to add screening on a porch at the rear or on a secondary façade; however, the enclosure should match the color of the porch and be placed behind columns and railings so that it does not obscure these features.

STOREFRONTS

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving storefronts and their functional and decorative features that are important in defining the overall historic character of the building. The storefront materials (including wood, masonry, metals, ceramic tile, clear glass, and pigmented structural glass) and the configuration of the storefront are significant, as are features, such as display windows, base panels, bulkheads, signs, doors, transoms, kick plates, corner posts, piers, and entablatures. The removal of inappropriate, non-historic cladding, false mansard roofs, and other later, non-significant alterations can help reveal the historic character of the storefront.	Removing or substantially changing storefronts and their features which are important in defining the overall historic character of the building so that, as a result, the character is diminished. Changing the storefront so that it has a residential rather than commercial appearance. Introducing features from an earlier period that are not compatible with the historic character of the storefront. Changing the location of the storefront's historic main entrance. Replacing or covering a glass transom with solid material or inappropriate signage, or installing an incompatible awning over it.
Retaining later, non-original features that have acquired significance over time.	Removing later features that may have acquired significance.



[28] This new storefront, which replaced one that was missing, is compatible with the historic character of the building.

STOREFRONTS

RECOMMENDED	NOT RECOMMENDED
Protecting and maintaining masonry, wood, glass, ceramic tile, and metals which comprise storefronts through appropriate treatments, such as cleaning, paint removal, and reapplication of protective coating systems.	Failing to protect and maintain storefront materials on a cyclical basis so that deterioration of storefront features results.
Protecting storefronts against arson and vandalism before work begins by covering windows and doors and by installing alarm systems keyed into local protection agencies.	Leaving the storefront unprotected and subject to vandalism before work begins, thereby also allowing the interior to be damaged if it can be accessed through unprotected entrances.
Protecting the storefront when working on other features of the building.	Failing to protect the storefront when working on other features of the building.
Evaluating the overall condition of the storefront to determine whether more than protection and maintenance, such as repairs to storefront features, will be necessary.	Failing to undertake adequate measures to ensure the protection of storefront features.

[27] This original c. 1940s storefront, with its character-defining angled and curved glass display window and recessed entrance with a decorative terrazzo paving, is in good condition and should be retained in a rehabilitation project.

STOREFRONTS

RECOMMENDED	NOT RECOMMENDED
Repairing storefronts by patching, splicing, consolidating, or otherwise reinforcing them using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing components of storefronts when there are surviving prototypes, such as transoms, base panels, kick plates, piers, or signs.	Removing storefronts that could be stabilized, repaired, and conserved, or using untested consolidants, improper repair techniques, or unskilled personnel, potentially causing further damage to historic materials.
Replacing in kind an entire storefront 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 or when the replacement can be based on historic documentation. If using the same kind of material is not feasible, then a compatible substitute material may be considered.	Replacing a storefront feature when repair of the feature and limited replacement of deteriorated or missing components are feasible. Using a substitute material for the replacement that does not convey the same appearance of the surviving components of the storefront or that is physically incompatible. Removing a storefront that is unrepairable and not replacing it or replacing it with a new storefront that does not match.
The following work is highlighted to indicate that it is specific to **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.*	
Designing the Replacement for Missing Historic Features	
Designing and installing a new storefront when the historic storefront is completely missing or has previously been replaced by one that is incompatible. It may be an accurate restoration based on documentary and physical evidence, but only when the historic storefront to be replaced coexisted with the features currently on the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building.	Creating an inaccurate appearance because the replacement for the missing storefront is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature to be replaced did not coexist with the features currently on the building. Using new, over-scaled, or internally-lit signs unless there is a historic precedent for them or using other types of signs that obscure, damage, or destroy character-defining features of the storefront and the building.

STOREFRONTS

RECOMMENDED	NOT RECOMMENDED
Replacing missing awnings or canopies that can be historically documented to the building, or adding new signage, awnings, or canopies that are compatible with the historic character of the building.	Adding vinyl awnings, or other awnings that are inappropriately sized or shaped, which are incompatible with the historic character of the building; awnings that do not extend over the entire length of the storefront; or large canopies supported by posts that project out over the sidewalk, unless their existence can be historically documented.
Alterations and Additions for a New Use	
Retaining the glazing and the transparency (i.e., which allows the openness of the interior to be experienced from the exterior) that is so important in defining the character of a historic storefront when the building is being converted for residential use. Window treatments (necessary for occupants' privacy) should be installed that are uniform and compatible with the commercial appearance of the building, such as screens or wood blinds. When display cases still exist behind the storefront, the screening should be set at the back of the display case.	Replacing storefront glazing with solid material for occupants' privacy when the building is being converted for residential use. Installing window treatments in storefront windows that have a residential appearance, which are incompatible with the commercial character of the building. Installing window treatments that are not uniform in a series of repetitive storefront windows.

[29] The rehabilitation of the 1910 Mā'alaea General Store (a), which served the workers' camp at the Wailuku Sugar Company on the Hawaiian island of Maui, included the reconstruction of the original parapet (b).

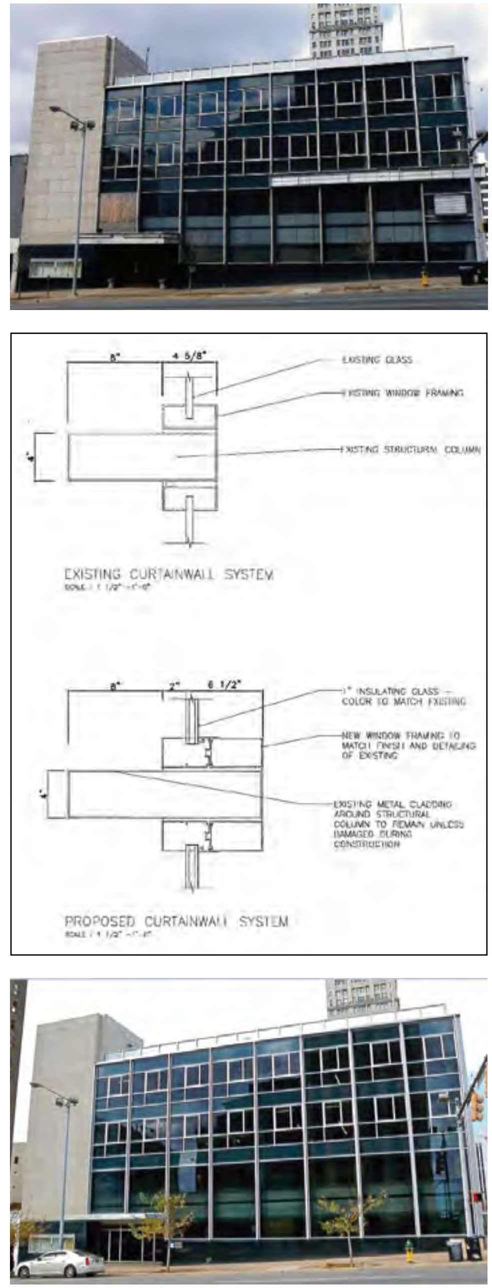
CURTAIN WALLS

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving curtain wall systems and their components (metal framing members and glass or opaque panels) that are important in defining the overall historic character of the building. The design of the curtain wall is significant, as are its component materials (metal stick framing and panel materials, such as clear or spandrel glass, stone, terra cotta, metal, and fiber-reinforced plastic), appearance (e.g., glazing color or tint, transparency, and reflectivity), and whether the glazing is fixed, operable or louvered glass panels. How a curtain wall is engineered and fabricated, and the fact that it expands and contracts at a different rate from the building's structural system, are important to understand when undertaking the rehabilitation of a curtain wall system.	Removing or substantially changing curtain wall components which are important in defining the overall historic character of the building so that, as a result, the character is diminished. Replacing historic curtain wall features instead of repairing or replacing only the deteriorated components.
Protecting and maintaining curtain walls and their components through appropriate surface treatments, such as cleaning, paint removal, and reapplication of protective coating systems; and by making them watertight and ensuring that sealants and gaskets are in good condition.	Failing to protect and maintain curtain wall components on a cyclical basis so that deterioration of curtain walls results. Failing to identify, evaluate, and treat various causes of curtain wall failure, such as open gaps between components where sealants have deteriorated or are missing.
Protecting ground-level curtain walls from vandalism before work begins by covering them, while ensuring adequate ventilation, and by installing alarm systems keyed into local protection agencies.	Leaving ground-level curtain walls unprotected and subject to vandalism before work begins, thereby also allowing the interior to be damaged if it can be accessed through unprotected glazing.
Protecting curtain walls when working on other features of the building.	Failing to protect curtain walls when working on other features of the building.
Cleaning curtain wall systems only when necessary to halt deterioration or to remove heavy soiling.	Cleaning curtain wall systems when they are not heavily soiled, thereby needlessly introducing chemicals or moisture into historic materials.

CURTAIN WALLS

RECOMMENDED	NOT RECOMMENDED
Carrying out cleaning tests, when it has been determined that cleaning is appropriate, using only cleaning materials that will not damage components of the system, including factory-applied finishes. Test areas should be examined to ensure that no damage has resulted.	Cleaning curtain wall systems without testing or using cleaning materials that may damage components of the system.
Evaluating the overall condition of curtain walls to determine whether more than protection and maintenance, such as repair of curtain wall components, will be necessary.	Failing to undertake adequate measures to protect curtain wall components.
Repairing curtain walls by ensuring that they are watertight by augmenting existing components or replacing deteriorated or missing sealants or gaskets, where necessary, to seal any gaps between system components. Repair may include the limited replacement of those extensively deteriorated or missing components of curtain walls when there are surviving prototypes.	Removing curtain wall components that could be repaired or using improper repair techniques. Replacing an entire curtain wall system when repair of materials and limited replacement of deteriorated or missing components are feasible.
Applying sealants carefully so that they are not readily visible.	
Replacing in kind a component or components of a curtain wall system that are too deteriorated to repair (if the overall form and detailing are still evident) using the physical evidence as a model to reproduce the feature. If using the same kind of material is not feasible, then a compatible substitute material may be considered as long as it has the same finish and appearance.	Removing a curtain wall component or the entire system, if necessary, that is unrepairable and not replacing it or replacing it with a new component or system that does not convey the same appearance.
Replacing masonry, metal, glass, or other components of a curtain wall system (or the entire system, if necessary) which have failed because of faulty design with substitutes that match the original as closely as possible and which will reestablish the viability and performance of the system.	Using substitute material for the replacement that does not convey the same appearance of the surviving components of the curtain wall or that is physically incompatible.

[30] Rather than replace the original curtain wall system of the 1954 Simms Building in Albuquerque, NM, with a different color tinted glass or coat it with a non-historic reflective film, the HVAC system was updated to improve energy efficiency. *Photo: Harvey M. Kaplan.*



[31 a-c:] (a) The rehabilitation of the First Federal Savings and Loan Association building in Birmingham, AL, constructed in 1961, required replacing the deteriorated historic curtain wall system because the framing and the fasteners holding the spandrel glass and the windows had failed. (b) Comparative drawings show that the differences between the replacement system, which incorporated new insulated glass to meet wind-load requirements, and the original system are minimal. (c) The replacement system, shown after completion of the project, has not altered the historic character of the building.

CURTAIN WALLS

RECOMMENDED	NOT RECOMMENDED
The following work is highlighted to indicate that it is specific to **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.*	
Designing the Replacement for Missing Historic Features	
Designing and installing a new curtain wall or its components when the historic feature is completely missing. It may be an accurate restoration based on documentary and physical evidence, but only when the historic feature to be replaced coexisted with the features currently on the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building.	Creating an inaccurate appearance because the replacement for the missing curtain wall component is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature did not coexist with the features currently on the building. Introducing a new curtain wall component that is incompatible in size, scale, material, color, and finish.
Alterations and Additions for a New Use	
Installing new glazing or an entire new curtain wall system, when necessary to meet safety-code requirements, with dimensions, detailing, materials, colors, and finish as close as possible to the historic curtain wall components.	Installing new glazing or an entire new curtain wall system, when necessary to meet safety-code requirements, with dimensions and detailing that is significantly different from the historic curtain wall components.
Installing impact-resistant glazing, when necessary for security, so that it is compatible with the historic windows and does not damage them or negatively impact their character.	Installing impact-resistant glazing in a curtain wall system, when necessary for security, that is incompatible with the historic curtain walls and damages them or negatively impacts their character.

STRUCTURAL SYSTEMS

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving structural systems and visible features of systems that are important in defining the overall historic character of the building. This includes the materials that comprise the structural system (i.e., wood, metal and masonry), the type of system, and its features, such as posts and beams, trusses, summer beams, vigas, cast-iron or masonry columns, above-grade stone foundation walls, or load-bearing masonry walls.	Removing or substantially changing visible features of historic structural systems which are important in defining the overall historic character of the building so that, as a result, the character is diminished. Overloading the existing structural system, or installing equipment or mechanical systems which could damage the structure. Replacing a load-bearing masonry wall that could be augmented and retained. Leaving known structural problems untreated, such as deflected beams, cracked and bowed walls, or racked structural members.
Protecting and maintaining the structural system by keeping gutters and downspouts clear and roofing in good repair; and by ensuring that wood structural members are free from insect infestation.	Failing to protect and maintain the structural system on a cyclical basis so that deterioration of the structural system results. Using treatments or products that may retain moisture, which accelerates deterioration of structural members.

[33] Retaining as much as possible of the historic wood sill plate and replacing only the termite-damaged wood is always the preferred and recommended treatment.

STRUCTURAL SYSTEMS

RECOMMENDED	NOT RECOMMENDED
Evaluating the overall condition of the structural system to determine whether more than protection and maintenance, such as repairs to structural features, will be necessary.	Failing to undertake adequate measures to ensure the protection of structural systems.
Repairing the structural system by augmenting individual components, using recognized preservation methods. For example, weakened structural members (such as floor framing) can be paired or sistered with a new member, braced, or otherwise supplemented and reinforced.	Upgrading the building structurally in a manner that diminishes the historic character of the exterior or that damages interior features or spaces. Replacing a historic structural feature in its entirety or in part when it could be repaired or augmented and retained.

[32] (a-b) The rehabilitation of the 1892 Carson Block Building in Eureka, CA, for its owner, the Northern California Indian Development Council, included recreating the missing corner turret and sensitively introducing seismic reinforcement (c) shown here (opposite page) in a secondary upper floor office space. *Photos: Page & Turnbull.*

STRUCTURAL SYSTEMS

RECOMMENDED	NOT RECOMMENDED
Installing seismic or structural reinforcement, when necessary, in a manner that minimizes its impact on the historic fabric and character of the building.	
Replacing in kind or with a compatible substitute material large portions or entire features of the structural system that are either extensively damaged or deteriorated or that are missing when there are surviving prototypes, such as cast-iron columns, trusses, or masonry walls. Substitute material must be structurally sufficient, physically compatible with the rest of the system, and, where visible, must have the same form, design, and appearance as the historic feature.	Using substitute material that does not equal the load-bearing capabilities of the historic material; does not convey the same appearance of the historic material, if it is visible; or is physically incompatible. Installing a visible or exposed structural replacement feature that does not match.
Replacing to match any interior features or finishes that may have to be removed to gain access to make structural repairs, and reusing salvageable material.	

STRUCTURAL SYSTEMS

RECOMMENDED	NOT RECOMMENDED
The following work is highlighted to indicate that it is specific to **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.*	
Alterations and Additions for a New Use	
Limiting any new excavations next to historic foundations to avoid undermining the structural stability of the building or adjacent historic buildings. The area next to the building foundation should be investigated first to ascertain potential damage to site features or archeological resources.	Carrying out excavations or regrading land adjacent to a historic building which could cause the historic foundation to settle, shift, or fail, or which could destroy significant archeological resources.
Correcting structural deficiencies needed to accommodate a new use in a manner that preserves the structural system and individual character-defining features.	Making substantial changes to significant interior spaces or damaging or destroying features or finishes that are character defining to correct structural deficiencies.
Designing and installing new mechanical or electrical equipment, when necessary, in a manner that minimizes the number and size of cuts or holes in structural members.	Installing new mechanical or electrical equipment in a manner which reduces the load-bearing capacity of historic structural members.
Inserting a new floor when required for the new use if it does not negatively impact the historic character of the interior space; and if it does not damage the structural system, does not abut window glazing, and is not visible from the exterior of the building.	Inserting a new floor that damages or destroys the structural system or abuts window glazing and is visible from the exterior of the building and, thus, negatively impacts its historic character.
Creating an atrium, light court, or lightwell to provide natural light when required for a new use only when it can be done in a manner that preserves the structural system and the historic character of the building.	Removing structural features to create an atrium, light court, or lightwell if it negatively impacts the historic character of the building.

MECHANICAL SYSTEMS: HEATING, AIR CONDITIONING, ELECTRICAL, AND PLUMBING

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving visible features of early mechanical systems that are important in defining the overall historic character of the building, such as radiators, vents, fans, grilles, and plumbing and lighting fixtures.	Removing or substantially changing visible 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.
Protecting and maintaining mechanical, plumbing, and electrical systems and their features through cyclical maintenance.	Failing to protect and maintain a functioning mechanical system, plumbing, and electrical systems and their visible features on a cyclical basis so that their deterioration results.
Improving the energy efficiency of existing mechanical systems to help reduce the need for a new system by installing storm windows, insulating attics and crawl spaces, or adding awnings, if appropriate.	
Evaluating the overall condition of mechanical systems to determine whether more than protection and maintenance, such as repairs to mechanical system components, will be necessary.	Failing to undertake adequate measures to ensure the protection of mechanical system components.
Repairing mechanical systems by augmenting or upgrading system components (such as installing new pipes and ducts), rewiring, or adding new compressors or boilers.	Replacing a mechanical system when its components could be upgraded and retained.
Replacing in kind or with a compatible substitute material those extensively deteriorated or missing visible features of mechanical systems when there are surviving prototypes, such as ceiling fans, radiators, grilles, or plumbing fixtures.	Installing a visible replacement feature of a mechanical system, if it is important in defining the historic character of the building, that does not convey the same appearance.

MECHANICAL SYSTEMS: HEATING, AIR CONDITIONING, ELECTRICAL, AND PLUMBING

RECOMMENDED	NOT RECOMMENDED
The following work is highlighted to indicate that it is specific to **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.*	
Alterations and Additions for a New Use	
Installing a new mechanical system, if required, so that it results in the least alteration possible to the historic building and its character-defining features.	Installing a new mechanical system so that character-defining structural or interior features are radically changed, damaged, or destroyed.
Providing adequate structural support for the new mechanical equipment.	Failing to consider the weight and design of new mechanical equipment so that, as a result, historic structural members or finished surfaces are weakened or cracked.
Installing new mechanical and electrical systems and ducts, pipes, and cables in closets, service areas, and wall cavities to preserve the historic character of the interior space.	Installing systems and ducts, pipes, and cables in walls or ceilings in a manner that results in extensive loss or damage or otherwise obscures historic building materials and character-defining features.
Concealing HVAC ductwork in finished interior spaces, when possible, by installing it in secondary spaces (such as closets, attics, basements, or crawl spaces) or in appropriately-located, furred-down soffits.	Leaving HVAC ductwork exposed in most finished spaces or installing soffits in a location that will negatively impact the historic character of the interior or exterior of the building.
Installing exposed ductwork in a finished space when necessary to protect and preserve decorative or other features (such as column capitals, pressed-metal or ornamental plaster ceilings, coffers, or beams) that is painted, and appropriately located so that it will have minimal impact on the historic character of the space.	Installing exposed ductwork in a finished space when necessary to protect and preserve decorative or other features that is not painted, or is located where it will negatively impact the historic character of the space.
Lowering ceilings, installing a dropped ceiling, or constructing soffits to conceal ductwork in a finished space when this will not result in extensive loss or damage to historic materials or decorative and other features, and will not change the overall character of the space or the exterior appearance of the building (i.e., lowered ceilings or soffits visible through window glazing).	Lowering ceilings, installing a dropped ceiling, or constructing soffits to conceal ductwork in a finished space in a manner that results in extensive loss or damage to historic materials or decorative and other features, and will change the overall character of the space or the exterior appearance of the building.

MECHANICAL SYSTEMS: HEATING, AIR CONDITIONING, ELECTRICAL, AND PLUMBING

RECOMMENDED	NOT RECOMMENDED
Installing appropriately located, exposed ductwork in historically-unfinished interior spaces in industrial or utilitarian buildings.	
Installing a split system mechanical unit in a manner that will have minimal impact on the historic character of the interior and result in minimal loss of historic building material.	Installing a split system mechanical unit without considering its impact on the historic character of the interior or the potential loss of historic building material.
Installing heating or air conditioning window units only when the installation of any other system would result in significant damage or loss of historic materials or features.	
Installing mechanical equipment on the roof, when necessary, so that it is minimally visible to preserve the building's historic character and setting.	Installing mechanical equipment on the roof that is overly large or highly visible and negatively impacts the historic character of the building or setting.
Placing air conditioning compressors in a location on a secondary elevation of the historic building that is not highly visible.	Placing air conditioning compressors where they are highly visible and negatively impact the historic character of the building or setting.

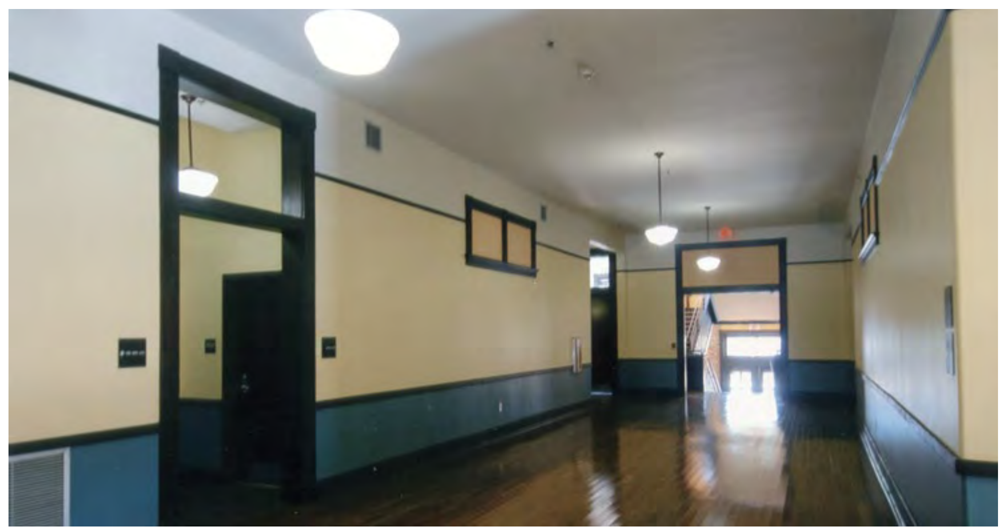
[34] The new ceiling ducts installed during the conversion of this historic office building into apartments are minimal in design and discretely placed above the windows.

INTERIOR SPACES, FEATURES, AND FINISHES

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving a floor plan or interior spaces, features, and finishes that are important in defining the overall historic character of the building. Significant spatial characteristics include the size, configuration, proportion, and relationship of rooms and corridors; the relationship of features to spaces; and the spaces themselves, such as lobbies, lodge halls, entrance halls, parlors, theaters, auditoriums, gymnasiums, and industrial and commercial interiors. Color, texture, and pattern are important characteristics of features and finishes, which can include such elements as columns, plaster walls and ceilings, flooring, trim, fireplaces and mantels, paneling, light fixtures, hardware, decorative radiators, ornamental grilles and registers, windows, doors, and transoms; plaster, paint, wallpaper and wall coverings, and special finishes, such as marbleizing and graining; and utilitarian (painted or unpainted) features, including wood, metal, or concrete exposed columns, beams, and trusses and exposed load-bearing brick, concrete, and wood walls.	Altering a floor plan, or interior spaces (including individual rooms), features, and finishes, which are important in defining the overall historic character of the building so that, as a result, the character is diminished. Altering the floor plan by demolishing principal walls and partitions for a new use. Altering or destroying significant interior spaces by inserting additional floors or lofts; cutting through floors to create lightwells, light courts, or atriums; lowering ceilings; or adding new walls or removing historic walls. Relocating an interior feature, such as a staircase, so that the circulation pattern and the historic relationship between features and spaces are altered. Installing new material that obscures or damages character-defining interior features or finishes. Removing paint, plaster, or other finishes from historically-finished interior surfaces to create a new appearance (e.g., removing plaster to expose brick walls or a brick chimney breast, stripping paint from wood to stain or varnish it, or removing a plaster ceiling to expose unfinished beams). Applying paint, plaster, or other coatings to surfaces that have been unfinished historically, thereby changing their character. Changing the type of finish or its color, such as painting a historically-varnished wood feature, or removing paint from a historically-painted feature.

INTERIOR SPACES, FEATURES, AND FINISHES

RECOMMENDED	NOT RECOMMENDED
Retaining decorative or other character-defining features or finishes that typify the showroom or interior of a historic store, such as a pressed-metal ceiling, a beaded-board ceiling, or wainscoting.	Removing decorative or other character-defining features or finishes that typify the showroom or interior of a historic store, such as a pressed-metal ceiling, a beaded-board ceiling, or wainscoting.
Protecting and maintaining historic materials (including plaster, masonry, wood, and metals) which comprise interior spaces through appropriate surface treatments, such as cleaning, paint removal, and reapplication of protective coating systems.	Failing to protect and maintain interior materials and finishes on a cyclical basis so that deterioration of interior features results.
Protecting interior features and finishes against arson and vandalism before project work begins by erecting temporary fencing or by covering broken windows and open doorways, while ensuring adequate ventilation, and by installing alarm systems keyed into local protection agencies.	Leaving the building unprotected and subject to vandalism before work begins, thereby allowing the interior to be damaged if it can be accessed through unprotected entrances.
Protecting interior features (such as a staircase, mantel, flooring, or decorative finishes) from damage during project work by covering them with plywood, heavy canvas, or plastic sheeting.	Failing to protect interior features and finishes when working on the interior.



[35] (a) Although deteriorated, the historic school corridor, shown on the left, with its character-defining features, including doors and transoms, was retained and repaired as part of the rehabilitation project (b).

[36] The elaborate features and finishes of this historic banking hall in the Union Trust Company Building, in Cleveland, OH, were retained and repaired as part of its conversion into a food market.

INTERIOR SPACES, FEATURES, AND FINISHES

RECOMMENDED	NOT RECOMMENDED
Removing damaged or deteriorated paint and finishes only to the next sound layer using the gentlest method possible prior to repainting or refinishing using compatible paint or other coating systems.	Using potentially damaging methods, such as open-flame torches or abrasive techniques, to remove paint or other coatings. Removing paint that is firmly adhered to interior surfaces.
Using abrasive cleaning methods only on the interior of industrial or warehouse buildings with utilitarian, unplastered masonry walls and where wood features are not finished, molded, beaded, or worked by hand. Low-pressure abrasive cleaning (e.g., sand-blasting or other media blasting) should only be considered if test patches show no surface damage and after gentler methods have proven ineffective.	Using abrasive methods anywhere but utilitarian and industrial interior spaces or when there are other methods that are less likely to damage the surface of the material.
Evaluating the overall condition of the interior materials, features, and finishes to determine whether more than protection and maintenance, such as repairs to features and finishes, will be necessary.	Failing to undertake adequate measures to ensure the protection of interior materials, features, and finishes.
Repairing interior features and finishes by patching, splicing, consolidating, or otherwise reinforcing the materials using recognized preservation methods. Repairs may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing parts of interior features when there are surviving prototypes, such as stairs, balustrades, wood paneling, columns, decorative wall finishes, and ornamental pressed-metal or plaster ceilings. Repairs should be physically and visually compatible.	Removing materials that could be repaired or using improper repair techniques. Replacing an entire interior feature (such as a staircase, mantel, or door surround) or a finish (such as a plaster) when repair of materials and limited replacement of deteriorated or missing components are feasible.

[37] Exposed and painted ducts were appropriately installed here in a retail space in Denver's historic Union Station after considering other options that would have impacted the ceiling height, or damaged or obscured the ornamental plaster crown molding. *Photo: Heritage Consulting Group.*

[38] The rehabilitation project retained the industrial character of this historic factory building, which included installation of a fire-rated, clear glass enclosure that allows the stairway, an important interior feature, to remain visible.

[39] Leaving the ceiling structure exposed and installing exposed ductwork where it does not impact the windows, are appropriate treatments when rehabilitating an industrial building for another use.

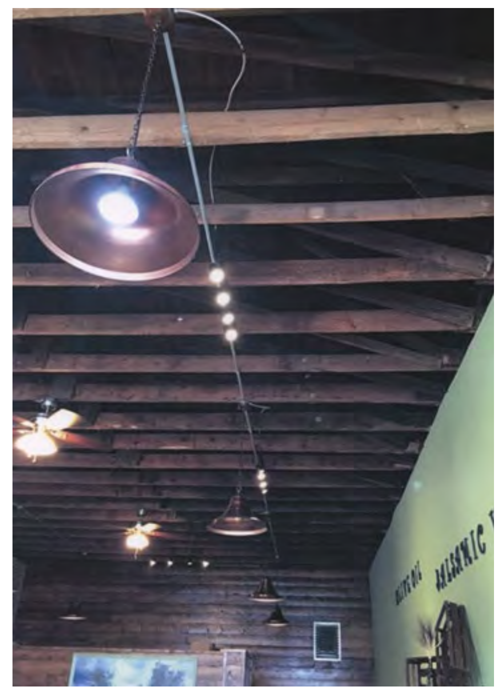
INTERIOR SPACES, FEATURES, AND FINISHES

RECOMMENDED	NOT RECOMMENDED
Replacing in kind an entire interior 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 wainscoting, window and door surrounds, or stairs. If using the same kind of material is not feasible, then a compatible substitute material may be considered.	Removing a character-defining interior feature that is unrepairable and not replacing it, or replacing it with a new feature or finish that does not match the historic feature. Using a substitute material for the replacement that does not convey the same appearance of the interior feature or that is physically incompatible. Using a substitute material for the replacement that does not convey the same appearance of the interior feature or that is physically incompatible.
The following work is highlighted to indicate that it is specific to **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.*	
Designing the Replacement for Missing Historic Features	
Designing and installing a new interior feature or finish when the historic feature or finish is completely missing. This could include missing walls, stairs, mantels, wood trim, and plaster, or even entire rooms if the historic spaces, features, and finishes are missing or have been destroyed by inappropriate alterations. The design may be an accurate restoration based on documentary and physical evidence, but only when the feature or finish to be replaced coexisted with the features currently in the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building.	Creating an inaccurate appearance because the replacement for the missing feature is based upon insufficient physical or historic documentation; is not a compatible design; or because the feature did not coexist with the feature currently on the building. Introducing a new interior feature or finish that is incompatible in size, scale, material, color, and finish.
Alterations and Additions for a New Use	
Installing new or additional systems required for a new use for the building, such as bathrooms and mechanical equipment, in secondary spaces to preserve the historic character of the most significant interior spaces.	Subdividing primary spaces, lowering ceilings, or damaging or obscuring character-defining features (such as fireplaces, windows, or stairways) to accommodate a new use for the building.

INTERIOR SPACES, FEATURES, AND FINISHES

RECOMMENDED	NOT RECOMMENDED
Installing new mechanical and electrical systems and ducts, pipes, and cables in closets, service areas, and wall cavities to preserve the historic character of interior spaces, features, and finishes.	Installing ducts, pipes, and cables where they will obscure character-defining features or negatively impact the historic character of the interior.
Creating open work areas, when required by the new use, by selectively removing walls only in secondary spaces, less significant upper floors, or other less-visible locations to preserve primary public spaces and circulation systems.	
Retaining the configuration of corridors, particularly in buildings with multiple floors with repetitive plans (such as office and apartment buildings or hotels), where not only the floor plan is character defining, but also the width and the length of the corridor, doorways, transoms, trim, and other features, such as wainscoting and glazing.	Making extensive changes to the character of significant historic corridors by narrowing or radically shortening them, or removing their character-defining features.
Reusing decorative material or features that had to be removed as part of the rehabilitation work (including baseboards, door casing, paneled doors, and wainscoting) and reusing them in areas where these features are missing or are too deteriorated to repair.	Discarding historic material when it can be reused to replace missing or damaged features elsewhere in the building, or reusing material in a manner that may convey a false sense of history.
Installing permanent partitions in secondary, rather than primary, spaces whenever feasible. Removable partitions or partial-height walls that do not destroy the sense of space often may be installed in large character-defining spaces when required by a new use.	Installing partitions that abut windows and glazing or that damage or obscure character-defining spaces, features, or finishes.
Enclosing a character-defining interior stairway, when required by code, with fire-rated glass walls or large, hold-open doors so that the stairway remains visible and its historic character is retained.	Enclosing a character-defining interior stairway for safety or functional reasons in a manner that conceals it or destroys its character.
Locating new, code-required stairways or elevators in secondary and service areas of the historic building.	Making incompatible changes or damaging or destroying character-defining spaces, features, or finishes when adding new code-required stairways and elevators.

[41] **Not Recommended**: Leaving fragments of deteriorated or "sculpted" plaster is not a compatible treatment for either finished or unfinished interior spaces.



[40] **Not Recommended:** Removing a finished ceiling and leaving the structure exposed in a historic retail space does not meet the Standards for Rehabilitation.

INTERIOR SPACES, FEATURES, AND FINISHES

RECOMMENDED	NOT RECOMMENDED
Creating an atrium, light court, or lightwell to provide natural light when required for a new use only when it can be done in a manner that preserves significant interior spaces, features, and finishes or important exterior elevations.	Destroying or damaging character-defining interior spaces, features, or finishes, or damaging the structural system to create an atrium, light court, or lightwell.
Inserting a new floor, mezzanine, or loft when required for a new use if it does not damage or destroy significant interior features and finishes and is not visible from the exterior of the building.	Inserting a new floor, mezzanine, or loft that damages or destroys significant interior features or abuts window glazing and is visible from the exterior of the building, and, thus, negatively impacts its historic character.
Inserting a new floor, when necessary for a new use, only in large assembly spaces that are secondary to another assembly space in the building; in a space that has been greatly altered; or where character-defining features have been lost or are too deteriorated to repair.	Inserting a new floor in significant, large assembly spaces with distinctive features and finishes, which negatively impacts their historic character.
Installing exposed ductwork in a finished space when necessary to protect and preserve decorative or other features (such as column capitals, ornamental plaster or pressed-metal ceilings, coffers, or beams) that is designed, painted, and appropriately located so that it will have minimal impact on the historic character of the space.	Installing exposed ductwork in a finished space when necessary to protect and preserve decorative or other features that is not painted, or is located where it will negatively impact the historic character of the space.
Lowering ceilings, installing a dropped ceiling, or constructing soffits to conceal ductwork in a finished space when they will not result in extensive loss or damage to historic materials or decorative and other features, and will not change the overall character of the space or the exterior appearance of the building (i.e., lowered ceilings or soffits visible through window glazing).	Lowering ceilings, installing a dropped ceiling, or constructing soffits to conceal ductwork in a finished space in a manner that results in extensive loss or damage to historic materials or decorative and other features, and will change the overall character of the space or the exterior appearance of the building.
Installing a split system mechanical unit in a manner that will have minimal impact on the historic character of the interior and will result in minimal loss of historic building material.	Installing a split system mechanical unit without considering its impact on the historic character of the interior or the potential loss of historic building material.

BUILDING SITE

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving features of the building site that are important in defining its overall historic character. Site features may include walls, fences, or steps; circulation systems, such as walks, paths or roads; vegetation, such as trees, shrubs, grass, orchards, hedges, windbreaks, or gardens; landforms, such as hills, terracing, or berms; furnishings and fixtures, such as light posts or benches; decorative elements, such as sculpture, statuary, or monuments; water features, including fountains, streams, pools, lakes, or irrigation ditches; and subsurface archeological resources, other cultural or religious features, or burial grounds which are also important to the site.	Removing or substantially 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.

[42] This garden is an important character-defining landscape feature on this college campus.

BUILDING SITE

RECOMMENDED	NOT RECOMMENDED
Retaining the historic relationship between buildings and the landscape.	Removing or relocating buildings or landscape features, thereby destroying the historic relationship between buildings and the landscape. Removing or relocating buildings on a site or in a complex of related historic structures (such as a mill complex or farm), thereby diminishing the historic character of the site or complex. Moving buildings onto the site, thereby creating an inaccurate historic appearance. Changing the grade level of the site if it diminishes its historic character. For example, lowering the grade adjacent to a building to maximize use of a basement, which would change the historic appearance of the building and its relation to the site.
Protecting and maintaining buildings and site features by providing proper drainage to ensure that water does not erode foundation walls, drain toward the building, or damage or erode the landscape.	Failing to ensure that site drainage is adequate so that buildings and site features are damaged or destroyed; or, alternatively, changing the site grading so that water does not drain properly.
Correcting any existing irrigation that may be wetting the building excessively.	Neglecting to correct any existing irrigation that may be wetting the building excessively.
Minimizing disturbance of the terrain around buildings or elsewhere on the site, thereby reducing the possibility of destroying or damaging important landscape features, archeological resources, other cultural or religious features, or burial grounds.	Using heavy machinery or equipment in areas where it may disturb or damage important landscape features, archeological resources, other cultural or religious features, or burial grounds.
Surveying and documenting areas where the terrain will be altered to determine the potential impact to important landscape features, archeological resources, other cultural or religious features, or burial grounds.	Failing to survey the building site prior to beginning work, which may result in damage or loss of important landscape features, archeological resources, other cultural or religious features, or burial grounds.

BUILDING SITE

RECOMMENDED	NOT RECOMMENDED
Protecting (e.g., preserving in place) important site features, archeological resources, other cultural or religious features, or burial grounds.	Leaving known site features or archeological material unprotected so that it is damaged during rehabilitation work.
Planning and carrying out any necessary investigation before rehabilitation begins, using professional archeologists and methods, when preservation in place is not feasible.	Allowing unqualified personnel to perform data recovery on archeological resources, which can result in damage or loss of important archeological material
Preserving important landscape features through regularly-scheduled maintenance of historic plant material.	Allowing important landscape features or archeological resources to be lost, damaged, or to deteriorate due to inadequate protection or lack of maintenance
Protecting the building site and landscape features against arson and vandalism before rehabilitation work begins by erecting temporary fencing and by installing alarm systems keyed into local protection agencies.	Leaving the property unprotected and subject to vandalism before work begins so that the building site and landscape features, archeological resources, other cultural or religious features, or burial grounds can be damaged or destroyed. Removing or destroying features from the site, such as fencing, paths or walkways, masonry balustrades, or plant material.
Installing protective fencing, bollards, and stanchions on a building site, when necessary for security, that are as unobtrusive as possible.	Installing protective fencing, bollards, and stanchions on a building site, when necessary for security, without taking into consideration their location and visibility so that they negatively impact the historic character of the site.
Providing continued protection and maintenance of buildings and landscape features on the site through appropriate grounds and landscape management.	Failing to protect and maintain materials and features from the restoration period on a cyclical basis so that deterioration of the site results.
Protecting buildings and landscape features when working on the site.	Failing to protect building and landscape features during work on the site or failing to repair damaged or deteriorated site features.

BUILDING SITE

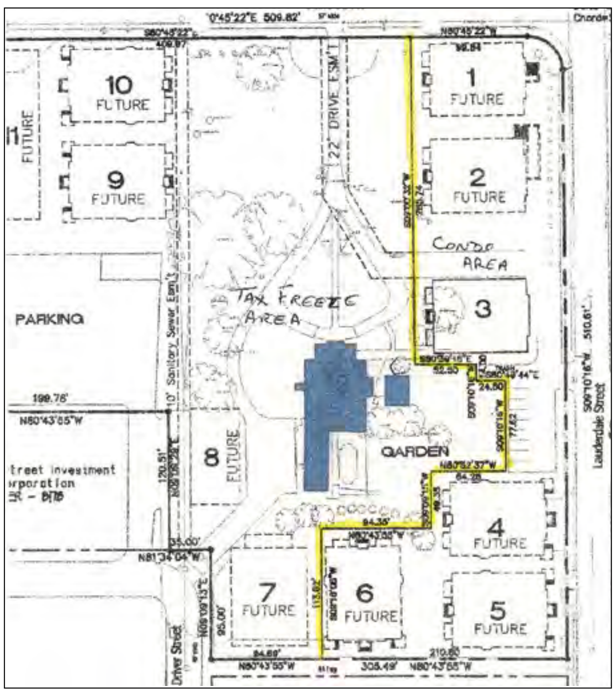
RECOMMENDED	NOT RECOMMENDED
Evaluating the overall condition of materials and features to determine whether more than protection and maintenance, such as repairs to site features, will be necessary.	Failing to undertake adequate measures to ensure the protection of the site.
Repairing historic site features which have been damaged, are deteriorated, or have missing components order reestablish the whole feature and to ensure retention of the integrity of the historic materials. Repairs may include limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing parts of site features when there are surviving prototypes, such as paving, railings, or individual plants within a group (e.g., a hedge). Repairs should be physically and visually compatible.	Removing materials and features that could be repaired or using improper repair techniques. Replacing an entire feature of the site (such as a fence, walkway, or drive) when repair of materials and limited replacement of deteriorated or missing components are feasible.

[43] The industrial character of the site was retained when this brewery complex was rehabilitated for residential use.

[44] **Not Recommended:** (a-b) The historic character of this plantation house (marked in blue on plan on opposite page) and its site was diminished and adversely impacted when multiple new buildings like this (#3 on plan) were constructed on the property (c).

BUILDING SITE

RECOMMENDED	NOT RECOMMENDED
Replacing in kind an entire feature of the site 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 a walkway or a fountain, a land form, or plant material. If using the same kind of material is not feasible, then a compatible substitute material may be considered.	Removing a character-defining feature of the site that is unrepairable and not replacing it, or replacing it with a new feature that does not match. Using a substitute material for the replacement that does not convey the same appearance of the surviving site feature or that is physically or ecologically incompatible. Adding conjectural landscape features to the site (such as period reproduction light fixtures, fences, fountains, or vegetation) that are historically inappropriate, thereby creating an inaccurate appearance of the site.



[45] Undertaking a survey to document archeological resources may be considered in some rehabilitation projects when a new exterior addition is planned.

BUILDING SITE

RECOMMENDED	NOT RECOMMENDED
The following work is highlighted to indicate that it is specific to **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.*	
Designing the Replacement for Missing Historic Features	
Designing and installing a new feature on a site when the historic feature is completely missing. This could include missing outbuildings, terraces, drives, foundation plantings, specimen trees, and gardens. The design may be an accurate restoration based on documentary and physical evidence, but only when the feature to be replaced coexisted with the features currently on the site. Or, it may be a new design that is compatible with the historic character of the building and site.	Creating an inaccurate appearance because the replacement for the missing feature is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature did not coexist with the features currently on the site. Introducing a new feature, including plant material, that is visually incompatible with the site or that alters or destroys the historic site patterns or use.
Alterations and Additions for a New Use	
Designing new onsite features (such as parking areas, access ramps, or lighting), when required by a new use, so that they are as unobtrusive as possible, retain the historic relationship between the building or buildings and the landscape, and are compatible with the historic character of the property.	Locating parking areas directly adjacent to historic buildings where vehicles may cause damage to buildings or landscape features or when they negatively impact the historic character of the building site if landscape features and plant materials are removed.
Designing new exterior additions to historic buildings or adjacent new construction that are compatible with the historic character of the site and preserves the historic relationship between the building or buildings and the landscape.	Introducing new construction on the building site which is visually incompatible in terms of size, scale, design, material, or color, which destroys historic relationships on the site, or which damages or destroys important landscape features, such as replacing a lawn with paved parking areas or removing mature trees to widen a driveway.
Removing non-significant buildings, additions, or site features which detract from the historic character of the site.	Removing a historic building in a complex of buildings or removing a building feature or a landscape feature which is important in defining the historic character of the site.
Locating an irrigation system needed for a new or continuing use of the site where it will not cause damage to historic buildings.	Locating an irrigation system needed for a new or continuing use of the site where it will damage historic buildings.

SETTING (DISTRICT / NEIGHBORHOOD)

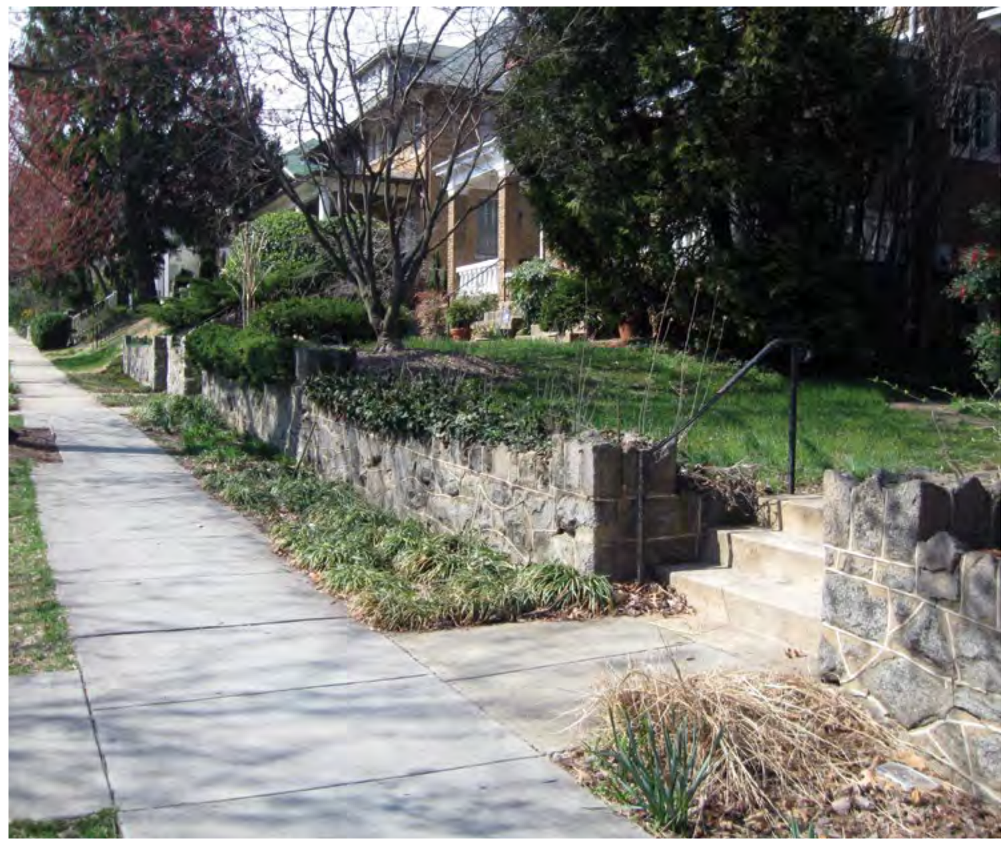
RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving building and landscape features that are important in defining the overall historic character of the setting. Such features can include circulation systems, such as roads and streets; furnishings and fixtures, such as light posts or benches; vegetation, gardens and yards; adjacent open space, such as fields, parks, commons, or woodlands; and important views or visual relationships.	Removing or substantially changing those building and landscape features in the setting which are important in defining the historic character so that, as a result, the character is diminished.

[46] The varied size, shapes, and architectural styles of these historic buildings are unique to this street in Christiansted, St. Croix, USVI, and should be retained in a rehabilitation project.

[47] Original paving stones contribute to the character of the historic setting and distinguish this block from other streets in the district.

SETTING (DISTRICT / NEIGHBORHOOD)

RECOMMENDED	NOT RECOMMENDED
Retaining the historic relationship between buildings and landscape features in the setting. For example, preserving the relationship between a town common or urban plaza and the adjacent houses, municipal buildings, roads, and landscape and streetscape features.	Altering the relationship between the buildings and landscape features in the setting by widening existing streets, changing landscape materials, or locating new streets or parking areas where they may negatively impact the historic character of the setting. Removing or relocating buildings or landscape features, thereby destroying the historic relationship between buildings and the landscape in the setting.



[48] Old police and fire call boxes, which are distinctive features in this historic district, have been retained, and now showcase work by local artists.

[49] Low stone walls are character-defining features in this hilly, early-20th-century residential neighborhood.

SETTING (DISTRICT / NEIGHBORHOOD)

RECOMMENDED	NOT RECOMMENDED
Protecting and maintaining historic features in the setting through regularly-scheduled maintenance and grounds and land-scape management.	Failing to protect and maintain materials in the setting on a cycli-cal basis so that deterioration of buildings and landscape features results. Stripping or removing historic features from buildings or the setting, such as a porch, fencing, walkways, or plant material.
Installing protective fencing, bollards, and stanchions in the setting, when necessary for security, that are as unobtrusive as possible.	Installing protective fencing, bollards, and stanchions in the setting, when necessary for security, without taking into consideration their location and visibility so that they negatively impact the historic character of the setting.
Protecting buildings and landscape features when undertaking work in the setting.	Failing to protect buildings and landscape features during work in the setting.
Evaluating the overall condition of materials and features to determine whether more than protection and maintenance, such as repairs to materials and features in the setting, will be necessary.	Failing to undertake adequate measures to ensure the protection of materials and features in the setting.
Repairing features in the setting by reinforcing the historic materials. Repairs may include the replacement in kind or with a compatible substitute material of those extensively deteriorated or missing parts of setting features when there are surviving pro-totypes, such as fencing, paving materials, trees, and hedgerows. Repairs should be physically and visually compatible.	Failing to repair and reinforce damaged or deteriorated historic materials and features in the setting. Removing material that could be repaired or using improper repair techniques. Replacing an entire feature of the building or landscape in the setting when repair of materials and limited replacement of deterio-rated or missing components are feasible.

SETTING (DISTRICT / NEIGHBORHOOD)

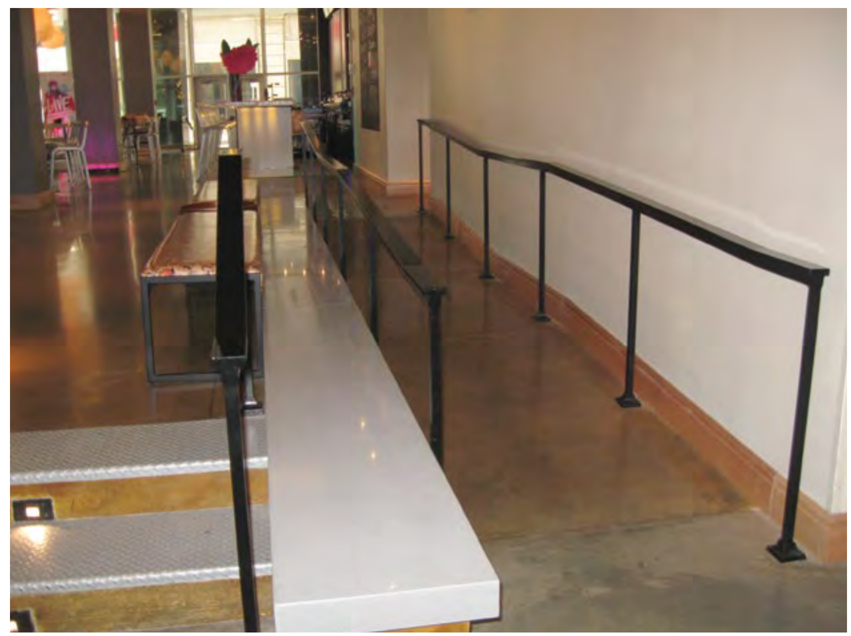
RECOMMENDED	NOT RECOMMENDED
Replacing in kind an entire building or landscape feature in the setting that is too deteriorated to repair (if the overall form and detailing are still evident) using the physical evidence as a model to reproduce the feature. If using the same kind of material is not feasible, then a compatible substitute material may be considered.	Removing a character-defining feature of the building or landscape from the setting that is unrepairable and not replacing it or replacing it with a new feature that does not match. Using a substitute material for the replacement that does not convey the same appearance of the surviving building or landscape feature in the setting or that is physically or ecologically incompatible.
The following work is highlighted to indicate that it is specific to **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.*	
Designing the Replacement for Missing Historic Features	
Designing and installing a new feature of the building or landscape in the setting when the historic feature is completely missing. This could include missing steps, streetlights, terraces, trees, and fences. The design may be an accurate restoration based on documentary and physical evidence, but only when the feature to be replaced coexisted with the features currently in the setting. Or, it may be a new design that is compatible with the historic character of the setting.	Creating an inaccurate appearance because the replacement for the missing feature is based upon insufficient physical or historic documentation; is not a compatible design, or because the feature did not coexist with the features currently in the setting. Introducing a new building or landscape feature that is visually or otherwise incompatible with the setting's historic character (e.g., replacing low metal fencing with a high wood fence).
Alterations and Additions for a New Use	
Designing new features (such as parking areas, access ramps, or lighting), when required by a new use, so that they are as unobtrusive as possible, retain the historic relationships between buildings and the landscape in the setting, and are compatible with the historic character of the setting.	Locating parking areas directly adjacent to historic buildings where vehicles may cause damage to buildings or landscape features or when they negatively impact the historic character of the setting if landscape features and plant materials are removed.
Designing new exterior additions to historic buildings or adjacent new construction that are compatible with the historic character of the setting that preserve the historic relationship between the buildings and the landscape.	Introducing new construction into historic districts which is visually incompatible or that destroys historic relationships within the setting, or which damages or destroys important landscape features.
Removing non-significant buildings, additions, or landscape features which detract from the historic character of the setting.	Removing a historic building, a building feature, or landscape feature which is important in defining the historic character of the setting.

CODE-REQUIRED WORK

RECOMMENDED	NOT RECOMMENDED
Sensitive solutions to meeting accessibility and life-safety code requirements are an important part of protecting the historic character of the building and site. Thus, work that must be done to meet use-specific code requirements should be considered early in planning a ***Rehabilitation*** *of a historic building for a new use. Because code mandates are directly related to occupancy, some uses require less change than others and, thus, may be more appropriate for a historic building. Early coordination with code enforcement authorities can reduce the impact of alterations necessary to comply with current codes.*	
ACCESSIBILITY	
Identifying the historic building's character-defining exterior features, interior spaces, features, and finishes, and features of the site and setting which may be affected by accessibility code-required work.	Undertaking accessibility code-required alterations before identifying those exterior features, interior spaces, features, and finishes, and features of the site and setting which are character defining and, therefore, must be preserved.
Complying with barrier-free access requirements in such a manner that the historic building's character-defining exterior features, interior spaces, features, and finishes, and features of the site and setting are preserved or impacted as little as possible.	Altering, damaging, or destroying character-defining exterior features, interior spaces, features, and finishes, or features of the site and setting while making modifications to a building, its site, or setting to comply with accessibility requirements.

[50] This kitchen in a historic apartment complex was rehabilitated to meet accessibility requirements.

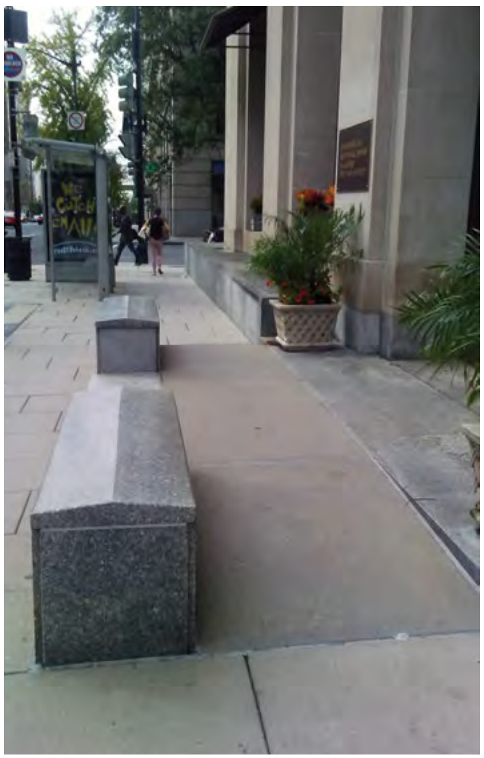
[51] A new interior access ramp with a simple metal railing is compatible with the character of this mid-century-modern building.



CODE-REQUIRED WORK

RECOMMENDED	NOT RECOMMENDED
Working with specialists in accessibility and historic preservation to determine the most sensitive solutions to comply with access requirements in a historic building, its site, or setting.	Making changes to historic buildings, their sites, or setting without first consulting with specialists in accessibility and historic preservation to determine the most appropriate solutions to comply with accessibility requirements.
Providing barrier-free access that promotes independence for the user while preserving significant historic features.	Making modifications for accessibility that do not provide independent, safe access while preserving historic features.
Finding solutions to meet accessibility requirements that minimize the impact of any necessary alteration on the historic building, its site, and setting, such as compatible ramps, paths, and lifts.	Making modifications for accessibility without considering the impact on the historic building, its site, and setting.

[52] The access ramp blends in with the stone façade of the First National Bank in Stephenville, TX, and is appropriately located on the side where it is does not impact the historic character of the building. *Photo: Nancy McCoy, QuimbyMcCoy Preservation Architecture, LLP.*



[53] This entrance ramp (right) is compatible with the historic character of this commercial building.

[54] The gently-sloped path in a historic park in Kansas City, MO, which accesses the memorial below, includes a rest area part way up the hill. *Photo: STRATA Architecture + Preservation.*

CODE-REQUIRED WORK

RECOMMENDED	NOT RECOMMENDED
Using relevant sections of existing codes regarding accessibility for historic buildings that provide alternative means of code compliance when code-required work would otherwise negatively impact the historic character of the property.	
Minimizing the impact of accessibility ramps by installing them on secondary elevations when it does not compromise accessibility or by screening them with plantings.	Installing elevators, lifts, or incompatible ramps at a primary entrance, or relocating primary entrances to secondary locations to provide access without investigating other options or locations.
Adding a gradual slope or grade to the sidewalk, if appropriate, to access the entrance rather than installing a ramp that would be more intrusive to the historic character of the building and the district.	
Adding an exterior stair or elevator tower that is compatible with the historic character of the building in a minimally-visible location only when it is not possible to accommodate it on the interior without resulting in the loss of significant historic spaces, features, or finishes.	
Installing a lift as inconspicuously as possible when it is necessary to locate it on a primary elevation of the historic building.	
Installing lifts or elevators on the interior in secondary or less significant spaces where feasible.	Installing lifts or elevators on the interior in primary spaces which will negatively impact the historic character of the space.

[55] The lift is compatible with the industrial character of this former warehouse.

CODE-REQUIRED WORK

RECOMMENDED	NOT RECOMMENDED
LIFE SAFETY	
Identifying the historic building's character-defining exterior features, interior spaces, features, and finishes, and features of the site and setting which may be affected by life-safety code-required work.	Undertaking life-safety code-required alterations before identifying those exterior features, interior spaces, features, and finishes, and features of the site and setting which are character defining and, therefore, must be preserved.
Complying with life-safety codes (including requirements for impact-resistant glazing, security, and seismic retrofit) in such a manner that the historic building's character-defining exterior features, interior spaces, features, and finishes, and features of the site and setting are preserved or impacted as little as possible.	Altering, damaging, or destroying character-defining exterior features, interior spaces, features, and finishes, or features of the site and setting while making modifications to a building, its site, or setting to comply with life-safety code requirements.
Removing building materials only after testing has been conducted to identify hazardous materials, and using only the least damaging abatement methods.	Removing building materials without testing first to identify the hazardous materials, or using potentially damaging methods of abatement.
Providing workers with appropriate personal equipment for protection from hazards on the worksite.	Removing hazardous or toxic materials without regard for workers' health and safety or environmentally-sensitive disposal of the materials.
Working with code officials and historic preservation specialists to investigate systems, methods, or devices to make the building compliant with life-safety codes to ensure that necessary alterations will be compatible with the historic character of the building.	Making life-safety code-required changes to the building without consulting code officials and historic preservation specialists, with the result that alterations negatively impact the historic character of the building.
Using relevant sections of existing codes regarding life safety for historic buildings that provide alternative means of code compliance when code-required work would otherwise negatively impact the historic character of the building.	

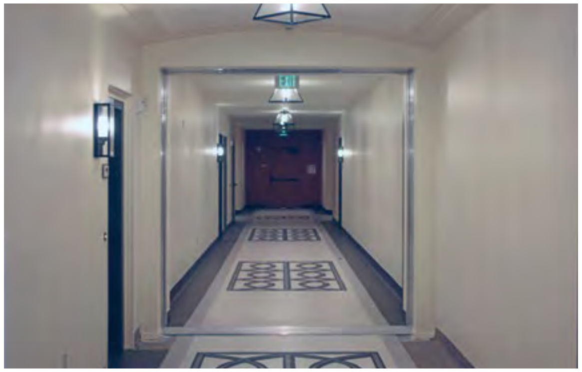
[56 a-b] In order to continue in its historic use, the door openings of this 1916 Colonial Revival-style fire station had to be widened to accommodate the larger size of modern fire trucks. Although this resulted in some change to the arched door surrounds, it is minimal and does not negatively impact the historic character of the building. (a) Above, before; *Photo: Fire and Emergency Medical Services Department (FEMS), Washington, D.C.;* below, after.

[57] Workers wear protective clothing while removing lead paint from metal features.

[59] (a-b) The decorative concrete balcony railings on this 1960s building did not meet life-safety code requirements. They were replaced with new glass railings with a fritted glass pattern matching the original design—a creative solution that satisfies codes, while preserving the historic appearance of the building when viewed from the street (c-d). *Photos: (a, b, d) ERA Architects, Inc.; (c) Nathan Cyprys, photographer*.

CODE-REQUIRED WORK

RECOMMENDED	NOT RECOMMENDED
Upgrading historic stairways and elevators to meet life-safety codes so that they are not damaged or otherwise negatively impacted.	Damaging or making inappropriate alterations to historic stairways and elevators or to adjacent features, spaces, or finishes in the process of doing work to meet code requirements.
Installing sensitively-designed fire-suppression systems, such as sprinklers, so that historic features and finishes are preserved.	Covering character-defining wood features with fire-retardant sheathing, which results in altering their appearance.
Applying fire-retardant coatings when appropriate, such as intumescent paint, to protect steel structural systems.	Using fire-retardant coatings if they will damage or obscure character-defining features.
Adding a new stairway or elevator to meet life-safety code requirements in a manner that preserves adjacent character-defining features and spaces.	Altering, damaging, or destroying character-defining spaces, features, or finishes when adding a new code-required stairway or elevator.
Using existing openings on secondary or less-visible elevations or, if necessary, creating new openings on secondary or less-visible elevations to accommodate second egress requirements.	Using a primary or other highly-visible elevation to accommodate second egress requirements without investigating other options or locations.
Placing a code-required stairway or elevator that cannot be accommodated within the historic building in a new exterior addition located on a secondary or minimally-visible elevation.	Constructing a new addition to accommodate code-required stairs or an elevator on character-defining elevations or where it will obscure, damage, or destroy character-defining features of the building, its site, or setting.
Designing a new exterior stairway or elevator tower addition that is compatible with the historic character of the building.	



[58] Fire doors that retract into the walls have been installed here (not visible in photo) preserve the historic character of this corridor.

RESILIENCE TO NATURAL HAZARDS

RECOMMENDED	NOT RECOMMENDED
Resilience to natural hazards should be addressed as part of the treatment ***Rehabilitation****. A historic building may have existing characteristics or features that help address or minimize the impacts of natural hazards. These should be used to best advantage and should be taken into consideration early in the planning stages of a rehabilitation project before proposing any new treatments. When new adaptive treatments are needed they should be carried out in a manner that will have the least impact on the historic character of the building, its site, and setting. .*	
Identifying the vulnerabilities of the historic property to the impacts of natural hazards (such as wildfires, hurricanes, or tornadoes) using the most current climate information and data available.	Failing to identify and periodically reevaluate the potential vulnerability of the building, its site, and setting to the impacts of natural hazards.
Assessing the potential impacts of known vulnerabilities on character-defining features of the building, its site, and setting; and reevaluating and reassessing potential impacts on a regular basis.	
Documenting the property and character-defining features as a record and guide for future repair work, should it be necessary, and storing the documentation in a weatherproof location.	Failing to document the historic property and its character-defining features with the result that such information is not available in the future to guide repair or reconstruction work, should it be necessary.
Ensuring that historic resources inventories and maps are accurate, up to date, and accessible in times of emergency.	
Maintaining the building, its site, and setting in good repair, and regularly monitoring character-defining features.	Failing to regularly monitor and maintain the property and the building systems in good repair.
Using and maintaining existing characteristics and features of the historic building, its site, setting, and larger environment (such as shutters for storm protection or a site wall that keeps out flood waters) that may help to avoid or minimize the impacts of natural hazards	Allowing loss, damage, or destruction to occur to the historic building, its site, or setting by failing to evaluate potential future impacts of natural hazards or to plan and implement adaptive measures, if necessary to address possible threats.
Undertaking work to prevent or minimize the loss, damage, or destruction of the historic property while retaining and preserving significant features and the overall historic character of the building, its site, and setting.	Carrying out adaptive measures intended to address the impacts of natural hazards that are unnecessarily invasive or will otherwise adversely impact the historic character of the building, its site, or setting.

[60] In some instances, it may be necessary to elevate a historic building located in a floodplain to protect it. But this treatment is appropriate only if elevating the building will retain its historic character, including its relationship to the site, and its new height will be compatible with surrounding buildings if in a historic district. The house on the right, which has been raised only slightly, has retained its historic character. The house on the left has been raised several feet higher, resulting in a greater impact on the historic character of the house and the district.

RESILIENCE TO NATURAL HAZARDS

RECOMMENDED	NOT RECOMMENDED
Ensuring that, when planning work to adapt for natural hazards, all feasible alternatives are considered, and that the options requiring the least alteration are considered first.	
Implementing local and regional traditions (such as elevating residential buildings at risk of flooding or reducing flammable vegetation around structures in fire-prone areas) for adapting buildings and sites in response to specific natural hazards, when appropriate. Such traditional methods may be appropriate if they are compatible with the historic character of the building, its site, and setting.	Implementing a treatment traditionally used in another region or one typically used for a different property type or architectural style which is not compatible with the historic character of the property.
Using special exemptions and variances when adaptive treatments to protect buildings from known hazards would otherwise negatively impact the historic character of the building, its site, and setting.	
Considering adaptive options, whenever possible, that would protect multiple historic resources, if the treatment can be implemented without negatively impacting the historic character of the district, or archeological resources, other cultural or religious features, or burial grounds.	

Sustainability

Sustainability is usually a very important and integral part of the treatment **Rehabilitation.** Existing energy-efficient features should be taken into consideration early in the planning stages of a rehabilitation project before proposing any energy improvements. There are numerous treatments that may be used to upgrade a historic building to help it operate more efficiently while retaining its character.

The topic of sustainability is addressed in detail in **The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings.**

NEW EXTERIOR ADDITIONS TO HISTORIC BUILDINGS AND RELATED NEW CONSTRUCTION

RECOMMENDED	NOT RECOMMENDED
New Additions	
Placing functions and services required for a new use (including elevators and stairways) in secondary or non-character-defining interior spaces of the historic building rather than constructing a new addition.	Expanding the size of the historic building by constructing a new addition when requirements for the new use could be met by altering non-character-defining interior spaces.
Constructing a new addition on a secondary or non-character-defining elevation and limiting its size and scale in relationship to the historic building.	Constructing a new addition on or adjacent to a primary elevation of the building which negatively impacts the building's historic character.
Constructing a new addition that results in the least possible loss of historic materials so that character-defining features are not obscured, damaged, or destroyed.	Attaching a new addition in a manner that obscures, damages, or destroys character-defining features of the historic building.
Designing a new addition that is compatible with the historic building.	Designing a new addition that is significantly different and, thus, incompatible with the historic building.
Ensuring that the addition is subordinate and secondary to the historic building and is compatible in massing, scale, materials, relationship of solids to voids, and color.	Constructing a new addition that is as large as or larger than the historic building, which visually overwhelms it (i.e., results in the diminution or loss of its historic character).

NEW EXTERIOR ADDITIONS TO HISTORIC BUILDINGS AND RELATED NEW CONSTRUCTION

RECOMMENDED	NOT RECOMMENDED
Using the same forms, materials, and color range of the historic building in a manner that does not duplicate it, but distinguishes the addition from the original building.	Duplicating the exact form, material, style, and detailing of the historic building in a new addition so that the new work appears to be historic.
Basing the alignment, rhythm, and size of the window and door openings of the new addition on those of the historic building.	
Incorporating a simple, recessed, small-scale hyphen, or connection, to physically and visually separate the addition from the historic building.	
Distinguishing the addition from the original building by setting it back from the wall plane of the historic building.	

[61 a-b] The materials, design, and location at the back of the historic house are important factors in making this a compatible new addition. *Photos: © Maxwell MacKenzie.*

NEW EXTERIOR ADDITIONS TO HISTORIC BUILDINGS AND RELATED NEW CONSTRUCTION

RECOMMENDED	NOT RECOMMENDED
Ensuring that the addition is stylistically appropriate for the historic building type (e.g., whether it is residential or institutional).	
Considering the design for a new addition in terms of its relationship to the historic building as well as the historic district, neighborhood, and setting.	

[62] The stair tower at the rear of this commercial building is a compatible new addition.

NEW EXTERIOR ADDITIONS TO HISTORIC BUILDINGS AND RELATED NEW CONSTRUCTION

RECOMMENDED	NOT RECOMMENDED
Rooftop Additions	
Designing a compatible rooftop addition for a multi-story building, when required for a new use, that is set back at least one full bay from the primary and other highly-visible elevations and that is inconspicuous when viewed from surrounding streets.	Constructing a rooftop addition that is highly visible, which negatively impacts the character of the historic building, its site, setting, or district.

[63] (a) A mockup should be erected to demonstrate the visibility of a proposed rooftop addition and its potential impact on the historic building. Based on review of this mockup (orange marker), it was determined that the rooftop addition would meet the Standards (b). The addition is unobtrusive and blends in with the building behind it.

NEW EXTERIOR ADDITIONS TO HISTORIC BUILDINGS AND RELATED NEW CONSTRUCTION

RECOMMENDED	NOT RECOMMENDED
Limiting a rooftop addition to one story in height to minimize its visibility and its impact on the historic character of the building.	Constructing a highly-visible, multi-story rooftop addition that alters the building's historic character. Constructing a rooftop addition on low-rise, one- to three-story historic buildings that is highly visible, overwhelms the building, and negatively impacts the historic district. Constructing a rooftop addition with amenities (such as a raised pool deck with plantings, HVAC equipment, or screening) that is highly visible and negatively impacts the historic character of the building.

[64] **Not Recommended:** It is generally not appropriate to construct a rooftop addition on a low-rise, two- to three-story building such as this, because it negatively affects its historic character.

NEW EXTERIOR ADDITIONS TO HISTORIC BUILDINGS AND RELATED NEW CONSTRUCTION

RECOMMENDED	NOT RECOMMENDED
Related New Construction	
Adding a new building to a historic site or property only if the requirements for a new or continuing use cannot be accommodated within the existing structure or structures.	Adding a new building to a historic site or property when the project requirements could be accommodated within the existing structure or structures.
Locating new construction far enough away from the historic building, when possible, where it will be minimally visible and will not negatively affect the building's character, the site, or setting.	Placing new construction too close to the historic building so that it negatively impacts the building's character, the site, or setting.

[65] (a) This (far left) is a compatible new outbuilding constructed on the site of a historic plantation house (b). Although traditional in design, it is built of wood to differentiate it from the historic house (which is scored stucco) located at the back of the site so as not to impact the historic house, and minimally visible from the public right-of-way (c).

NEW EXTERIOR ADDITIONS TO HISTORIC BUILDINGS AND RELATED NEW CONSTRUCTION

RECOMMENDED	NOT RECOMMENDED
Designing new construction on a historic site or in a historic setting that it is compatible but differentiated from the historic building or buildings.	Replicating the features of the historic building when designing a new building, with the result that it may be confused as historic or original to the site or setting.
Considering the design for related new construction in terms of its relationship to the historic building as well as the historic district and setting.	
Ensuring that new construction is secondary to the historic building and does not detract from its significance.	Adding new construction that results in the diminution or loss of the historic character of the building, including its design, materials, location, or setting. Constructing a new building on a historic property or on an adjacent site that is much larger than the historic building. Designing new buildings or groups of buildings to meet a new use that are not compatible in scale or design with the character of the historic building and the site, such as apartments on a historic school property that are too residential in appearance.
Using site features or land formations, such as trees or sloping terrain, to help minimize the new construction and its impact on the historic building and property.	
Designing an addition to a historic building in a densely-built location (such as a downtown commercial district) to appear as a separate building or infill, rather than as an addition. In such a setting, the addition or the infill structure must be compatible with the size and scale of the historic building and surrounding buildings—usually the front elevation of the new building should be in the same plane (i.e., not set back from the historic building). This approach may also provide the opportunity for a larger addition or infill when the façade can be broken up into smaller elements that are consistent with the scale of the historic building and surrounding buildings.	

STANDARDS FOR RESTORATION & GUIDELINES FOR RESTORING HISTORIC BUILDINGS

Restoration

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

Standards for Restoration

1. A property will be used as it was historically or be given a new use that interprets the property and its restoration period.
2. Materials and features from the restoration period will be retained and preserved. The removal of materials or alteration of features, spaces and spatial relationships that characterize the period will not be undertaken.
3. Each property will be recognized as a physical record of its time, place and use. Work needed to stabilize, consolidate and conserve materials and features from the restoration period will be physically and visually compatible, identifiable upon close inspection and properly documented for future research.
4. Materials, features, spaces and finishes that characterize other historical periods will be documented prior to their alteration or removal.
5. Distinctive materials, features, finishes and construction techniques or examples of craftsmanship that characterize the restoration period will be preserved.
6. Deteriorated features from the restoration period will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture and, where possible, materials.
7. Replacement of missing features from the restoration period will be substantiated by documentary and physical evidence. A false sense of history will not be created by adding conjectural features, features from other properties, or by combining features that never existed together historically.
8. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.
9. Archeological resources affected by a project will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.
10. Designs that were never executed historically will not be constructed.

GUIDELINES FOR RESTORING HISTORIC BUILDINGS

INTRODUCTION

Restoration is the treatment that should be followed when the expressed goal of the project is to make the building appear as it did at a particular—and at its most significant—time in its history. The guidance provided by the **Standards for Restoration and Guidelines for Restoring Historic Buildings** is to first ***identify*** the materials and features from the *restoration period*. After these materials and features have been identified, they should be maintained, protected, repaired, and replaced, when necessary. Unlike the other treatments in which most, if not all, of the historic elements are retained, restoration will likely include the removal of features from other periods. Missing features from the *restoration period* should be *replaced*, based on physical or historic documentation, with either the same or compatible substitute materials. Only those designs that can be documented as having been built should be recreated in a restoration project.

Identify, Retain, and Preserve Materials and Features from the Restoration Period

The guidance for the treatment **Restoration** begins with recommendations to identify the form and detailing of those architectural materials and features that are significant to the *restoration period* as established by historic research and documentation. Therefore, guidance on ***identifying, retaining, and preserving*** features from the *restoration period* is always given first.

Protect and Maintain Materials and Features from the Restoration Period

After identifying those materials and features from the *restoration period* that must be retained in the process of **Restoration** work, then ***protecting and maintaining*** them are addressed. Protection generally involves the least degree of intervention and is preparatory to other work. Protection includes the maintenance of materials and features from the *restoration period* as well as ensuring that the property is protected before and during restoration work. An overall evaluation of the physical condition of the features from the *restoration period* should always begin at this level.

Repair (Stabilize, Consolidate, and Conserve) Materials and Features from the Restoration Period

Next, when the physical condition of *restoration-period* features requires additional work, repairing by ***stabilizing, consolidating, and conserving*** is recommended. **Restoration** guidance focuses on the preservation of those materials and features that are significant to the period. In **Restoration**, repair may include the limited replacement in kind or with a compatible substitute material of extensively deteriorated or missing components of existing *restoration-period* features when there are surviving prototypes to use as a model.

Replace Extensively Deteriorated Features from the Restoration Period

In **Restoration**, ***replacing*** an entire feature from the *restoration period,* such as a porch, that is too deteriorated to repair may be appropriate. Together with documentary evidence, the form and detailing of the historic feature should be used as a model for the replacement. Using the same kind of material is preferred; however, compatible substitute material may be considered. New work may be unobtrusively dated to guide future research and treatment.

Remove Existing Features from Other Historic Periods

Most buildings change over time, but in **Restoration** the goal is to depict the building as it appeared at the most significant time in its history. Thus, it may involve ***removing*** or altering existing historic features that do not represent the *restoration period*. Materials, features, spaces, and finishes that characterize other historical periods should be documented to guide future research and treatment prior to their alteration or removal.

Recreate Missing Features from the Restoration Period

Most **Restoration** projects involve ***recreating*** features that were significant to the building during the *restoration period*, such as a porch, but are now missing. Missing features to be replaced should be substantiated by documentary and physical evidence to ensure the restoration is accurate. Using the same materials to depict lost features is always the preferred approach; however, using compatible substitute material is an acceptable alternative in **Restoration** because the goal of this treatment is to replicate the *appearance* of the historic building at a particular time.

If documentary and physical evidence are not available to provide an accurate recreation of missing features, the treatment Rehabilitation might be a better overall approach to project work.

Code-Required Work: Accessibility and Life Safety

Sensitive solutions to meeting code requirements in a **Restoration** project are an important part of protecting the historic character of the building. Work that must be done to meet accessibility and life-safety requirements must also be assessed for its potential impact on the historic building as it is restored.

Resilience to Natural Hazards

Resilience to natural hazards should be addressed as part of a **Restoration** project. A historic building may have existing characteristics or features that help to address or minimize the impacts of natural hazards. These should always be used to best advantage when planning new adaptive treatments that have the least impact on the historic character of the building, its site, and setting.

Sustainability

Sustainability should be addressed as part of a **Restoration** project. Good preservation practice is often synonymous with sustainability. Existing energy-efficient features should be retained and repaired. New sustainability treatments should generally be limited to updating existing features and systems to have the least impact on the historic character of the building.

The topic of sustainability is addressed in detail in *The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings*. Although specifically developed for the treatment Rehabilitation, the Sustainability Guidelines can be used to help guide the other treatments.

Restoration as a Treatment. *When the property's design, architectural, or historical significance during a particular period of time outweighs the potential loss of extant materials, features, spaces, and finishes that characterize other historical periods; when there is substantial physical and documentary evidence for the work; and when contemporary alterations and additions are not planned, Restoration may be considered as a treatment. Prior to undertaking work, a particular period of time, i.e., the restoration period, should be selected and justified, and a documentation plan for Restoration developed.*

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining and preserving masonry features from the restoration period (such as walls, brackets, railings, cornices, window and door surrounds, steps, and columns) and decorative ornament and other details, such as tooling and bonding patterns, coatings, and color.	Altering masonry features from the restoration period. Failing to document masonry features from the restoration period, which may result in their loss. Applying paint or other coatings (such as stucco) to restoration-period masonry features, or removing them, if such treatments cannot be documented to the restoration period. Changing the type of paint or coating or the color of restoration-period masonry features, unless the work can be substantiated by historical documentation.
Protecting and maintaining masonry features from the restoration period by ensuring that historic drainage features and systems that divert rainwater from masonry surfaces (such as roof overhangs, gutters, and downspouts) are intact and functioning properly.	Failing to identify and treat the causes of masonry deterioration, such as leaking roofs and gutters or rising damp.

[1] (a) When it was acquired by the National Trust for Historic Preservation in the 1980s, Montpelier in Montpelier Station, VA, the home of James and Dolley Madison, had been much altered and enlarged since it was first constructed. Based on historical documentation and research, Montpelier was accurately restored to its 1820s appearance when the president and his wife lived there (b). *Photos: Courtesy of The Montpelier Foundation.*

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Cleaning masonry only when necessary to halt deterioration or remove heavy soiling.	Cleaning masonry surfaces from the restoration period when they are not heavily soiled to create a "like-new" appearance, thereby needlessly introducing chemicals or moisture into historic materials.
Carrying out masonry cleaning tests when it has been determined that cleaning is appropriate. Test areas should be examined to ensure that no damage has resulted and, ideally, monitored over a sufficient period of time to allow long-range effects to be predicted.	Cleaning masonry surfaces without testing or without sufficient time for the testing results to be evaluated.
Cleaning soiled restoration-period masonry surfaces with the gentlest method possible, such as using low-pressure water and detergent and natural bristle or other soft-bristle brushes.	Cleaning or removing paint from masonry surfaces from the restoration period using most abrasive methods (including sandblasting, other media blasting, or high-pressure water) which can damage the surface of the masonry and mortar joints. Using a cleaning or paint-removal method that involves water or liquid chemical solutions when there is any possibility of freezing temperatures. Cleaning with chemical products that will damage some types of masonry (such as using acid on limestone or marble), or failing to neutralize or rinse off chemical cleaners from masonry surfaces.
Using biodegradable or environmentally-safe cleaning or paint-removal products.	
Using paint-removal methods that employ a poultice to which paint adheres, when possible, to neatly and safely remove old lead paint.	
Using coatings that encapsulate lead paint, when possible, where paint is not required to be removed to meet environmental regulations.	
Allowing only trained conservators to use abrasive or laser cleaning methods, when necessary, to clean hard-to-reach, highly-carved, or detailed decorative stone features.	

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Removing damaged or deteriorated paint only to the next sound layer using the gentlest method possible (e.g., hand scraping) prior to repainting.	Removing paint that is firmly adhered to masonry surfaces.
Applying compatible paint coating systems to historically-painted, restoration-period masonry following proper surface preparation.	Failing to follow manufacturers' product and application instructions when repainting masonry features.
Repainting historically-painted masonry features with colors that are documented to the restoration period of the building (i.e., verifying through paint analysis).	Using paint colors on historically-painted masonry features that are not documented to the restoration period.
Protecting adjacent restoration-period materials when cleaning or removing paint from masonry features from the restoration period.	Failing to protect adjacent restoration-period materials when cleaning or removing paint from masonry features from the restoration period.
Evaluating the overall condition of masonry from the restoration period to determine whether more than protection and maintenance, such as repairs to masonry features will be necessary.	Failing to undertake adequate measures to ensure the protection of masonry features from the restoration period.
Repairing masonry features from the restoration period by patching, splicing, consolidating, or otherwise reinforcing the masonry using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing components of masonry features from the restoration period when there are surviving prototypes (such as terra-cotta brackets or stone balusters) or when the replacement can be based on physical or historic documentation. The new work should match the old in material, design, scale, color, and finish.	Removing masonry from the restoration period that could be stabilized, repaired, and conserved, or using untested consolidants and unskilled personnel, potentially causing further damage to materials.

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Repairing masonry walls and other masonry features from the restoration period by repointing the mortar joints where there is evidence of deterioration, such as disintegrating mortar, cracks in mortar joints, loose bricks, or damaged plaster.	
Removing deteriorated lime mortar from the restoration period carefully by hand raking the joints to avoid damaging the masonry.	Removing restoration-period mortar that is not deteriorated from sound joints.

[2] (a) Decatur House in Washington, DC, was designed by William Henry Latrobe and constructed in 1816. (b) In the late-19th century, the façade was "modernized" by removing the limestone lintels on the first floor and replacing them with decorative sandstone lintels in the style of the period. (c) In the mid-20th century, the house was brought back to its original appearance based on historic documentation. Photos: The White House Historical Association and Decatur House, a National Trust Site.

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Using power tools only on horizontal joints on restoration-period brick masonry in conjunction with hand chiseling to remove hard mortar that is deteriorated or that is a non-historic material which is causing damage to the masonry units. Mechanical tools should be used only by skilled masons in limited circumstances and generally not on short, vertical joints in brick masonry.	Allowing unskilled workers to use masonry saws or mechanical tools to remove deteriorated mortar from joints prior to repointing.
Duplicating historic mortar joints in strength, composition, color, and texture when repointing is necessary. In some cases, a lime-based mortar may also be considered when repointing Portland cement mortar joints because it is more flexible.	Repointing masonry units with mortar of high Portland cement content (unless it is the content of the mortar from the restoration period).
Duplicating restoration-period mortar joints in width and joint profile when repointing is necessary.	Using “surface grouting” or a “scrub” coating technique, such as a “sack rub” or “mortar washing,” to repoint exterior masonry units from the restoration period instead of traditional repointing methods. Changing the width or joint profile when repointing masonry from the restoration period.

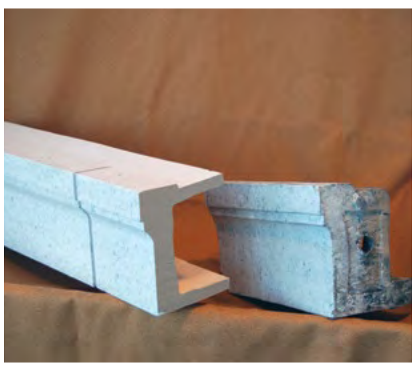
[3] **Not Recommended:** Although the Dutchman stone repair has been well executed, the replacement stone is not a good color match.

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Repairing stucco from the restoration period by removing the damaged material and patching with new material that duplicates the historic stucco in strength, composition, color, and texture.	Removing sound stucco from the restoration period or repairing with new stucco that is different in composition from the historic stucco. Patching stucco or concrete from the restoration period without removing the source of deterioration. Replacing deteriorated stucco from the restoration period with synthetic stucco, an exterior finish and insulation system (EFIS), or other non-traditional materials.
Using mud plaster or a compatible lime-plaster adobe render, when appropriate, to repair adobe from the restoration period.	Applying cement stucco, unless it already exists, to adobe from the restoration period.
Sealing joints in concrete from the restoration period with appropriate flexible sealants and backer rods, when necessary.	Repointing masonry units from the restoration period (other than concrete) with a synthetic caulking compound instead of mortar.
Cutting damaged concrete from the restoration period back to remove the source of deterioration, such as corrosion on metal reinforcement bars. The new patch must be applied carefully so that it will bond satisfactorily with and match the historic concrete.	Patching concrete from the restoration period without removing the source of deterioration.
Using a non-corrosive, stainless-steel anchoring system when replacing damaged stone, concrete, or terra-cotta units from the restoration period that have failed.	
Repairing masonry features from the restoration period by patching, splicing, consolidating, or otherwise reinforcing the masonry using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing components of masonry features from the restoration period when there are surviving prototypes (such as terra-cotta brackets or stone balusters) or when the replacement can be based on physical or historic documentation. The new work should match the old in material, design, scale, color, and finish.	Removing masonry from the restoration period that could be stabilized, repaired, and conserved, or using untested consolidants, improper repair techniques, or unskilled personnel, potentially causing further damage to materials. Replacing an entire masonry feature from the restoration period, such as a cornice or balustrade, when repair of the masonry and limited replacement of deteriorated or missing components are appropriate.

[4] (a) Over the years terra-cotta cladding had been replaced on the lower floors of this early-20th century bank building with a storefront and incompatible windows. (b) A 1936 photograph of the building provided the documentation to restore its historic appearance. (c) Glass fiber reinforced plastic (GRFP) was chosen as a substitute material, and samples were made in a variety of colors and textures to obtain the best match for the missing and damaged terra cotta. (d) This photo taken after restoration shows that the GFRP replacements successfully blend in with the original terra cotta. *Photo (d): Blamonet at English Wikipedia.*

(a)



(c)

(d)

(b)

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Applying non-historic surface treatments, such as water-repellent coatings, to masonry from the restoration period only after repointing and only if masonry repairs have failed to arrest water penetration problems.	Applying waterproof, water-repellent, or other coatings that are not from the restoration period (such as stucco) to masonry as a substitute for repointing and masonry repairs.
Applying permeable, anti-graffiti coatings to masonry from the restoration period when appropriate.	Applying water-repellent or anti-graffiti coatings that change the historic appearance of the masonry from the restoration period or that may trap moisture if the coating is not sufficiently permeable.
Replacing in kind an entire masonry feature from the restoration period 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 a wall, a cornice, balustrade, pier, or parapet. If using the same kind of material is not feasible, then a compatible substitute material may be considered. The new work may be unobtrusively dated to guide future research and treatment.	Removing a masonry feature from the restoration period that is unrepairable and not replacing it, or replacing it with a new feature that does not match. Using a substitute material for the replacement that does not convey the same appearance of the surviving components of the masonry.
The following Restoration *work is highlighted to indicate that it involves the removal or alteration of existing historic masonry features that would be retained in Preservation and Rehabilitation treatments; and the replacement of missing masonry features from the restoration period using all new materials.*	
Removing Existing Features from Other Historic Periods	
Removing masonry features from other historic periods, such as a door surround, porch, or steps.	Failing to remove a masonry feature from another period, thereby confusing the depiction of the building's appearance from the restoration period.
Documenting masonry features dating from other periods prior to their alteration or removal. If possible, selected examples of these features or materials should be stored for future research.	Failing to document masonry features from other historic periods that are removed from the building so that a valuable portion of the historic record is lost.
Recreating Missing Features from the Restoration Period	
Recreating a missing masonry feature that existed during the restoration period based on documentary and physical evidence; for example, duplicating a terra-cotta bracket or stone balustrade. The new work may be unobtrusively dated to guide future research and treatment.	Constructing a masonry feature that was part of the original design for the building but was never actually built, or a feature which was thought to have existed during the restoration period but which cannot be documented.

WOOD: CLAPBOARD, WEATHERBOARD, SHINGLES, AND OTHER FUNCTIONAL AND DECORATIVE ELEMENTS

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving wood features from the restoration period (such as siding, cornices, brackets, window and door surrounds, and steps) and their paints, finishes, and colors.	Altering wood features from the restoration period. Failing to document wood features from the restoration period, which may result in their loss. Applying paint or other coatings to restoration-period wood features, or removing them, if such treatments cannot be documented to the restoration period. Changing the type of paint or coating or the color of restoration-period wood features, unless the work can be substantiated by historical documentation.
Protecting and maintaining wood features from the restoration period by ensuring that historic drainage features that divert rainwater from wood surfaces (such as roof overhangs, gutters, and downspouts) are intact and functioning properly.	Failing to identify and treat the causes of wood deterioration, such as faulty flashing, leaking gutters, cracks and holes in siding, deteriorated caulking in joints and seams, plant material growing too close to wood surfaces, or insect or fungal infestation.
Applying chemical preservatives or paint to wood features from the restoration period that are subject to weathering, such as exposed beam ends, outriggers, or rafter tails.	Using chemical preservatives that can change the appearance of wood features from the restoration period.
Implementing an integrated pest management plan to identify appropriate preventive measures to guard against insect damage, such as installing termite guards, fumigating, and treating with chemicals.	
Retaining coatings from the restoration period (such as paint) that protect the wood from moisture and ultraviolet light. Paint removal should be considered only when there is paint surface deterioration and as part of an overall maintenance program which involves repainting or applying other appropriate coatings.	Stripping restoration-period paint or other coatings from wood features without recoating them.
Using biodegradable or environmentally-safe cleaning or paint-removal products.	

WOOD: CLAPBOARD, WEATHERBOARD, SHINGLES, AND OTHER FUNCTIONAL AND DECORATIVE ELEMENTS

RECOMMENDED	NOT RECOMMENDED
Using thermal devices (such as infrared heaters) carefully to remove paint, when it is so deteriorated that total removal is necessary prior to repainting.	Using a thermal device to remove paint from wood features without first checking for and removing any flammable debris behind them. Using thermal devices without limiting the amount of time the wood is exposed to heat.
Using paint-removal methods that employ a poultice to which paint adheres, when possible, to neatly and safely remove old lead paint.	
Using coatings that encapsulate lead paint, when possible, where the paint is not required to be removed to meet environmental regulations.	
Using chemical strippers primarily to supplement other methods such as hand scraping, hand sanding, and thermal devices.	Failing to neutralize the wood thoroughly after using chemical paint removers so that new paint may not adhere. Removing paint from detachable, restoration-period wood features by soaking them in a caustic solution which can roughen the surface, split the wood, or result in staining from residual acid leaching out through the wood.
Removing damaged or deteriorated paint to the next sound layer using the gentlest method possible (e.g., hand scraping and hand sanding) prior to repainting.	Using potentially-damaging paint-removal methods on restoration-period wood surfaces, such as open-flame torches, orbital sanders, abrasive methods (including sandblasting, other media blasting, or high-pressure water), or caustic paint-removers. Removing paint that is firmly adhered to wood surfaces.
Applying compatible paint coating systems to historically-painted wood following proper surface preparation.	Failing to follow manufacturers' product and application instructions when repainting wood features from the restoration period.
Repainting historically-painted wood features with colors that are documented to the restoration period of the building (i.e., verifying through paint analysis).	Using paint colors on historically-painted wood features that are not documented to the restoration period.

WOOD: CLAPBOARD, WEATHERBOARD, SHINGLES, AND OTHER FUNCTIONAL AND DECORATIVE ELEMENTS

RECOMMENDED	NOT RECOMMENDED
Protecting adjacent restoration-period materials when cleaning or removing paint from wood features from the restoration period.	Failing to protect adjacent restoration-period materials when cleaning or removing paint from wood features from the restoration period.
Evaluating the overall condition of wood features from the restoration period to determine whether more than protection and maintenance, such as repairs to wood features, will be necessary.	Failing to undertake adequate measures to ensure the protection of wood features from the restoration period.
Repairing wood features from the restoration period by patching, splicing, consolidating, or otherwise reinforcing the wood using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing components of features from the restoration period when there are surviving prototypes (such as brackets, molding, or sections of siding) or when the replacement can be based on physical or historic documentation. The new work should match the old in material, design, scale, color, and finish.	Removing wood features from the restoration period that could be stabilized, repaired, and conserved, or using untested consolidants or unskilled personnel, potentially causing further damage to historic materials. Replacing an entire wood feature from the restoration period, such as a cornice or porch railing, when repair of the wood and limited replacement of deteriorated or missing components are appropriate.
Replacing in kind an entire wood feature from the restoration period 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 or when the replacement can be based on historic documentation. Examples can include a cornice, entablature, or a balustrade. If using the same kind of material is not feasible, then a compatible substitute material may be considered. The new work may be unobtrusively dated to guide future research and treatment.	Removing a wood feature from the restoration period that is unrepairable and not replacing it, or replacing it with a new feature that does not match. Using substitute material for the replacement that does not convey the same appearance of the surviving components of the wood feature from the restoration period or that is physically incompatible.

WOOD: CLAPBOARD, WEATHERBOARD, SHINGLES, AND OTHER FUNCTIONAL AND DECORATIVE ELEMENTS

RECOMMENDED	NOT RECOMMENDED
The following **Restoration** *work is highlighted to indicate that it involves the removal or alteration of existing historic masonry features that would be retained in Preservation and Rehabilitation treatments; and the replacement of missing wood features from the restoration period using all new materials.*	
Removing Existing Features from Other Historic Periods	
Removing wood features from other historic periods, such as a door surround, porch, or steps.	Failing to remove a wood feature from another period, thereby confusing the depiction of the building's appearance from the restoration period.
Documenting wood features dating from other periods prior to their alteration or removal. If possible, selected examples of these features or materials should be stored for future research.	Failing to document wood features from other historic periods that are removed from the building so that a valuable portion of the historic record is lost.
Recreating Missing Features from the Restoration Period	
Recreating a missing wood feature that existed during the restoration period based on documentary and physical evidence; for example, duplicating a wood dormer or porch	Constructing a wood feature that was part of the original design for the building but was never actually built, or a feature which was thought to have existed during the restoration period but cannot be documented.

[5] New wood trim pieces were milled to match the few remaining historic features to replace those that were missing.

METALS: WROUGHT AND CAST IRON, STEEL, PRESSED METAL, TERNEPLATE, COPPER, ALUMINUM, AND ZINC

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving metal features from the restoration period (such as columns, capitals, pilasters, spandrel panels, or stairways) and their finishes and colors. The type of metal should be identified prior to work because each metal has its own properties and may require a different treatment.	Altering metal features from the restoration period. Failing to document metal features from the restoration period, which may result in their loss. Applying paint or other coatings to restoration-period metal features, or removing them, if such treatments cannot be documented to the restoration period. Changing the type of paint or coating or the color of restoration-period metal features, unless the work can be substantiated by historical documentation.
Protecting and maintaining metals from the restoration period from corrosion by providing proper drainage so that water does not stand on flat, horizontal surfaces or accumulate in curved decorative features.	Failing to identify and treat the causes of corrosion of restoration-period metal features such as moisture from leaking roofs or gutters.
Cleaning metals from the restoration period, when necessary, to remove corrosion prior to repainting or applying other appropriate protective coatings.	Failing to reapply coating systems after cleaning metals from the restoration period that require protection from corrosion. Removing the patina from restoration-period metal features. The patina may be a protective layer on some metals (such as bronze or copper) as well as a distinctive finish.
Identifying the particular type of metal from the restoration period prior to any cleaning procedure and then testing to ensure that the gentlest cleaning method possible is selected; or alternatively, determining that cleaning is inappropriate for the particular metal.	Using cleaning methods which alter or damage the restoration-period color, texture, and finish of the metal, or cleaning when it is inappropriate for the metal.
Using non-corrosive chemical methods to clean soft metals from the restoration period (such as lead, tinplate, terneplate, copper, and zinc) whose finishes can be easily damaged by abrasive methods.	Cleaning soft metals from the restoration period (such as lead, tinplate, terneplate, copper, and zinc) with abrasive methods (including sandblasting, other media blasting, or high-pressure water) which will damage the surface of the metal.

METALS: WROUGHT AND CAST IRON, STEEL, PRESSED METAL, TERNEPLATE, COPPER, ALUMINUM, AND ZINC

RECOMMENDED	NOT RECOMMENDED
Using the least abrasive cleaning method on hard metals from the restoration period (such as cast iron, wrought iron, and steel) to remove paint buildup and corrosion. If hand scraping and wire brushing have Using the least abrasive cleaning method on hard metals from the restoration period (such as cast iron, wrought iron, and steel) to remove paint buildup and corrosion. If hand scraping and wire brushing have proven ineffective, low-pressure abrasive methods may be used as long as they do not damage the surface.	Using high-pressure abrasive techniques without first trying gentler cleaning methods prior to cleaning cast iron, wrought iron, or steel.
Applying appropriate paint or other coating systems to historically-painted, restoration-period metal features after cleaning to protect them from corrosion.	Applying paint or other coatings to metals (such as copper, bronze, or stainless steel) if they were not coated during the restoration period.
Repainting historically-painted metal features with colors that are documented to the restoration period of the building (i.e., verifying through paint analysis).	Using paint colors on historically-painted metal features that are not documented to the restoration period of the building.
Applying an appropriate protective coating (such as lacquer or wax) to an architectural metal feature that was historically unpainted, such as a bronze door, that is subject to heavy use.	
Protecting adjacent restoration-period materials when working on metal features from the restoration period.	Failing to protect adjacent restoration-period materials when working on metal features from the restoration period.
Evaluating the overall condition of metals from the restoration period to determine whether more than protection and maintenance, such as repairs to metal features, will be necessary.	Failing to undertake adequate measures to ensure the protection of metal features from the restoration period.
Repairing metal features from the restoration period by reinforcing the metal by using recognized preservation methods. Repair may 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, storefronts, railings, or porch cresting) or when the replacement can be based on physical or historic documentation. The new work should match the old in material, design, scale, color, and finish.	Removing metal features from the restoration period that could be stabilized, repaired, and conserved, or using improper repair techniques, or untrained personnel, potentially causing further damage to historic materials. Replacing an entire metal feature from the restoration period, such as a column or balustrade, when repair of the metal and limited replacement of deteriorated or missing components are appropriate.

[6] Preliminary work before starting restoration revealed that the columns and the decorative shingles ornamenting the top floor of this historic building were fabricated of metal to imitate the red sandstone used elsewhere on the building.

METALS: WROUGHT AND CAST IRON, STEEL, PRESSED METAL, TERNEPLATE, COPPER, ALUMINUM, AND ZINC

RECOMMENDED	NOT RECOMMENDED
Replacing in kind an entire metal feature from the restoration period 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 or when the replacement can be based on historic documentation. Examples of such a feature could include cast-iron porch steps or steel-sash windows. If using the same kind of material is not feasible, then a compatible substitute material may be considered as long as it has the same appearance as the original. The new work may be unobtrusively dated to guide future research and treatment.	Removing a metal feature from the restoration period that is unrepairable and not replacing it, or replacing it with a new feature that does not match. Using a substitute material for the replacement that does not convey the same appearance of the surviving components of the metal feature from the restoration period or that is physically or chemically incompatible.
The following **Restoration** *work is highlighted to indicate that it involves the removal or alteration of existing historic masonry features that would be retained in Preservation and Rehabilitation treatments; and the replacement of missing metal features from the restoration period using all new materials.*	
Removing Existing Features from Other Historic Periods	
Removing metal features from other historic periods, such as a cast-iron porch railing or aluminum windows.	Failing to remove a metal feature from another period, thereby confusing the depiction of the building's appearance from the restoration period.
Documenting metal features dating from other periods prior to their alteration or removal. If possible, selected examples of these features or materials should be stored for future research.	Failing to document metal features from other historic periods that are removed from the building so that a valuable portion of the historic record is lost.
Recreating Missing Features from the Restoration Period	
Recreating a missing metal feature that existed during the restoration period based on documentary and physical evidence; for example, duplicating a cast-iron storefront or porch.	Constructing a metal feature that was part of the original design for the building but was never actually built, or a feature which was thought to have existed during the restoration period but cannot be documented.

ROOFS

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving roofs from the restoration period and their functional and decorative features. The form of the roof (gable, hipped, gambrel, flat, or mansard) is significant, as are its decorative and functional features (such as cupolas, cresting, parapets, monitors, chimneys, weather vanes, dormers, ridge tiles, and snow guards), roofing materials (such as slate, wood, clay tile, metal, roll roofing, or asphalt shingles) and size, color, and patterning.	Altering roof and roofing materials from the restoration period. Failing to document roof features from the restoration period, which may result in their loss. Changing the type of paint or coating or the color of restoration-period roof features, unless the work can be substantiated by historical documentation. Stripping the roof of sound historic roofing material (such as slate, clay tile, wood, or metal) from the restoration period.
Protecting and maintaining a roof from the restoration period by cleaning gutters and downspouts and replacing deteriorated flashing. Roof sheathing should also be checked for indications of moisture due to leaks or condensation.	Failing to clean and maintain gutters and downspouts so that water and debris collect and cause damage to roof fasteners, sheathing, and the underlying structure.
Providing adequate anchorage for roofing material from the restoration period to guard against wind damage and moisture penetration.	Allowing flashing, caps, and exposed roof fasteners to corrode, which accelerates deterioration.
Protecting a leaking roof with a temporary waterproof membrane with a synthetic underlayment, roll roofing, plywood, or a tarpaulin until it can be repaired.	Leaving a leaking roof unprotected so that accelerated deterioration of historic building materials from the restoration period (such as masonry, wood, plaster, paint, and structural members) results.
Repainting a roofing material from the restoration period that requires a protective coating and was painted historically (such as a terneplate metal roof or gutters) as part of regularly-scheduled maintenance.	Failing to repaint a roofing material from the restoration period that requires a protective coating and was painted historically as part of regularly-scheduled maintenance.
Protecting a restoration-period roof covering when working on other roof features from the restoration period.	Failing to protect restoration-period roof coverings when working on other roof features from the restoration period.
Evaluating the overall condition of the roofing materials from the restoration period to determine whether more than protection and maintenance, such as repairs to roof features, will be necessary.	Failing to undertake adequate measures to ensure the protection of roof features from the restoration period.

[7 a-b] This crumbling chimney was restored to its historic appearance using matching bricks.

[8] The missing steeple of this historic church was replaced with a new steeple made of a substitute material that, from the street below, closely resembles the original steeple. *Photo: en.Wikipedia.*

ROOFS

RECOMMENDED	NOT RECOMMENDED
Repairing a roof from the restoration period by reinforcing the materials that comprise the roof using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing components of features when there are surviving prototypes (such as cupola louvers, cresting, dormer roofing, roof monitors, or slate or tile on a main roof) or when replacement can be based on physical or historic documentation. The new work should match the old in materials, design, scale, color, and finish.	Replacing an entire roof feature from the restoration period, such as a dormer, when repair of the roofing materials and limited replacement of deteriorated or missing components are feasible. Failing to reuse intact slate or tile from the restoration period when only the roofing substrate or fasteners need replacement.
Replacing in kind an entire roof covering or feature from the restoration period 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 or when the replacement can be based on historic documentation. Examples of such a feature could include a large section of roofing, a dormer, or a chimney. If using the same kind of material is not feasible, then a compatible substitute material may be appropriate.	Removing a roof feature from the restoration period that is unrepairable, such as a chimney or dormer, and not replacing it, or replacing it with a feature that does not match. Using a substitute material for the replacement of a single element of a roof (such as a tile or slate) or an entire feature that does not convey the same appearance of the surviving components of the roof feature from the restoration period or that is physically or chemically incompatible.
The following **Restoration** *work is highlighted to indicate that it involves the removal or alteration of existing historic masonry features that would be retained in Preservation and Rehabilitation treatments; and the replacement of missing roof features from the restoration period using all new materials.*	
Removing Existing Features from Other Historic Periods	
Removing roofs or roof features from other historic periods, such as a dormer or asphalt roofing.	Failing to remove a roof feature from another period, thereby confusing the depiction of the building's appearance from the restoration period.
Documenting roof features dating from other periods prior to their alteration or removal. If possible, selected examples of these features or materials should be stored for future research.	Failing to document roofing materials and roof features from other historic periods that are removed from the building so that a valuable portion of the historic record is lost.
Recreating Missing Features from the Restoration Period	
Recreating a missing roofing material or roof feature that existed during the restoration period based on documentary and physical evidence; for example, duplicating a former dormer or cupola.	Constructing a roof feature that was part of the original design for the building but was never actually built, or a feature which was thought to have existed during the restoration period but cannot be documented.

WINDOWS

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving windows from the restoration period and their functional and decorative features. The window material and how the window operates (e.g., double hung, casement, awning, or hopper) are significant, as are its components (including sash, muntins, ogee lugs, glazing, pane configuration, sills, mullions, hardware, casings or brick molds) and related features, such as shutters.	Altering windows or window features from the restoration period. Failing to document window features from the restoration period, which may result in their loss. Applying paint or other coatings to restoration-period window features, or removing them, if such treatments cannot be documented to the restoration period. Changing the type of paint or coating or the color of restoration-period windows, unless the work can be substantiated by historical documentation. Stripping windows of sound historic material (such as wood or metal) from the restoration period.
Conducting an in-depth survey of the condition of existing windows from the restoration period early in the planning process so that repair, upgrading, and, if necessary, possible replacement options can be fully explored.	Replacing windows from the restoration period solely because of peeling paint, broken glass, stuck sash, or high air infiltration. These conditions, in themselves, do not indicate that windows are beyond repair.
Protecting and maintaining the restoration-period wood or metal which comprises the window jamb, sash, and trim through appropriate surface treatments such as cleaning, paint removal, and reapplication of the same protective coatings.	Failing to protect and maintain window materials from the restoration period on a cyclical basis so that deterioration of the window results.
Protecting windows from the restoration period against vandalism before work begins by covering them and by installing alarm systems that are keyed into local protection agencies.	Leaving windows unprotected before work begins, thereby also allowing the interior to be damaged if it can be accessed through unprotected windows.
Installing impact-resistant glazing, when necessary for security, so that it is compatible with the historic windows from the restoration period and does not damage them or negatively impact their character.	Installing impact-resistant glazing, when necessary, for security that is not compatible with the historic windows from the restoration period and damages them or negatively impacts their character.

WINDOWS

RECOMMENDED	NOT RECOMMENDED
Protecting restoration-period windows when working on other features of the building.	Failing to protect restoration-period windows when working on other features of the building.
Protecting and retaining historic glass from the restoration period when replacing putty or repairing other components of the window.	Failing to protect historic glass from the restoration period when making repairs.
Sustaining the historic operability of windows from the restoration period by lubricating friction points and replacing broken components of the operating system (such as hinges, latches, sash chains or cords) and replacing deteriorated gaskets or insulating units.	Failing to maintain windows and window components from the restoration period so that windows are inoperable, or sealing operable sash permanently. Failing to repair and reuse window hardware from the restoration period, such as sash lifts, latches, and locks.
Evaluating the overall condition of windows from the restoration period to determine whether more than protection and maintenance, such as repairs to windows and window features, will be necessary.	Failing to undertake adequate measures to ensure the protection of window features from the restoration period.
Repairing window frames and sash from the restoration period by patching, splicing, consolidating, or otherwise reinforcing them using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated, broken, or missing components of windows when there are surviving prototypes (such as sash, sills, hardware, or shutters) or when the replacement can be based on physical or historic documentation. The new work should match the old in material, design, scale, color, and finish.	Replacing an entire window from the restoration period when repair of materials and limited replacement in kind are appropriate. Removing a window from the restoration period that is unrepairable and not replacing it, or replacing it with a new window that does not match.

[9] Historic window and shutter hardware such as that shown here should be retained and repaired in a restoration project.

WINDOWS

RECOMMENDED	NOT RECOMMENDED
Replacing in kind an entire window from the restoration period 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 or when the replacement can be based on historic documentation. If using the same kind of material is not feasible, then a compatible substitute material may be considered. The new work may be unobtrusively dated to guide future research and treatment.	Removing a window from the restoration period that is unrepairable and not replacing it, or replacing it with a new window that does not match. Using substitute material for the replacement that does not convey the same appearance of the surviving components of the window from the restoration period or that is physically incompatible.
The following **Restoration** *work is highlighted to indicate that it involves the removal or alteration of existing historic masonry features that would be retained in Preservation and Rehabilitation treatments; and the replacement of missing window features from the restoration period using all new materials.*	
Removing Existing Features from Other Historic Periods	
Removing windows or window features from other historic period, such as the glazing pattern or inappropriate shutters.	Failing to remove a window or window feature from another period, thereby confusing the depiction of the building's appearance from the restoration period.
Documenting window features dating from other periods prior to their alteration or removal. If possible, selected examples of these features or materials should be stored for future research.	Failing to document window features from other historic periods that are removed from the building so that a valuable portion of the historic record is lost.
Recreating Missing Features from the Restoration Period	
Recreating a missing window or window feature that existed during the restoration period based on documentary and physical evidence; for example, duplicating a hoodmold or shutter.	Constructing a window feature that was part of the original design for the building but was never actually built, or constructing a feature which was thought to have existed during the restoration period but cannot be documented.

ENTRANCES AND PORCHES

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving entrances and porches from the restoration period and their functional and decorative features. The materials themselves (including wood, masonry, and metal) are important, as are their features, such as doors, transoms, pilasters, columns, balustrades, stairs, roofs, and projecting canopies.	Altering entrances and porch features from the restoration period. Failing to document entrance and porch features from the restoration period, which may result in their loss. Applying paint or other coatings to restoration-period entrance and porch features, or removing them, if such treatments cannot be documented to the restoration period. Changing the type of paint or coating or the color of restoration-period entrance and porch features, unless the work can be substantiated by historical documentation. Stripping entrances and porches of sound material from the restoration period, such as wood, cast iron, tile, or brick.
Protecting and maintaining the masonry, wood, and metals which comprise entrances and porches from the restoration period through appropriate surface treatments, such as cleaning, rust removal, paint removal, and reapplication of protective coatings.	Failing to protect and maintain materials from the restoration period on a cyclical basis so that deterioration of the entrance or porch results.
Protecting entrances and porches against arson and vandalism before work begins by covering them and by installing alarm systems keyed into local protection agencies.	Leaving entrances and porches unprotected and subject to vandalism before work begins, thereby also allowing the interior to be damaged if it can be accessed through unprotected entrances.
Protecting entrance and porch features from the restoration period when working on other features of the building.	Failing to protect entrances and porches from the restoration period when working on other features of the building.
Evaluating the overall condition of entrances and porches from the restoration period to determine whether more than protection and maintenance, such as repairs to entrance and porch features, will be necessary.	Failing to undertake adequate measures to ensure the protection of entrance and porch features from the restoration period.

ENTRANCES AND PORCHES

RECOMMENDED	NOT RECOMMENDED
Repairing entrances and porches from the restoration period by reinforcing them or replacing deteriorated materials using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing components of features when there are surviving prototypes (such as balustrades, columns, and stairs) or when the replacement can be based on physical or historic documentation. The new work should match the old in material, design, scale, color, and finish.	Replacing an entire entrance or porch feature from the restoration period when the repair of materials and limited replacement of deteriorated or missing components are feasible.

[10] (a) The entrance of this house had been altered over the years, including removal of the porch floor and steps. (b) This photograph shows the house after the porch and steps were restored to their historic appearance.

ENTRANCES AND PORCHES

RECOMMENDED	NOT RECOMMENDED
Replacing in kind an entire entrance or porch from the restoration period 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 or when the replacement can be based on historic documentation. If using the same kind of material is not feasible, then a compatible substitute material may be considered. The new work may be unobtrusively dated to guide future research and treatment.	Removing an entrance or porch feature from the restoration period that is unrepairable and not replacing it, or replacing with a new entrance or porch that does not match. Using a substitute material for the replacement that does not convey the same appearance of the surviving components of restoration-period entrance or porch features or that is otherwise incompatible.
The following Restoration *work is highlighted to indicate that it involves the removal or alteration of existing historic entrances and porches or their features that would be retained in Preservation and Rehabilitation treatments; and the replacement of missing entrances and porches or their features from the restoration period using all new materials.*	
Removing Existing Features from Other Historic Periods	
Removing entrances and porches and their features from other historic periods, such as a porch railing.	Failing to remove an entrance or porch feature from another period, thereby confusing the depiction of the building's appearance from the restoration period.
Documenting entrance and porch features dating from other periods prior to their alteration or removal. If possible, selected examples of these features or materials should be stored for future research.	Failing to document entrance and porch features from other historic periods that are removed from the building so that a valuable portion of the historic record is lost.
Recreating Missing Features from the Restoration Period	
Recreating a missing entrance or porch or its features that existed during the restoration period based on documentary and physical evidence; for example, duplicating a transom or porch column.	Constructing an entrance or porch feature that was part of the original design for the building but was never actually built, or constructing a feature which was thought to have existed during the restoration period but cannot be documented.

STOREFRONTS

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving storefronts from the restoration period and their functional and decorative features. The storefront materials (including wood, masonry, metals, ceramic tile, clear glass, and pigmented structural glass) and the configuration of the storefront are significant, as are its features, such as display windows, base panels, bulkheads, signs, doors, transoms, kick plates, corner posts, piers, and entablatures.	Altering storefronts and their features from the restoration period. Failing to document storefront features from the restoration period, which may result in their loss. Applying paint or other coatings to restoration-period storefront features, or removing them, if such treatments cannot be documented to the restoration period. Changing the type of paint or coating or the color of restoration-period storefront features, unless the work can be substantiated by historical documentation. Stripping storefronts of material from the restoration period, such as wood, cast iron, ceramic tile, pigmented structural glass, or masonry.
Protecting and maintaining masonry, wood, glass, ceramic tile, and metals which comprise storefronts from the restoration period through appropriate surface treatments, such as cleaning, paint removal, and reapplication of protective coatings.	Failing to protect and maintain storefront materials from the restoration period on a cyclical basis so that deterioration of storefront features results. Replacing storefront windows from the restoration period rather than maintaining all the components of the window system.
Protecting storefronts against arson and vandalism before work begins by covering windows and doors and by installing alarm systems keyed into local protection agencies.	Leaving the storefront unprotected and subject to vandalism before work begins, thereby also allowing the interior to be damaged if it can be accessed through unprotected entrances.
Protecting restoration-period storefront features when working on other features of the building.	Failing to protect the restoration-period storefront when working on other features of the building.
Evaluating the overall condition of the storefront from the restoration period to determine whether more than protection and maintenance, such as repairs to storefront features, will be necessary.	Failing to undertake adequate measures to ensure the protection of storefront features from the restoration period.

[11] (a) Some of the materials on the front of this historic building had been previously replaced, but the façade retained its essential distinctive features and design. (b) A vintage postcard of the building (far left) provided sufficient documentation to restore the façade to its historic 1945 appearance, using spandrel glass as a replacement for the original Carrara glass (c). *Photo (b): Courtesy Kelsey & Associates.*

STOREFRONTS

RECOMMENDED	NOT RECOMMENDED
Repairing storefronts from the restoration period by reinforcing them or replacing deteriorated materials using recognized preservation methods. Repair may include the limited replacement in kind or with compatible substitute materials of those extensively deteriorated or missing components of features when there are surviving prototypes (such as transoms, pilasters, or signs) or when the replacement can be based on physical or historic documentation. The new work should match the old in material, design, scale, color, and finish.	Replacing an entire storefront from the restoration period when repair of materials and limited replacement of deteriorated or missing components are feasible.
Replacing in kind an entire storefront from the restoration period 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 or when the replacement can be based on historic documentation. If using the same kind of material is not feasible, then a compatible substitute material may be considered. The new work may be unobtrusively dated to guide future research and treatment.	Removing a storefront from the restoration period that is unrepairable and not replacing it, or replacing it with a new storefront that does not match. Using a substitute material for the replacement that does not convey the same appearance of the surviving components of the restoration-period storefront or that is physically incompatible.
The following **Restoration** *work is highlighted to indicate that it involves the removal or alteration of existing historic entrances and porches or their features that would be retained in Preservation and Rehabilitation treatments; and the replacement of missing storefronts or their features from the restoration period using all new materials.*	
Removing Existing Features from Other Historic Periods	
Removing storefronts and their features from other historic periods, such as later cladding or signage.	Failing to remove a storefront feature from another period, thereby confusing the depiction of the building's appearance from the restoration period.
Documenting storefront features dating from other periods prior to their alteration or removal. If possible, selected examples of these features or materials should be stored for future research.	Failing to document storefront features from other historic periods that are removed from the building so that a valuable portion of the historic record is lost.
Recreating Missing Features from the Restoration Period	
Recreating a missing storefront or storefront feature that existed during the restoration period based on documentary and physical evidence; for example, duplicating a display window or transom.	Constructing a storefront feature that was part of the original design for the building but was never actually built, or constructing a feature which was thought to have existed during the restoration period but which cannot be documented.

CURTAIN WALLS	
RECOMMENDED	**NOT RECOMMENDED**
Identifying, retaining, and preserving curtain wall systems from the restoration period and their components. The design of the curtain wall is significant, as are its component materials (metal stick framing and panel materials, such as clear or spandrel glass, stone, terra cotta, metal, and fiber-reinforced plastic), appearance (e.g., glazing color or tint, transparency, and reflectivity), and whether the glazing is fixed, operable, or louvered glass panels. How a curtain wall is engineered and fabricated, and the fact that it expands and contracts at a different rate from the building's structural system, are important to understand when undertaking the restoration of a curtain wall system.	Altering curtain wall components from the restoration period. Failing to document curtain wall systems from the restoration period, which may result in their loss. Replacing curtain wall features from the restoration period instead of repairing or replacing only the deteriorated components.
Protecting and maintaining curtain walls and their components from the restoration period through appropriate surface treatments, such as cleaning, paint removal, and reapplication of protective coating system; and by making them watertight and ensuring that sealants and gaskets are in good condition.	Failing to protect and maintain curtain wall components from the restoration period on a cyclical basis so that deterioration of the curtain wall results.
Protecting ground-level curtain walls from the restoration period from vandalism before work begins by covering them, while ensuring adequate ventilation, and by installing alarm systems keyed into local protection agencies.	Leaving ground-level curtain walls from the restoration period unprotected and subject to vandalism before work begins, thereby also allowing the interior to be damaged if it can be accessed through unprotected glazing.
Protecting restoration-period curtain wall components when working on other features of the building.	Failing to protect curtain wall components from the restoration period when working on other features of the building.
Installing impact-resistant glazing, when required by safety codes or necessary for security, with color, transparency, and reflectivity as close as possible to the original in a curtain wall system from the restoration period so that it is compatible with the historic curtain walls and does not damage them or negatively impact their character.	Installing impact-resistant glazing, when required by safety codes or necessary for security, that is not compatible with the historic curtain walls and damages them or negatively impacts their character.
Evaluating the overall condition of the curtain wall system from the restoration period and its individual components to determine whether more than protection and maintenance, such as repairs to curtain wall features, will be necessary.	Failing to undertake adequate measures to ensure the protection of curtain wall features from the restoration period.

CURTAIN WALLS

RECOMMENDED	NOT RECOMMENDED
Repairing curtain walls from the restoration period by reinforcing them or replacing deteriorated materials, including replacing deteriorated or missing sealants or gaskets, when necessary, to seal any gaps between system components. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing components of curtain walls where there are surviving prototypes or when the replacement can be based on physical or historic documentation. The new work should match the old in material, design, scale, color, and finish.	Replacing an entire curtain wall from the restoration period when repair of materials and limited replacement of deteriorated or missing components are feasible.

[12] This historic curtain wall features a distinctive variety of panel types which must be repaired or replicated in a restoration project if any are damaged or missing.

CURTAIN WALLS

RECOMMENDED	NOT RECOMMENDED
Replacing in kind an entire curtain wall from the restoration period 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 or when the replacement can be based on historic documentation. If using the same kind of material is not feasible, then a compatible substitute material may be considered. The new work may be unobtrusively dated to guide future research and treatment.	Removing a curtain wall feature from the restoration period that is unrepairable and not replacing it, or replacing it with a new curtain wall feature that does not match. Using a substitute material for the replacement that does not convey the same appearance of the surviving components of the restoration-period curtain wall or that is physically incompatible.
The following Restoration *work is highlighted to indicate that it involves the removal or alteration of existing historic entrances and porches or their features that would be retained in Preservation and Rehabilitation treatments; and the replacement of missing curtain walls or their features from the restoration period using all new materials.*	
Removing Existing Features from Other Historic Periods	
Removing curtain wall components from other historic periods.	Failing to remove a curtain wall component from another period, thereby confusing the depiction of the building's appearance from the restoration period
Documenting curtain wall components dating from other periods prior to their alteration or removal. If possible, selected examples of these components or materials should be stored for future research.	Failing to document curtain wall components from other historic periods that are removed from the building so that a valuable portion of the historic record is lost.
Recreating Missing Features from the Restoration Period	
Recreating a missing curtain wall component that existed during the restoration period based on documentary and physical evidence.	Constructing a curtain wall component that was part of the original design for the building but was never actually built, or constructing a feature which was thought to have existed during the restoration period but which cannot be documented.

STRUCTURAL SYSTEMS

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving structural systems and features from the restoration period. This includes the materials that comprise the structural system (i.e., wood, metal, and masonry), the type of system, and its features, such as posts and beams, trusses, summer beams, vigas, cast-iron or masonry columns, above-grade stone foundation walls, or load-bearing masonry walls.	Altering visible features of structural systems from the restoration period. Failing to document structural systems from the restoration period, which may result in their loss. Overloading the structural system from the restoration period, or installing equipment or mechanical systems which could damage the structure. Replacing a load-bearing masonry wall from the restoration period that could be augmented and retained. Leaving known structural problems untreated, such as deflected beams, cracked and bowed walls, or racked structural members.
Protecting and maintaining the structural system from the restoration period by keeping gutters and downspouts clear and roofing in good repair; and by ensuring that wood structural members are free from insect infestation.	Failing to protect and maintain exterior materials and features from the restoration period on a cyclical basis so that deterioration of the structural system results. Using treatments or products that may retain moisture, which accelerates deterioration of structural members.
Evaluating the overall condition of the structural system from the restoration period to determine whether more than protection and maintenance, such as repairs to structural features, will be necessary.	Failing to undertake adequate measures to ensure the protection of the structural system from the restoration period.

STRUCTURAL SYSTEMS

RECOMMENDED	NOT RECOMMENDED
Repairing structural systems from the restoration period by reinforcing them by augmenting or upgrading individual components or features in a manner that is consistent with the restoration period. For example, weakened structural members, such as floor framing, can be paired with a new member, braced, or otherwise supplemented and reinforced. The new work should match the old in material, design, scale, color, and finish.	Upgrading the building structurally in a manner that diminishes the restoration-period character of the exterior (such as installing strapping channels or removing a decorative masonry cornice) or that damages interior features or spaces. Replacing a component of the restoration-period structural system when it could be repaired or augmented and retained. Installing a visible or exposed structural replacement feature that does not match the restoration-period feature (e.g., replacing an exposed wood summer beam with a steel beam). Using substitute material that does not equal the load-bearing capabilities of the restoration-period structural component; does not convey the same appearance of the restoration-period component, if it is visible; or is physically incompatible.
Replacing in kind or with a compatible substitute material large portions or entire features of the structural system from the restoration period that are either extensively damaged or deteriorated or that are missing when there are surviving prototypes, such as cast-iron columns, trusses, or sections of load-bearing walls, or when the replacement can be based on historic documentation. Substitute material must be structurally sufficient, physically compatible with the rest of the system, and, where visible, must have the same form, design, and appearance as the restoration-period feature. The new work may be unobtrusively dated to guide future research and treatment.	

STRUCTURAL SYSTEMS

RECOMMENDED	NOT RECOMMENDED
The following **Restoration** *work is highlighted to indicate that it involves the removal or alteration of existing visible historic structural features that would be retained in Preservation and Rehabilitation treatments; and the replacement of missing visible structural features from the restoration period using all new materials.*	
Removing Existing Features from Other Historic Periods	
Removing visually-intrusive structural features from other historic periods, such as a non-matching column.	Failing to remove or alter a visually-intrusive structural feature from another period, thereby confusing the depiction of the building's appearance from the restoration period.
Documenting structural features dating from other periods prior to their alteration or removal. If possible, selected examples of these features or materials should be stored to facilitate future research.	Failing to document structural features from other historic periods that are removed from the building so that a valuable portion of the historic record is lost.
Recreating Missing Features from the Restoration Period	
Recreating a missing, visible structural feature that existed during the restoration period based on documentary and physical evidence; for example, duplicating a viga or cast-iron column.	Constructing a visible structural feature that was part of the original design for the building but was never actually built, or constructing a feature which was thought to have existed during the restoration period but cannot be documented.

MECHANICAL SYSTEMS: HEATING, AIR CONDITIONING, ELECTRICAL, AND PLUMBING

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving visible features of mechanical systems from the restoration period, such as radiators, vents, fans, grilles, and plumbing and lighting fixtures.	Altering visible features of mechanical systems from the restoration period. Failing to document visible features of mechanical systems from the restoration period, which may result in their loss.
Protecting and maintaining functioning mechanical, plumbing, and electrical systems and their features from the restoration period through cyclical maintenance.	Failing to protect and maintain functioning mechanical, plumbing, and electrical systems from the restoration period on a cyclical basis so that their deterioration results.
Improving the energy efficiency of functioning mechanical systems to help reduce the need for a new system by installing storm windows and insulating attics and crawl spaces, if appropriate.	
Repairing functioning mechanical systems by augmenting or upgrading system components (such as installing new pipes and ducts), rewiring, or adding new compressors or boilers.	Replacing a functioning mechanical system or its components when it could be upgraded and retained.
Replacing in kind or with a compatible substitute material those extensively deteriorated or missing visible features of restoration-period mechanical systems when there are prototypes, such as ceiling fans, radiators, grilles, or lighting fixtures.	Installing a visible replacement feature that does not convey the same appearance as the restoration-period feature.
Installing a new mechanical system, if required, in a manner that results in the least alteration possible to the building's appearance from the restoration period.	Installing a new mechanical system in a manner that the appearance of visible structural or interior features from the restoration period is significantly changed, or the features are damaged or destroyed.
Providing adequate structural support for new mechanical equipment.	Failing to consider the weight and design of new mechanical equipment so that, as a result, restoration-period structural members or finished surfaces are weakened or cracked.

MECHANICAL SYSTEMS:
HEATING, AIR CONDITIONING, ELECTRICAL, AND PLUMBING

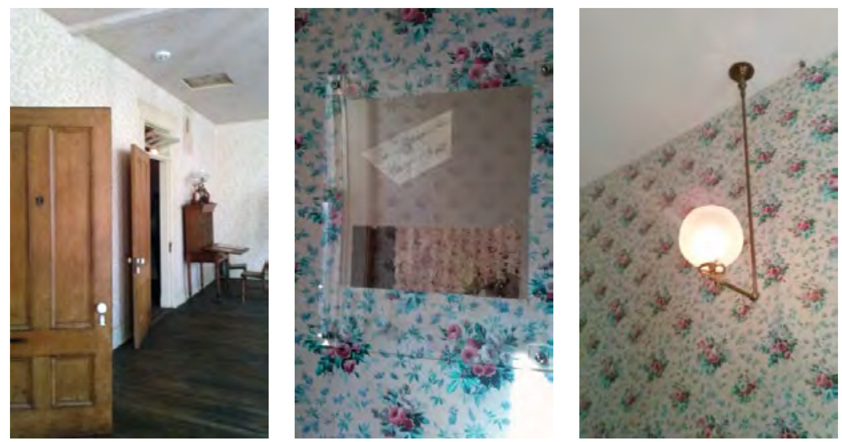
RECOMMENDED	NOT RECOMMENDED
Installing new mechanical and electrical systems and ducts, pipes, and cables in closets, services areas, and wall cavities to preserve the restoration-period character of the interior space.	Installing ducts, pipes, and cables where they will obscure features from the restoration period. Concealing mechanical equipment in walls or ceilings in a manner that results in extensive loss or damage or otherwise obscures restoration-period building materials and features.
Installing air conditioning units, if needed, in such a manner that features from the restoration period are not damaged or obscured, and so that excessive moisture is not generated that will accelerate deterioration of materials from the restoration period.	
The following **Restoration** *work is highlighted to indicate that it involves the removal or alteration of existing visible features of the mechanical system that would be retained in Preservation and Rehabilitation treatments; and the replacement of missing visible features of the mechanical system from the restoration period using all new materials..*	
Removing Existing Features from Other Historic Periods	
Removing mechanical systems and their visible features from other periods, such as a later elevator.	Failing to remove or alter a visually-intrusive structural feature from another period, thereby confusing the depiction of the building's appearance from the restoration period.
Documenting mechanical systems and features from other periods prior to their alteration or removal. If possible, selected examples of these features should be stored for future research.	Failing to document structural features from other historic periods that are removed from the building so that a valuable portion of the historic record is lost.
Recreating Missing Features from the Restoration Period	
Recreating a missing feature of the mechanical system that existed during the restoration period based on documentary and physical evidence; for example, duplicating a heating vent or lighting fixture.	Constructing a mechanical system or feature that was part of the original design for the building but was never actually built, or constructing a feature which was thought to have existed during the restoration period but cannot be documented.

INTERIOR SPACES, FEATURES, AND FINISHES

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving a floor plan and interior spaces, features, and finishes from the restoration period. Significant spatial characteristics include the size, configuration, proportion, and relationship of rooms and corridors; the relationship of features to spaces; and the spaces themselves, such as lobbies, lodge halls, entrance halls, parlors, theaters, auditoriums, gymnasiums, and industrial and commercial interiors. Color, texture, and pattern are important characteristics of features and finishes, which can include such elements as columns, plaster walls and ceilings, flooring, trim, fireplaces and mantels, paneling, light fixtures, hardware, decorative radiators, ornamental grilles and registers, windows, doors, and transoms; plaster, paint, wallpaper and wall coverings, and special finishes, such as marbleizing and graining; and utilitarian (painted or unpainted) features, including wood, metal, or concrete exposed columns, beams, and trusses and exposed load-bearing brick, concrete, and wood walls.	Altering a floor plan, interior spaces (including individual rooms), features, or finishes from the restoration period. Failing to document interior spaces, features, and finishes from the restoration period, which may result in their loss. Applying paint, plaster, or other coatings to surfaces that have been unfinished historically, if the work cannot be documented. Changing the type of finish or the color, such as painting a historically-varnished wood feature from the restoration period, or removing paint from a historically-painted feature from the restoration period and staining and varnishing it, unless the work can be substantiated by physical or historic documentation. Stripping paint to bare wood rather than repainting, or not reapplying documented grained or marbled finishes from the restoration period to features, such as doors and paneling. Removing restoration-period interior features (such as mantels, woodwork, doors, windows, light fixtures, or radiators) or other decorative materials from the restoration period.
Protecting and maintaining interior spaces, and materials, features, and finishes from the restoration period through appropriate surface treatments, such as cleaning, paint removal, and reapplication of protective coating systems.	Failing to protect interior features and finishes from the restoration period when working on the interior.
Protecting interior features and finishes from the restoration period against arson and vandalism before project work begins by covering broken windows and boarding open doorways, while ensuring adequate ventilation, and by installing fire alarm systems keyed into local protection agencies.	Leaving the building unprotected with broken windows and open doorways before restoration begins so that the interior features and finishes from the restoration period can be damaged by exposure to weather and vandalism.

INTERIOR SPACES, FEATURES, AND FINISHES

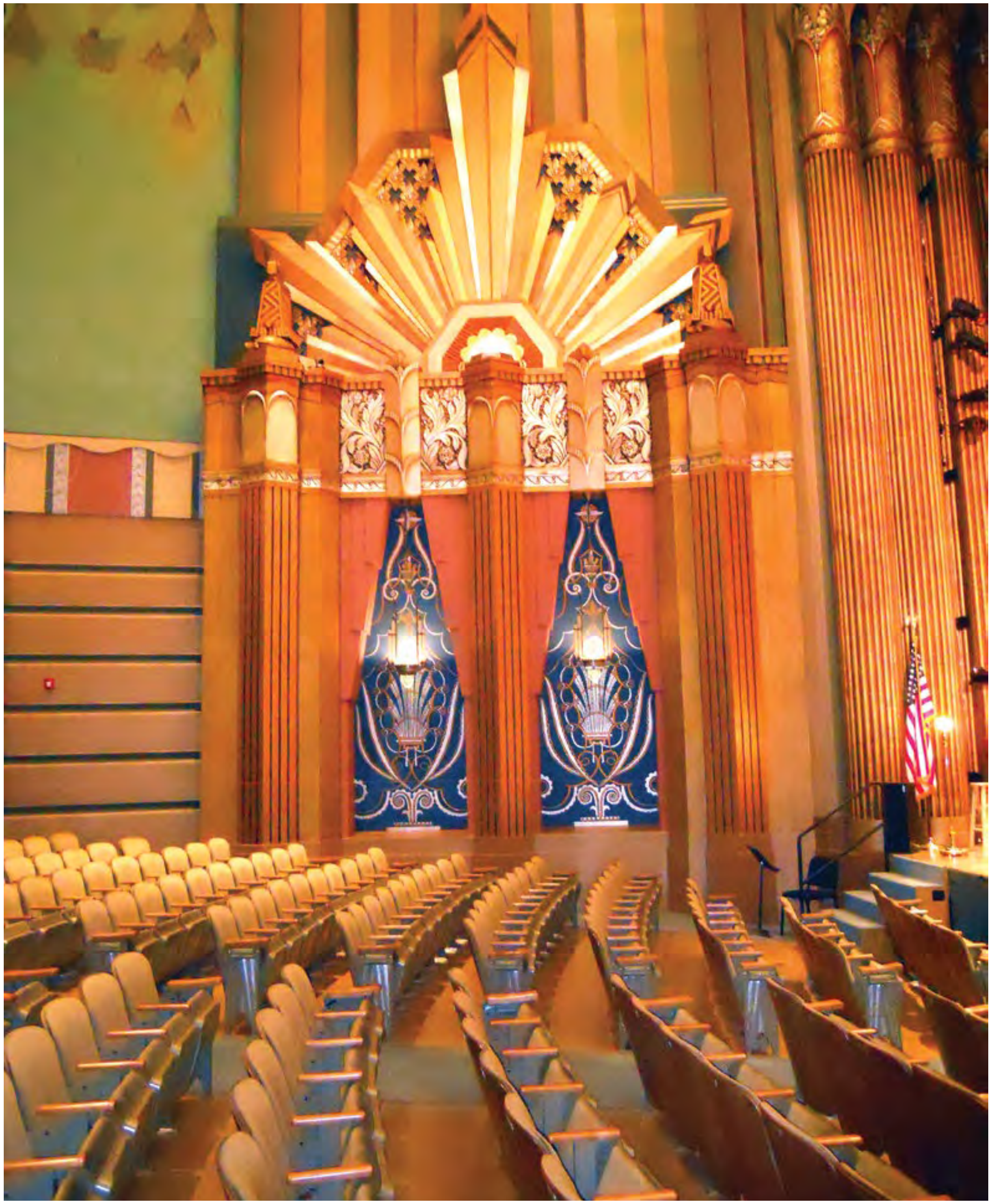
RECOMMENDED	NOT RECOMMENDED
Protecting interior features from the restoration period (such as a staircase, mantel, flooring, or decorative finishes) from damage during project work by covering them with plywood, heavy canvas, or plastic sheeting.	Failing to protect interior features and finishes from the restoration period when working on the interior.
Removing damaged or deteriorated paint and finishes from the restoration period only to the next sound layer, using the gentlest method possible, prior to repainting or refinishing using compatible paint or other coating systems based on historical documentation.	Using potentially damaging methods, such as open-flame torches or abrasive techniques, to remove paint or other coatings. Removing paint that is firmly adhered to interior surfaces.
Repainting with colors that are documented to the building's restoration period.	Using paint colors that are inappropriate to the building's restoration period.



[13] (a) In the 1990s the Missing Soldier's Office—established by Clara Barton at the end of the Civil War—was discovered still extant on the third floor of a building in Washington, DC, that was slated for demolition. The office was restored to its historic appearance using physical and documentary evidence. The original numeral '9' is still on the door to the office, and wall paper was reproduced from scraps found on the walls (b-d).

INTERIOR SPACES, FEATURES, AND FINISHES

RECOMMENDED	NOT RECOMMENDED
Using abrasive cleaning methods only on the interior of industrial or warehouse buildings with utilitarian, unplastered masonry walls from the restoration period and where wood features are not finished, molded, beaded, or worked by hand. Low-pressure abrasive cleaning (e.g., sandblasting or other media blasting) should only be considered if test patches show no surface damage and after gentler methods have proven ineffective.	Using abrasive methods anywhere but utilitarian and industrial interior spaces or when there are other methods that are less likely to damage the surface of the material.
Evaluating the overall condition of interior materials, features, and finishes from the restoration period to determine whether more than protection and maintenance, such as repairs to features and finishes, will be necessary.	Failing to undertake adequate measures to ensure the protection of interior materials, features, and finishes from the restoration period.
Repairing Interior features and finishes from the restoration period by patching, splicing, consolidating, or otherwise reinforcing the materials using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing components of interior features when there are surviving prototypes (such as stairs, balustrades, wood paneling, columns, decorative wall finishes, or pressed-metal or plaster ceilings) or when the replacement can be based on physical or historic documentation. The new work should match the old in material, design, scale, color, and finish.	Replacing an interior feature from the restoration period or a finish when repair of materials and limited replacement of deteriorated or missing components are feasible.



[14] When the 1931 Fox Theater in Spokane, WA, was rehabilitated as a performing arts center, the auditorium was restored to its original Art Deco splendor.

INTERIOR SPACES, FEATURES, AND FINISHES

RECOMMENDED	NOT RECOMMENDED
Replacing in kind an entire interior feature from the restoration period 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 or when the replacement can be based on historic documentation. Examples could include wainscoting, window and door surrounds, or interior stairs. If using the same kind of material is not feasible, then a compatible substitute material may be considered. The new work may be unobtrusively dated to guide future research and treatment.	Removing a feature or finish from the restoration period that is unrepairable and not replacing it, or replacing it with a new feature or finish that does not match. Using a substitute material for the replacement that does not convey the same appearance of the surviving components of the restoration-period interior feature or finish or that is physically incompatible.
The following **Restoration** *work is highlighted to indicate that it involves the removal or alteration of existing historic interior spaces, features, and finishes that would be retained in Preservation and Rehabilitation treatments; and the replacement of missing interior spaces, features, and finishes from the restoration period using all new materials.*	
Removing Existing Features from Other Historic Periods	
Removing or altering interior spaces, features, or finishes from other historic periods, such as a dropped ceiling or wood paneling.	Failing to remove an interior space, feature, or finish from another historic period, thereby confusing the depiction of the building's appearance from the restoration period.
Documenting materials and features dating from other periods prior to their alteration or removal. If possible, selected examples of these features or materials should be stored for future research.	Failing to document interior spaces, features, and finishes from other periods that are removed from the building so that a valuable portion of the historic record is lost.
Recreating Missing Features from the Restoration Period	
Recreating an interior space or a missing feature or finish from the restoration period based on documentary and physical evidence; for example, duplicating a mantel or a staircase.	Creating an interior space, adding a feature, or applying a finish that was part of the original design for the building but was never actually built, or adding a feature which was thought to have existed during the restoration period but cannot be documented.

BUILDING SITE

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving features of the building site from the restoration period. Site features may include walls, fences, or steps; circulation systems, such as walks, paths, or roads; vegetation, such as trees, shrubs, grass, orchards, hedges, windbreaks, or gardens; landforms, such as hills, terracing, or berms; furnishings and fixtures, such as light posts or benches; decorative elements, such as sculpture, statuary, or monuments; water features, such as fountains, streams, pools, lakes, irrigation ditches; and subsurface archeological resources, other cultural or religious features, or burial grounds which are also important to the restoration period of the site.	Altering buildings and their features or site features from the restoration period. Failing to document building and site features from the restoration period, which may result in their loss.
Reestablishing the relationship between buildings and the landscape on the site that existed during the restoration period.	Retaining non-restoration period buildings or landscape features on the site, thereby confusing the depiction of the restoration-period appearance of the site.
Protecting and maintaining buildings and site features from the restoration period by providing proper drainage to ensure that water does not erode foundation walls, drain toward a building, or damage or erode the landscape.	Failing to ensure that site drainage is adequate so that buildings and site features from the restoration period are damaged or destroyed. Or, alternatively, changing the site grading so that water does not drain properly.
Minimizing disturbance of the terrain around buildings or elsewhere on the site, thereby reducing the possibility of destroying or damaging important landscape features from the restoration period or archeological resources, other cultural or religious features, or burial grounds.	Using heavy machinery or equipment in areas where it may disturb or damage important landscape features from the restoration period or archeological resources, other cultural or religious features, or burial grounds.

[15] (a) Cherry Hill House and Farm (c. 1845) in Falls Church, VA, was the site of encampments during the Civil War. Outbuildings on the property, such as the corn crib (b) in the foreground which was the source of provisions for the soldiers, are important in interpreting its role during the war.

BUILDING SITE

RECOMMENDED	NOT RECOMMENDED
Surveying and documenting areas of the site where the terrain will be altered during restoration work to determine the potential impact to important landscape features from the restoration period or archeological resources, other cultural or religious features, or burial grounds from the restoration period.	Failing to survey the building site prior to beginning restoration work, which can result in damaging or destroying landscape features from the restoration period, or archeological resources, other cultural or religious features, or burial grounds.
Protecting (e.g., preserving in place) important site features, archeological resources, other cultural or religious features, or burial grounds.	Failing to protect site features from the restoration period, or archeological resources, other cultural or religious features, or burial grounds when working on the site.
Planning and carrying out any necessary investigation before restoration of the site begins, using professional archeologists and methods, when preservation in place is not feasible.	Allowing unqualified personnel to perform data recovery on archeological resources, which can result in damage or loss of important archeological material.
Preserving important landscape features from the restoration period through regularly-scheduled site maintenance of historic plant material.	Allowing important landscape features from the restoration period to be lost or damaged due to lack of site maintenance.
Protecting the building site and landscape features from the restoration period against arson and vandalism before restoration work begins by erecting temporary fencing and by installing alarm systems keyed into local protection agencies.	Leaving the property unprotected and subject to vandalism before work begins so that the building site and landscape features from the restoration period, or archeological resources, other cultural or religious features, or burial grounds can be damaged or destroyed. Removing site features from the restoration period, such as fencing, paths or walkways, masonry balustrades, or plant material.
Installing protective fencing, bollards, and stanchions on a building site, when necessary for security, that are as unobtrusive as possible.	Installing protective fencing, bollards, and stanchions on a building site, when necessary for security, without taking into consideration their location and visibility so that they negatively impact the restoration-period character of the site.

BUILDING SITE

RECOMMENDED	NOT RECOMMENDED
Providing continued protection and maintenance of buildings and landscape features from the restoration-period of the site through appropriate grounds and landscape management.	Failing to protect and maintain materials and features from the restoration period on a cyclical basis so that deterioration of the site results.
Protecting buildings and site features from the restoration period when working on the site.	Failing to protect buildings and landscape features from the restoration period when working on the site or failing to repair damaged or deteriorated site features.
Evaluating the overall condition of materials and features from the restoration period to determine whether more than protection and maintenance, such as repairs to site features, will be necessary.	Failing to undertake adequate measures to ensure the protection of site features from the restoration period.
Repairing site features from the restoration period which have been damaged, are deteriorated, or have missing components to reestablish the whole feature and to ensure retention of the integrity of the historic materials. Repair may include limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing components of site features when there are surviving prototypes, such as paving, railing, or individual plants within a group (e.g., a hedge), or when the replacement can be based on physical or historic documentation.	Replacing an entire site feature from the restoration period (such as a fence, walkway, or drive) when repair of materials and limited replacement of deteriorated or missing components are feasible.
Replacing in kind an entire restoration-period feature of the site 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 or when the replacement can be based on historic documentation. Examples could include a walkway or fountain, a land form or plant materials. If using the same kind of material is not feasible, then a compatible substitute material may be used. The new work may be unobtrusively dated to guide future research and treatment.	Removing a site feature from the restoration period that is unrepairable and not replacing it, or replacing it with a new feature that does not match. Using a substitute material for the replacement that does not convey the same appearance of the surviving site feature from the restoration period or that is physically incompatible. Adding conjectural landscape features to the site (such as period reproduction light fixtures, fences, fountains, or vegetation) that cannot be documented, thereby confusing the depiction of the restoration-period appearance of the building site.

BUILDING SITE

RECOMMENDED	NOT RECOMMENDED
The following **Restoration** *work is highlighted to indicate that it involves the removal or alteration of existing visible features of the building site that would be retained in Preservation and Rehabilitation treatments; and the replacement of missing visible features of the mechanical system from the restoration period using all new materials.*	
Removing Existing Features from Other Historic Periods	
Removing site features from other historic periods, such as an outbuilding, paved road, or overgrown trees.	Failing to remove a site feature from another historic period, thereby confusing the depiction of the site's appearance from the restoration period.
Documenting features of the building site dating from other periods prior to their removal.	Failing to document site features from other periods that are removed during restoration so that a valuable portion of the historic record is lost.
Recreating Missing Features from the Restoration Period	
Recreating a missing site feature from the restoration period based on documentary and physical evidence; for example, duplicating a no-longer extant terrace, gazebo, fencing, or a hedge.	Constructing a feature of the building or site that was part of the original design but was never actually built, or constructing a feature which was thought to have existed during the restoration period but cannot be documented.

[16] Archeological investigation of the property was undertaken to ensure accuracy of the restoration of Montpelier. Photo: Courtesy of The Montpelier Foundation.

SETTING (DISTRICT / NEIGHBORHOOD)

RECOMMENDED	NOT RECOMMENDED
Identifying, retaining, and preserving building and landscape features from the restoration period in the setting. These features can include circulation systems, such as roads and streets; furnishings and fixtures, such as light posts or benches; vegetation, gardens, and yards; adjacent open space, such as fields, parks, commons, or woodlands; and important views or visual relationships.	Altering restoration-period building and landscape features in the setting. Failing to document restoration-period buildings and landscape features in the setting, which may result in their loss.
Retaining or reestablishing the relationship between buildings and landscape features in the setting that existed during the restoration period.	Retaining non-restoration period buildings or landscape features in the setting, thereby confusing the depiction of the restoration-period appearance of the setting.

(a)

[17 a-b] The cobblestone street, brick sidewalks, and stone stoops of these houses are important restoration-period features of the late 18th- through the 19th-century restoration period of this historic district.

SETTING (DISTRICT / NEIGHBORHOOD)

RECOMMENDED	NOT RECOMMENDED
Protecting and maintaining features from the restoration period in the setting through regularly-scheduled maintenance and grounds and landscape management.	Failing to protect and maintain materials in the setting on a cyclical basis so that deterioration of buildings and landscape features results. Removing restoration-period building or landscape features in the setting, such as porches, fencing, walkways, or plant material.
Installing protective fencing, bollards, and stanchions in a setting, when necessary for security, that are as unobtrusive as possible.	Installing protective fencing, bollards, and stanchions in a setting, when necessary for security, without taking into consideration their location and visibility so that they negatively impact the historic character of the setting.

(b)

SETTING (DISTRICT / NEIGHBORHOOD)

RECOMMENDED	NOT RECOMMENDED
Protecting buildings and landscape features from the restoration period when undertaking work in the setting.	Failing to protect buildings and landscape features from the restoration period when working in the setting.
Evaluating the overall condition of restoration-period materials and features in the setting to determine whether more than protection and maintenance, such as repairs to materials and features, will be necessary.	Failing to undertake adequate measures to ensure the protection of materials and features in the setting from the restoration period.
Repairing restoration-period features in the setting by reinforcing the historic materials. Repair may include the replacement in kind or with a compatible substitute material of those extensively deteriorated or missing components of features from the restoration period when there are surviving prototypes, such as porch balustrades, paving materials, or trees.	Replacing an entire building or landscape feature from the restoration period in the setting when repair of materials and limited replacement of deteriorated or missing components are feasible.
Replacing in kind an entire restoration-period building or landscape feature in the setting 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 or when the replacement can be based on historic documentation. If using the same kind of material is not feasible, then a compatible substitute material may be considered. The new work may be dated to guide future research and treatment.	Removing a restoration-period feature of the building or landscape in the setting that is unrepairable and not replacing it, or replacing it with a new feature that does not match. Using a substitute material for the replacement that does not convey the same appearance of the surviving restoration-period building or landscape feature in the setting or that is physically or ecologically incompatible.

SETTING (DISTRICT / NEIGHBORHOOD)

RECOMMENDED	NOT RECOMMENDED
The following **Restoration** *work is highlighted to indicate that it involves the removal or alteration of existing historic features of the setting that would be retained in Preservation and Rehabilitation treatments; and the replacement of missing restoration-period features of the setting using all new materials.*	
Removing Existing Features from Other Historic Periods	
Removing features of the building or landscape in the setting from other historic periods, such as a road, sidewalk, or fence.	Failing to remove a feature of the building or landscape in the setting from another period, thereby confusing the depiction of the setting's appearance from the restoration period.
Documenting features of the building or landscape in the setting dating from other periods prior to their removal.	Failing to document features of the building or landscape features in the setting from other periods that are removed during restoration so that a valuable portion of the historic record is lost.
Recreating Missing Features from the Restoration Period	
Recreating a missing feature of the building or landscape in the setting that existed during the restoration period based on documentary and physical evidence; for example, duplicating a non-longer extant path or park bench.	Constructing a feature of the building or landscape that was part of the original design for the setting but was never actually built, or constructing a feature which was thought to have existed during the restoration period but cannot be documented.

CODE-REQUIRED WORK

RECOMMENDED	NOT RECOMMENDED
Sensitive solutions to meeting accessibility and life-safety code requirements are an important part of protecting the restoration-period of the building and site. Thus, work that must be done to meet use-specific code requirements in the treatment **Restoration** *must also be assessed for its potential impact on the restoration-period of the historic building and site.*	
Accessibility	
Identifying the restoration-period exterior features, interior spaces, features, and finishes, and features of the site and setting which may be affected by accessibility code-required work.	Undertaking accessibility code-required alterations before identifying the exterior features, interior spaces, features, and finishes, and features of the site and setting from the restoration period and, therefore, must be preserved.
Complying with barrier-free access requirements in such a manner that the restoration-period exterior features, interior spaces, features, and finishes, and features of the site and setting are preserved or impacted as little as possible.	Altering, damaging, or destroying the exterior features, interior spaces, features, and finishes, or features of the site and setting from the restoration period while complying with accessibility requirements.
Working with specialists in accessibility and historic preservation to determine the most sensitive solutions to comply with access requirements in a restoration project.	Making changes to historic buildings and their sites without first consulting with specialists in accessibility and historic preservation to determine the most appropriate solutions to comply with accessibility requirements in a manner that will preserve the character of the restoration period.
Providing barrier-free access that promotes independence for the user while preserving significant features from the restoration period.	Making access modifications that do not provide independent, safe access while preserving restoration-period features.
Finding solutions to meet accessibility requirements that minimize the impact of any necessary alteration on the restoration period of the building, its site, and setting, such as compatible ramps, paths, and lifts.	Making modifications for accessibility without considering the impact on the restoration period of the building, its site, or setting.
Using relevant sections of existing codes regarding accessibility for historic buildings that provide alternative means of code compliance when code-required work would otherwise negatively impact the restoration-period character of the property.	

CODE-REQUIRED WORK

RECOMMENDED	NOT RECOMMENDED
Minimizing the visual impact of accessibility ramps by installing them on secondary elevations when it does not compromise accessibility or by screening them with plantings.	
Adding a gradual slope or grade to the sidewalk, if appropriate, to access the entrance rather than installing a ramp that would be more intrusive to the historic character of the restoration period of the building and the district.	

[18 a-b] The historic Chapel of Our Lady in Cold Spring, NY, is situated on a rocky promontory overlooking the Hudson River. Installing an accessible ramp would greatly compromise the character of the building and the site. However, an audio-visual program available in a separate building—located where it would not impact the character of the site, such as this small pavilion at the rear of the property—could provide visitors otherwise unable to access the Chapel an opportunity to experience the site.

CODE-REQUIRED WORK

RECOMMENDED	NOT RECOMMENDED
Installing a lift as inconspicuously as possible when it is necessary to locate it on a primary elevation of the historic building.	
Considering placing accessible facilities needed for visitors to the restored property (e.g., restrooms) in a separate building, such as a visitor center, that is located away from the historic structure rather than in the historic building if their installation would negatively impact character-defining spaces, features, or finishes from the restoration period.	Installing accessible facilities inside or on the exterior of the historic building that are incompatible with the character of the restoration period or would damage or destroy character-defining spaces, features, or finishes from the restoration period.
Devising non-permanent or temporary adaptive treatments that meet accessibility requirements to preserve the restoration-period character of the building, its site, and setting.	
Developing and providing virtual tours to help interpret the restored property when it is not feasible or it is physically impossible to make the building or its site accessible without damaging or obscuring character-defining building and landscape features in the setting from the restoration period.	
LIFE SAFETY	
Identifying the restoration-period exterior features, interior spaces, features, and finishes, and features of the site and setting which may be affected by life-safety code-required work.	Undertaking life-safety code-required alterations before identifying the exterior features, interior spaces, features, and finishes, and features of the site and setting from the restoration period and, therefore, must be preserved.
Complying with life-safety codes (including requirements for impact-resistant glazing, security, and seismic retrofit) in such a manner that the restoration-period exterior features, interior spaces, features, and finishes, and features of the site and setting are preserved or impacted as little as possible.	Altering, damaging, or destroying the restoration-period exterior features, interior spaces, features, and finishes, or features of the site and setting from the restoration period while making modifications to a building, its site, or setting to comply with life-safety code requirements.
Removing building materials from the restoration period only after testing has been conducted to identify hazardous materials, and using only the least damaging abatement methods.	Removing building materials from the restoration period without testing first to identify any hazardous materials, or using potentially-damaging methods of abatement without considering less-invasive methods of abatement.

CODE-REQUIRED WORK

RECOMMENDED	NOT RECOMMENDED
Providing workers with appropriate personal equipment for protection from hazards on the worksite.	Removing hazardous or toxic materials without regard for workers' health and safety or environmentally-sensitive disposal of the materials.
Working with code officials and historic preservation specialists to investigate systems, methods, or devices to make the building compliant with life-safety codes to ensure that necessary alterations will be compatible with the restoration-period character of the building.	Making life-safety code-required changes to the building without consulting code officials and historic preservation specialists, with the result that alterations negatively impact the restoration-period character of the building.
Using relevant sections of existing codes regarding life safety for historic buildings that provide alternative means of compliance when life-safety code-required work would otherwise negatively impact the restoration-period character of the building.	
Upgrading restoration-period stairways and elevators to meet life-safety codes so that they are not damaged or their historic character is not negatively impacted.	Damaging or making inappropriate alterations to historic stairways or elevators or to adjacent features, spaces, or finishes from the restoration period while complying with life-safety code requirements.
Installing sensitively-designed fire-suppression systems, such as sprinklers, so that historic features and finishes from the restoration period are preserved.	Covering wood features from the restoration period with fire-retardant sheathing, which results in altering their appearance.
Applying fire-retardant coatings when appropriate, such as intumescent paint, to protect steel structural systems from the restoration period.	Using fire-retardant coatings if they will damage or obscure character-defining features from the restoration period.

RESILIENCE TO NATURAL HAZARDS

RECOMMENDED	NOT RECOMMENDED
Resilience to natural hazards should be addressed as part of a **Restoration** *project. A historic building may have existing characteristics or features from the restoration period that help address or minimize the impacts of natural hazards. These should be used to best advantage and should be taken into consideration early in the planning stages of a restoration project before proposing any additional treatments. When new adaptive treatments are needed they should be carried out in a manner that will have the least impact on the restoration-period character of the building, its site, and setting.*	
Identifying the vulnerabilities of the restoration-period property to the impacts of natural hazards (such as wildfires, hurricanes, or tornadoes) using the most current climate information and data available.	Failing to identify and periodically reevaluate the potential vulnerability of the restoration-period building, its site, and setting to the impacts of natural hazards.
Assessing the potential impacts of known vulnerabilities on restoration-period features of the building, its site, and setting; and reevaluating and reassessing potential impacts on a regular basis.	

[19] The 1951 Mies van der Rohe-designed Farnsworth House, Plano, IL, was built close to the Fox River, which is increasingly prone to floods. To preserve the house in its original location, historic preservation architects and engineers continue to explore ways to protect it from the flooding, including a possible system that would lift the house above the flood waters and lower it back to the ground. *Photo: Courtesy Farnsworth, A Site of the National Trust for Historic Preservation.*

RESILIENCE TO NATURAL HAZARDS

RECOMMENDED	NOT RECOMMENDED
Documenting the restoration-period character of the property as a record and guide for future repair work, should it be necessary, and storing the documentation in a weatherproof location.	Failing to document the restoration-period character of the property with the result that such information is not available in the future to guide repair or reconstruction work, should it be necessary.
Ensuring that historic resources inventories and maps are accurate, up to date, and accessible in an emergency.	
Maintaining the restoration-period building, its site, and setting in good repair, and regularly monitoring their condition.	Failing to regularly monitor and maintain the restoration-period property and the building systems in good repair.
Using and maintaining existing characteristics and features of the restoration-period building, its site, setting, and larger environment (such as shutters for storm protection or a site wall that keeps out flood waters) that may help to avoid or minimize the impacts of natural hazards.	Allowing loss, damage, or destruction to occur to the restoration-period building, its site, or setting by failing to evaluate potential future impacts of natural hazards or to plan and implement adaptive measures, when necessary to address possible threats.
Undertaking work to prevent or minimize the loss, damage, or destruction of the historic property while retaining and preserving significant features and the overall restoration-period character of the building, its site, and setting.	Carrying out adaptive measures intended to address the impacts of natural hazards that are unnecessarily invasive or will otherwise adversely impact the restoration-period character of the building, its site, or setting.
Ensuring that, when planning work to adapt for natural hazards, all feasible alternatives are considered, and that the options requiring the least alteration to the restoration-period character of the property are considered first.	Implementing local and regional traditions (such as elevating residential buildings at risk of flooding or reducing flammable vegetation around structures in fire-prone areas) for adapting buildings and sites in response to specific natural hazards which would negatively impact the restoration-period character of the property.
Using special exemptions and variances when adaptive treatments to protect buildings from known hazards would otherwise negatively impact the restoration-period character of the building, its site, or setting.	

Sustainability

Sustainability should be addressed as part of a **Restoration** project. Existing energy-efficient features from the restoration period should be retained and restored while those that are no longer extant but which were important in defining the restoration-period character of the building should be recreated. New sustainability treatments should only be undertaken if they will not impact the restoration-period character of the building.

The topic of sustainability is addressed in detail in *The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings.* Although specifically developed for the treatment Rehabilitation, the Sustainability Guidelines can be used to help guide the other treatments

STANDARDS FOR RECONSTRUCTION & GUIDELINES FOR RECONSTRUCTING HISTORIC BUILDINGS

Reconstruction

Reconstruction is defined as the act or process of depicting, by means of new construction, the form, features, and detailing of a non-surviving site, landscape, building, structure, or object for the purpose of replicating its appearance at a specific period of time and in its historic location.

Standards for Reconstruction

1. Reconstruction will be used to depict vanished or non-surviving portions of a property when documentary and physical evidence is available to permit accurate reconstruction with minimal conjecture and such reconstruction is essential to the public understanding of the property.
2. Reconstruction of a landscape, building, structure or object in its historic location will be preceded by a thorough archeological investigation to identify and evaluate those features and artifacts which are essential to an accurate reconstruction. If such resources must be disturbed, mitigation measures will be undertaken.
3. Reconstruction will include measures to preserve any remaining historic materials, features, and spatial relationships.
4. Reconstruction will be based on the accurate duplication of historic features and elements substantiated by documentary or physical evidence rather than on conjectural designs or the availability of different features from other historic properties. A reconstructed property will re-create the appearance of the non-surviving historic property in materials, design, color and texture.
5. A reconstruction will be clearly identified as a contemporary re-creation.
6. Designs that were never executed historically will not be constructed.

INTRODUCTION

Reconstruction is different from the other treatments in that it is undertaken when there are often no visible historic materials extant or only a foundation remains. Whereas the treatment Restoration provides guidance on restoring historic building features, the **Standards for Reconstruction and Guidelines for Reconstructing Historic Buildings** should be followed when it is necessary to recreate a non-surviving building using new material. But, like restoration, reconstruction also involves recreating a historic building which appears as it did at a particular—and at its most significant—time in its history. Because of the potential for historical error in the absence of sound physical evidence, this treatment can be justified only rarely and, thus, is the least frequently undertaken of the four treatments. Reconstructing a historic building should only be considered when there is accurate documentation on which to base it. When only the appearance of the exterior of the building can be documented, it may be appropriate to reconstruct the exterior while designing a very simple, plain interior that does not attempt to appear historic or historically accurate. Signage and interpretative aids should make it clear to visitors that only the exterior of the building is a true reconstruction. Extant historic surface and subsurface materials should also be preserved. Finally, the reconstructed building must be clearly identified as a contemporary recreation.

Research and Document Historical Significance

The guidance for the treatment **Reconstruction** begins with ***researching and documenting*** the building's historical significance to determine whether its recreation is essential to the public understanding of the property. In some instances, reconstruction may not be necessary if there is a historic building still existing on the site or in a setting that can explain the history of the property. Justifying a reconstruction requires detailed physical and documentary evidence to minimize or eliminate conjecture and to ensure that the reconstruction is as accurate as possible. Only one period of significance is generally identified; a building—as it evolved—is rarely recreated. If research does not provide adequate documentation for an accurate reconstruction, other interpretive methods should be considered, such as an explanatory marker.

Investigate Archeological Resources

Investigating archeological resources is the next area of guidance in the treatment **Reconstruction**. The purpose of archeological research is to identify any remaining features of the building, site, and setting that are essential to an accurate recreation and must be reconstructed. Archeological resources that are not essential to the reconstruction should be left in place. The archeological findings, together with archival documentation, should be used to replicate the design, materials, and plan of the historic building.

Identify, Protect, and Preserve Extant Historic Features

Closely aligned with archeological research, recommendations are given for ***identifying, protecting, and preserving*** extant features of the historic building. It is never appropriate to base a **Reconstruction** upon conjectural designs or on features from other buildings. Any remaining historic materials and features should be retained and incorporated into the reconstruction when feasible. Both the historic and new materials should be documented to assist in interpretation.

Reconstruct Non-Surviving Building and Site

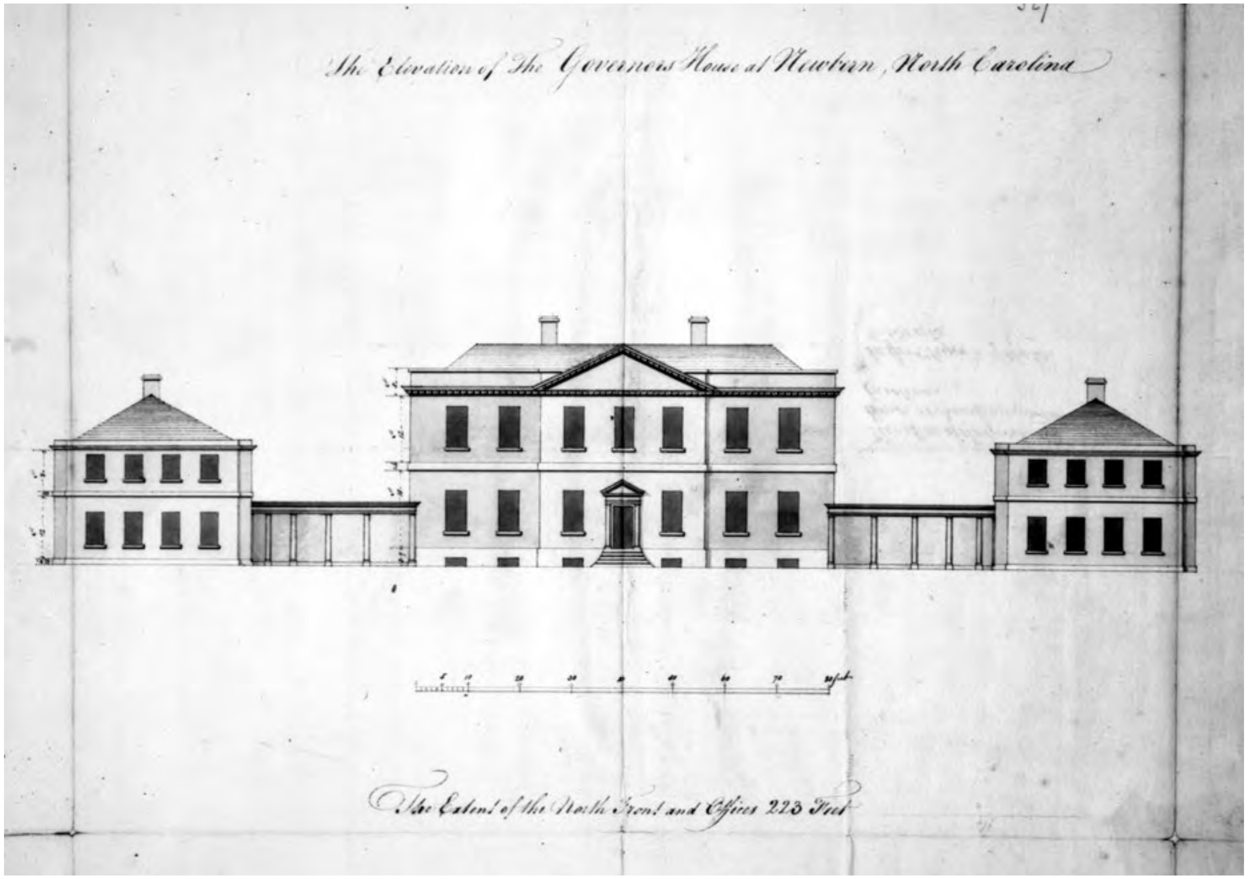
After the research and documentation phases, guidance is given for **Reconstruction** work itself. Exterior and interior features are addressed in general, always emphasizing the need for an accurate depiction (i.e., careful duplication of the appearance of historic materials and features for interpretative purposes). While the use of traditional materials and finishes is always preferred, in some instances substitute materials may be used if they are able to convey the same appearance. Where non-visible features of the building are concerned, such as interior structural systems, contemporary materials and technology may be used. Recreating the features of the building site or setting based on archeological findings should also be an integral part of project work.

Accessibility and Life Safety, Natural Hazards, and Sustainability

Whereas preservation, rehabilitation, and restoration treatments usually necessitate retrofitting to meet code requirements and to address other issues (including natural hazards and sustainability), in this treatment it is assumed that the **Reconstructed** building will be essentially new construction. Thus, code-required work, treatments to reduce the potential impact of natural hazards, and ensuring that the reconstructed building is as sustainable as possible should be considered during the design phase—when appropriate to the particular Reconstruction project—so as not to negatively impact or detract from the reconstructed appearance of the building, its site, and setting. The fact that the non-surviving building was located in a floodplain or another area especially vulnerable to the impact of natural hazards is crucial to consider when determining whether the building should be reconstructed.

The topic of sustainability is addressed in detail in *The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings*. Although specifically developed for the treatment Rehabilitation, the Guidelines can be used to help guide the other treatments.

Reconstruction as a Treatment. *When a contemporary depiction is required to understand and interpret a property's historic value (including the re-creation of missing components in a historic district or site); when no other property with the same associative value has survived; and when sufficient historical documentation exists to ensure an accurate reproduction,* ***Reconstruction*** *may be considered as a treatment. Prior to undertaking work, a documentation plan for Reconstruction should be developed.*



[1 a-b] Tyron Palace, New Bern, NC, was designed by John Hawks in 1767 for Governor William Tyron. It was completed in 1770, but destroyed by fire in 1798. The palace was reconstructed in 1959 based on the original plans, and on its original foundation, which was found 5 feet below the street, with the help of the 1767 drawing. *Photo: Courtesy Tyron Palace, New Bern, NC. Drawing: Courtesy of the State Archives of North Carolina.*

[2] The Saugus Iron Works, Saugus, MA, a National Historic Site, was active from 1646 to about 1670 and was the first integrated iron works in North America. The forge and mill (shown here) are part of the site which was reconstructed based on archeological research and historic documents and opened in 1954. *Photo: Daderot at the English language Wikipedia.*

OVERVIEW

RECOMMENDED	NOT RECOMMENDED
Researching and documenting the property's historical significance, focusing on documentary and physical evidence which is needed to justify reconstruction of the non-surviving building.	Undertaking a reconstruction based on insufficient research so that, as a result, a historically inaccurate building is created. Reconstructing a building unnecessarily when an existing building adequately reflects or explains the history of the property, the historical event, or has the same associative value. Executing a design for a building that was never constructed.
Investigating archeological resources to identify and evaluate those features and artifacts which are essential to the design and plan of the building.	Failing to identify and evaluate archeological material prior to reconstruction, or destroying extant historic material not relevant to the reconstruction but which should be preserved in place.
Minimizing disturbance of the terrain around buildings or elsewhere on the site, thereby reducing the possibility of destroying or damaging important landscape features, archeological resources, other cultural or religious features, or burial grounds.	Using heavy machinery or equipment in areas where it may disturb or damage important landscape features, archeological resources, cultural or religious features, or burial grounds.
Identifying, retaining, and preserving extant historic features of the building, site, and setting, such as remnants of a foundation, chimney, or walkway.	Beginning reconstruction work without first conducting a detailed site investigation to physically substantiate the documentary evidence. Basing a reconstruction on conjectural designs or on features from other historic buildings.

[3] The Cathedral of Saint Michael the Archangel, built in the early 1840s in Sitka, AK, was devastated by fire in 1966. It was reconstructed using measured drawings done in 1961 by the Historic American Buildings Survey (HABS). While the original cathedral was built of logs covered on the exterior with wood siding, its replacement is a fire-resistant structure with concrete and steel walls that replicates the historic building's appearance. *Photo: Barek at Wikimedia Commons.*

BUILDING EXTERIOR

RECOMMENDED	NOT RECOMMENDED
Reconstructing a non-surviving building to depict the documented historic appearance. Although the use of the original building materials (such as masonry, wood, and architectural metals) is preferable, substitute materials may be used as long as they recreate the historic appearance.	Reconstructing features that cannot be documented historically or for which existing documentation is inadequate. Using substitute materials that do not convey the appearance of the historic building.
Recreating the documented design of exterior features, such as the roof form and its coverings, architectural detailing, windows, entrances and porches, steps and doors, and their historic spatial relationships and proportions.	Omitting a documented exterior feature, or rebuilding a feature but altering its historic design. Using inappropriate designs or materials that do not convey the historic appearance.
Reproducing the appearance of historic paint colors and finishes based on documentary and physical evidence.	Using paint colors that cannot be documented through research and investigation or using other undocumented finishes.
Installing exterior electrical and telephone cables underground or in the least obtrusive location possible, unless they can be documented as having been aboveground historically.	Attaching exterior electrical and telephone cables to the principal elevations of the reconstructed building, unless they can be documented as having been there historically.
Using signage to identify the building as a contemporary recreation.	Failing to explain that the building is a reconstruction, thereby confusing the public's understanding of the property.

[4] The McLean House, where Robert E. Lee surrendered to Ulysses S. Grant, is located on the site of the battlefield—now part of Appomattox Courthouse National Historical Monument (VA). Several years after the end of the Civil War, measured drawings were made of the house before it was dismantled to be moved to Washington, DC, where it was to be reconstructed as a tourist attraction. This scheme never came to fruition, and the dismantled pieces gradually disappeared. The house was accurately reconstructed in 1949 on the original site based on the measured drawings.

BUILDING INTERIOR

RECOMMENDED	NOT RECOMMENDED
Recreating the appearance of *visible* features of the historic structural system, such as posts and beams, trusses, summer beams, vigas, cast-iron columns, above-grade masonry foundations, or load-bearing brick or stone walls. Contemporary methods and materials may be used for the actual structural system of the reconstructed building.	Changing the documented appearance of visible features of the structural system.
Recreating the historic floor plan and interior spaces, including the size, configuration, proportion, and relationship of rooms and corridors; the relationship of features to spaces; and the spaces themselves.	Altering the documented historic floor plan, or relocating an important interior feature, such as a staircase, so that the historic relationship between the feature and the space is inaccurately depicted. Reconstructing the historic appearance of the interior without accurate documentation.
Duplicating the documented historic appearance of the building's interior features and finishes (including columns, cornices, baseboards, fireplaces and mantels, paneling, light fixtures, hardware, and flooring); plaster, paint, and finishes (such as stenciling or marbleizing); and other decorative or utilitarian materials and features.	Altering the documented appearance of the building's interior features and finishes so that, as a result, an inaccurate depiction of the historic building is created. For example, moving a feature from one area of a room to another, or changing the type or color of the finish.
Installing mechanical systems and their components in the least obtrusive way possible so as not to impact the recreated interior spaces, features, or finishes while meeting user needs.	Altering the historic plan or the recreated appearance unnecessarily when installing mechanical systems.
Installing ducts, pipes, and cables in closets, service areas, and wall cavities.	Installing ducts, pipes, and cables where they will intrude upon the historic appearance of the building.

[5] The parlor of the McLean House was reconstructed to its appearance on the occasion of Robert E. Lee's surrender to Ulysses S. Grant in this room on April 9, 1865.

BUILDING SITE

RECOMMENDED	NOT RECOMMENDED
Reconstructing building site features based on documentary and physical evidence.	Reconstructing building site features without documentary and physical evidence.
Inventorying the building site to determine the existence of aboveground remains and subsurface archeological resources, other cultural or religious features, or burial grounds, and using this evidence as corroborating documentation for the reconstruction of related site features. These may include walls, fences, or steps; circulation systems, such as walks, paths, or roads; vegetation, such as trees, shrubs, grass, orchards, hedges, windbreaks, or gardens; landforms, such as hills, terracing, or berms; furnishings and fixtures, such as light posts or benches; decorative elements, such as sculpture, statuary, or monuments; water features, including fountains, streams, pools, lakes, or irrigation ditches.	Giving the building's site an inaccurate appearance by basing the reconstruction on conjectural designs or on features from other sites.
Recreating the historic spatial relationship between buildings and related site features.	Changing the historic spatial relationship between buildings and related site features, or reconstructing some site features but not others, thereby confusing the depiction of the reconstructed site.

[6] This lighthouse on Lake Ponchartrain in New Orleans was reconstructed after the historic 1890 lighthouse was destroyed by Hurricane Katrina.

SETTING (DISTRICT / NEIGHBORHOOD)

RECOMMENDED	NOT RECOMMENDED
Reconstructing features in the building's historic setting based on documentary and physical evidence.	Reconstructing features in the setting without documentary and physical evidence.
Inventorying the setting to determine the existence of above-ground remains and subsurface archeological resources, other cultural or religious features, or burial grounds, and using this evidence as corroborating documentation for the reconstruction of missing features of the historic setting. These may include circulation systems, such as roads and streets; furnishings and fixtures, such as light posts or benches; vegetation, gardens, and yards; adjacent open space, such as fields, parks, commons, or woodlands; and important views or visual relationships.	Giving the building's setting an inaccurate appearance by basing the reconstruction on conjectural designs or on features from other locations.
Recreating the historic spatial relationship between buildings and landscape features in the setting.	Changing the historic spatial relationship between buildings and landscape features in the setting by reconstructing some features but not others, thereby confusing the depiction of the reconstructed setting.

[7] The Muhlenberg Brigade Huts are reconstructions of nine log huts erected in 1777 at Valley Forge during the Revolutionary War. They have been reconstructed on the historic road with logs cut with modern power tools and finished with cement, unlike the original logs which were hand hewn and finished with traditional chinking. *Photo: Rdsmith4 at Wikimedia Commons.*

[8] The Palace of Fine Arts was designed by Bernard Maybeck and built for the 1915 Panama-Pacific Exposition in San Francisco. The pavilion was intended to be temporary and, although it had a steel structure, the exterior was finished only with staff, an impermanent material composed of plaster and fiber. The building was not torn down after the exposition, and it eventually fell into ruin. In 1964, all but the steel structure was demolished, and the building was reconstructed with lightweight poured-in-place concrete. *Photo: Kevinlcole at Wikimedia Commons.*

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

Appendix D

Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects

FP-14

GMUG Road Maintenance
Forest Service Supplemental Specifications (FSSS)

Specification	Number	Title	Latest Revision
FSSS	101-109	General Requirements	07/2017
FSSS	155	Schedule for Construction Contracts	11/2016
FSSS	201	Clearing and Grubbing	11/2016
FSSS	203	Removal of Structures and Obstructions	11/2016
FSSS	211	Roadway Obliteration	04/2018
FSSS	301	Untreated Aggregate Courses	07/2017
FSSS	302	Minor Crushed Aggregate	07/2017
FSSS	303	Road Reconditioning	07/2017
FSSS	633	Permanent Traffic Control	11/2016

- The **Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects FP-14** is part of the contract and binding upon all parties to the contract.

Table of Contents
GMUG Road Maintenance

Preface

Preface_wo_09_26_2018

<u>Delete all but the first paragraph and add the following:</u>

The Forest Service, US Department of Agriculture has adopted FP-14 for Construction of National Forest System Roads.

101 – Terms, Format, and Definitions

101.01_National_3_15_2017

<u>Add the following paragraph to Subsection 101.01:</u>

101.01 Meaning of Terms.

Delete all references to the FAR (Federal Acquisition Regulations) in the specifications when incorporating into 2400-6(T) Timber Sale or 2400-13(T) Stewardship contracts.

101.01_National_11_9_2016

<u>Add the following paragraph to Subsection 101.01:</u>

101.01 Meaning of Terms.

Delete all references to the TAR (Transportation Acquisition Regulations) in the specifications.

101.03_National_11_9_2016

<u>Add the following to Subsection 101.03:</u>

101.03 Abbreviations.

(a) Acronyms.

AGAR — Agriculture Acquisition Regulations
AFPA — American Forest and Paper Association
FSAR — Forest Service Acquisition Regulations
MSHA — Mine Safety and Health Administration
NESC — National Electrical Safety Code
WCLIB — West Coast Lumber Inspection Bureau

(f) Miscellaneous unit abbreviations.

MP	—	milepost	location
ppm	—	parts per million	volume
STA		station	location

Make the following changes to Subsection 101.04:

101.04 Definitions.

Delete these definitions and replace the following:

Bid Schedule — The Schedule of Items.

Bridge — A structure, including supports, erected over a depression or an obstruction such as water along a road, a trail, or a railway and having a deck for carrying traffic or other loads.

Contractor — the individual or legal entity contracting with the Government for performance of prescribed work. In a timber sale contract, the contractor is the "Purchaser".

Culvert — Any structure with a bottom, regardless of fill depth, depth of invert burial, or presence of horizontal driving surface, or any bottomless (natural channel) structure with footings that will not have wheel loads in direct contact with the top of the structure.

Drawings — (Public Works Contracts) Design sheets or fabrication, erection, or construction details submitted to the CO by the Contractor according to FAR Clause 52.236-21 Specifications and Drawings for Construction. Also refers to submissions and submittals.

Notice to Proceed — (Public Works Contracts) Written notice to the Contractor to begin the contract work.

Right-of-Way — A general term denoting (1) the privilege to pass over land in some particular line (including easement, lease, permit, or license to occupy, use, or traverse public or private lands), or (2) Real property necessary for the project, including roadway, buffer areas, access, and drainage areas.

Solicitation— (Public Works Contracts) The complete assembly of documents (whether attached or incorporated by reference) furnished to prospective bidders.

Add the following definitions:

Adjustment in Contract Price — "Equitable adjustment," as used in the Federal Acquisition Regulations, or "construction cost adjustment," as used in the Timber Sale Contract, as applicable.

Change — "Change" means "change order" as used in the Federal Acquisition Regulations, or "design change" as used in the Timber Sale Contract.

Forest Service — the United States of America, acting through the Forest Service, U.S. Department of Agriculture.

Neat Line — a line defining the proposed or specified limits of an excavation or structure.

Pioneer Road — Temporary construction access built along the route of the project.

Purchaser — The individual, partnership, joint venture, or corporation contracting with the Government under the terms of a Timber Sale Contract and acting independently or through agents, employees, or subcontractors.

Protected Stream course — a drainage shown on the plans or timber sale area map that requires designated mitigation measures.

Road Order — an order affecting and controlling traffic on roads under Forest Service jurisdiction. Road Orders are issued by a designated Forest Officer under the authorities of 36 CFR, part 260.

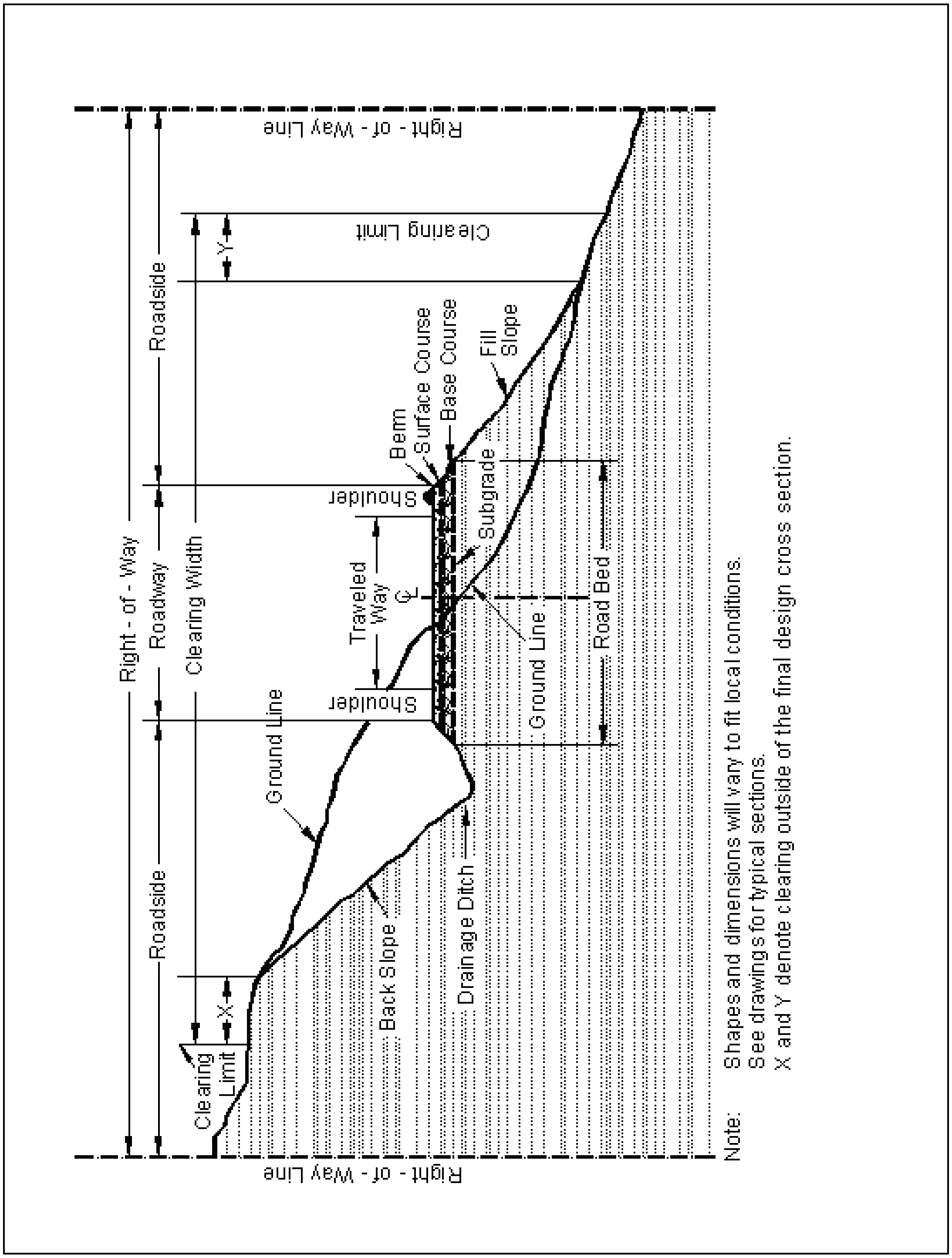
Shop Drawings — (Timber and Stewardship Contracts) Referred to as "Drawings" in FP-14, include drawings, diagrams, layouts, schematics, descriptive literature, illustrations, lists or tables, performance and test data, and similar materials furnished by Purchaser to explain in detail specific portions of the work required by the contract.

Utilization Standards —

The minimum size and percent soundness of trees described in Public Works contract specifications or Timber Sale and IRTC contract provisions to determine merchantable timber.

Add Figure 101-1—Illustration of road structure terms:

Figure 101-1—Illustration of road structure terms.



102 - Bid¸ Award¸ and Execution of Contract

102.00_National_11_9_2016

Delete Section 102 in its entirety.

Delete Section 102.

103 - Scope of Work

103.00_National_11_9_2016

Delete all of Section 103 except Subsection 103.01 Intent of Contract.

Delete Subsections 103.02, 103.03, 103.04, 103.05.

104 - Control of Work

104.00_National_11_9_2016

Delete Subsections 104.01, 104.02, and 104.04.

Delete Subsections 104.01, 104.02, 104.04.

104.06_National_11_9_2016

Add the following to Subsection 104.06:

104.06 Use of Roads by Contractor.

The Contractor is authorized to use roads under the jurisdiction of the Forest Service for all activities necessary to complete this contract, subject to the limitations and authorizations designated in the Road Order(s) or described in the contract, when such use will not damage the roads or national forest resources, and when traffic can be accommodated safely.

106 - Acceptance of Work

106.01_National_7_18_2017

Delete Subsection 106.01 and replace with the following:

106.01 Conformity with Contract Requirements.

Follow the requirements of FAR Clause 52.246-12 Inspection of Construction.

References to standard test methods of AASHTO, ASTM, GSA, and other recognized standard authorities refer to the methods in effect on the date of solicitation for bids.

Perform all work to the lines, grades, cross-sections, dimensions, and processes or material requirements shown on the plans or specified in the contract.

Incorporate manufactured materials into the work according to the manufacturer's recommendations or to these specifications, whichever is stricter.

Plan dimensions and contract specification values are the values to be strived for and complied with as the design values from which any deviations are allowed. Perform work and provide material that is uniform in character and reasonably close to the prescribed value or within the specified tolerance range. The purpose of a tolerance range is to accommodate occasional minor variations from the median zone that are unavoidable for practical reasons.

When standard manufactured items are specified (such as fence, wire, plates, rolled shapes, pipe conduits, etc., that are identified by gauge, unit mass, section dimensions, etc.), the identification will be nominal masses or dimensions. Unless specific contract tolerances are noted, established manufacturing tolerances will be accepted.

The Government may inspect, sample, or test all work at any time before final acceptance of the project. When the Government tests work, copies of test reports are furnished to the Contractor upon request. Government tests may or may not be performed at the work site. If Contractor testing and inspection is verified by the Government, the Contractor's results may be used by the Government to evaluate work for acceptance. Do not rely on the availability of Government test results for process control.

Acceptable work conforming to the contract will be paid for at the contract unit bid price. Four methods of determining conformity and accepting work are described in Subsections 106.02 to 106.05 inclusive. The primary method of acceptance is specified in each Section of work. However, work may be rejected at any time it is found by any of the methods not to comply with the contract.

Remove, repair, or replace work that does not conform to the contract, or to prevailing industry standards where no specific contract requirements are noted. Removing, repairing, or replacing work; providing temporary traffic control; and any other related work to accomplish conformity will be at no cost to the Government.

(a) Disputing Government test results. If the accuracy of Government test results is disputed, promptly inform the CO. If the dispute is unresolved after reasonable steps are taken to resolve the dispute, further evaluation may be obtained by written request. Include a narrative describing the dispute and a proposed resolution protocol that addresses the following:

1. Sampling method
2. Number of samples
3. Sample transport
4. Test procedures
5. Testing laboratories
6. Reporting
7. Estimated time and costs
8. Validation process

If the evaluation requires additional sampling or testing be performed, mutually agree with the Government on witnessing procedures and on sampling and testing by a third-party laboratory. Use a third-party laboratory accredited by the AASHTO accreditation program. Provide proof of the laboratory's accreditation for the test procedures to be used. Do not use the same laboratory that produced the disputed Government test results or that produced the test results used as a basis for the dispute.

The CO will review the proposed resolution protocol and may modify it before final approval and execution.

The Government will use the approved resolution protocol test results to determine the validity of the disputed testing. If the Government test results are validated, the Contractor will be responsible for all costs associated with developing and performing the resolution protocol. If the Government test results are not validated, the Government will be responsible for all costs associated with developing and performing the resolution protocol. If the validity of the Government test results cannot be determined, the Contractor and Government will equally share all costs associated with developing and carrying out the resolution protocol.

(b) Alternatives to removing and replacing non-conforming work. As an alternative to removal and replacement, the Contractor may submit a written request to:

1. Have the work accepted at a reduced price; or
2. Be given permission to perform corrective measures to bring the work into conformity.

The request must contain supporting rationale and documentation. Include references or data justifying the proposal based on an evaluation of test results, effect on service life, value of material or work, quality, aesthetics, and other tangible engineering basis. The CO will determine disposition of the nonconforming work.

106.02_National_11_9_2016

<u>Delete Subsection 106.02 and replace with the following:</u>

106.02 Visual Inspection.

Acceptance is based on visual inspection of the work for compliance with the specific contract requirements. Use prevailing industry standards in the absence of specific contract requirements or tolerances.

107 - Legal Relations and Responsibility to the Public

107.05_National_7_18_2017

Delete Subsection 107.05.

Delete Subsection 107.05.

108 - Prosecution and Progress

108.00_National_11_9_2016

Delete Section 108 in its entirety.

Delete Section 108.

109 - Measurement and Payment

109.00_National_11_9_2016

Delete Subsections 109.06, 109.07, 109.08, and 109.09:

Delete Subsections 109.06, 109.07, 109.08, 109.09.

109.02_National_11_9_2016

Add the following sentence to Subsection 109.02(b):

109.02 Measurement Terms and Definitions.

(b) Contract quantity.

Contract quantities will be adjusted only when there are errors in the original design of 15% or more.

155 - Schedules for Construction Contracts

155.00_National_11_9_2016

Delete Section 155 in its entirety.

Delete Section 155.

201 - Clearing and Grubbing

201.00_Forest_6_3_2018

Delete Section 201 in its entirety and replace with the following.

Section 201. — CLEARING AND GRUBBING

Description

201.01 This work consists of clearing and grubbing within the clearing limits designated in the plans.

Material

201.02 Conform to the following Subsection:

Backfill material	704.03

Construction Requirements

201.03 General. Construct erosion control measures according to Section 157. Perform work within designated limits.

Do not damage vegetation designated to remain. If damage occurs, repair or replace the vegetation in an acceptable manner. Where possible, preserve vegetation adjacent to bodies of water. Treat cuts or scarred surfaces of trees and shrubs with tree wound dressing.

201.04 Clearing. Within the clearing limits clear trees, brush, and other vegetation as follows:

(a) Cut trees so they fall within the clearing limits.

(b) In areas of cut slope rounding, cut stumps flush with or below the finished ground line.

(c) In areas outside the excavation, embankment, and slope rounding limits, cut stumps to within 6 inches of the ground; and

(d) Trim tree branches that extend over the road surface and shoulders to attain a clear height of 14 feet. Trim tree limbs as near flush with the trunk as practicable.

201.05 Grubbing. Grub deep enough to remove stumps, roots, buried logs, moss, turf, or other vegetative matter as follows:

(a) Grub areas to be excavated, except for cut slope rounding areas.

(b) Grub embankment areas. Undisturbed stumps less than 24 inches in diameter may be left in place if they protrude less than 6 inches above the original ground and will be covered with more than 48 inches of embankment. Remove all other stumps.

(c) Grub pits, channel changes, and ditches only to the depth necessary for the excavation.

(d) Backfill stump holes and other grubbing holes with backfill material to the level of the surrounding ground according to Subsection 209.09. Compact backfill according to Subsection 209.10; and

(e) Utilization standards for merchantable timber are listed below. Fall and buck merchantable material into lengths not to exceed 40 feet. Pieces (logs) meet utilization standards when such pieces would have met Utilization Standards if bucking lengths were varied to include such material.

Minimum Utilization Standards

Length = 12 feet.

Diameter (Inside Bark) at small end = 9 inches

33-1/3 Net Scale in % Gross for Saw log

201.06 Disposal. Merchantable timber is Government property. Dispose of clearing and grubbing debris according to Subsection 203.05.

201.07 Acceptance. Clearing and grubbing will be evaluated under Subsection 106.02.

Material for tree wound dressing will be evaluated under Subsection 106.03.

Backfilling and compacting of stumps and grubbing holes will be evaluated under Section 209.

Measurement

201.08 Measure the Section 201 pay items listed in the bid schedule according to Subsection 109.02 and the following as applicable:

Do not make deductions from the area computation unless excluded areas are shown on the plans.

Do not measure clearing and grubbing of borrow sources.

Payment

201.09 The accepted quantities will be paid at the contract price per unit of measurement for the Section 201 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

201.06_National_2_22_2018

Delete the first sentence of Subsection 201.06 and replace the following:

201.06 Disposal.

Merchantable timber is Government property.

203 - Removal of Structures and Obstructions

203.00_Forest_5_4_2018

Delete Section 203 in its entirety and replace with the following.

Section 203. — REMOVAL OF STRUCTURES AND OBSTRUCTIONS

Description

203.01 This work consists of salvaging, removing, and disposing of bridges, structures, culverts, and other obstructions.

Material

203.02 Conform to the following Subsection:

Backfill material	704.03

Construction Requirements

203.03 Salvaging Material. Salvage with reasonable care material designated to be salvaged. Salvage in readily transportable sections or pieces. Replace or repair members, pins, nuts, plates, and related hardware damaged, lost, or destroyed during the salvage operation. Securely attach parts to adjacent members or pack them in sturdy boxes with the contents clearly marked.

Match mark members of salvaged structures. Submit one set of drawings according to Section 104 identifying the members and their respective match marks.

Stockpile salvaged material at a designated area on the project.

203.04 Removing Material.

(a) Submittals. Submit a bridge removal plan at least 7 days before beginning bridge removal for approval. Include the following:

(1) Methods and equipment to be used.

(2) Measures to be used for protecting the environment, public, adjacent property, and workers.

(3) Methods to keep debris out of stream and streambed.

(b) General. Saw cut sidewalks, curbs, pavements, and structures when partial removal is required.

Construct structurally adequate debris shields to contain debris within the construction limits. Do not allow debris to enter waterways, travel lanes open to public traffic, or areas designated not to be disturbed.

Handle material with lead paint contamination according to Subsection 563.05.

Raze and remove foundations, pavements, culverts, sidewalks, curbs, structures, and other obstructions interfering with the work and not designated to remain.

Remove structures and obstructions in the roadbed to 12 inches below subgrade elevation. Remove structures and obstructions outside the roadbed to 12 inches below finished ground or to the natural stream bottom.

Except in excavation areas, backfill and compact cavities left by structure removal with backfill material to the lines and grades of the finished ground. Backfill excavated areas according to Subsection 209.09. Compact backfill according to Subsection 209.10.

(c) Concrete removal in repair areas. Saw cut ¾ inch deep along boundaries of repair areas. Use power driven hand tools to remove existing concrete. Do not damage concrete designated to remain in place.

Where the bond between existing concrete and reinforcing steel is destroyed, remove concrete adjacent to bond to the reinforcing steel to provide at least a ¾ inch clearance for the new concrete to bond to the reinforcing steel. Use care to prevent damage to remaining concrete when achieving the final surface.

Clean exposed concrete surfaces that will be in contact with repair material. Provide a residue free surface.

(d) Reinforcing steel. Do not cut or damage reinforcing steel designated to remain in place. Repair or replace damaged bars. Replace deteriorated bars as directed by the CO.

Clean exposed reinforcing steel of coatings or residue that inhibits bonding with the new concrete.

Protect the steel from corrosion and contamination. If the steel becomes corroded or contaminated, re-clean the steel before placing concrete.

203.05 Disposing of Material. Dispose of debris, unsuitable material, and excess material as follows:

(a) Remove from project. Recycle or dispose of material legally off the project.

(b) Scattering. Scatter construction slash in designated areas without damaging trees. Place stumps and logs away from trees, positioned so they will not roll, and are not on top of one another. Scatter construction slash to reduce slash concentrations. When scattering for erosion control, place construction slash as flat as practical on the completed slope.

(c) Debris Mat. Use tree limbs, tops, cull logs, split stumps, wood chunks, and other debris to form a mat upon which construction equipment is operated. Place stumps upside down and blend stumps into the mat.

(d) Decking. Deck logs so that logs are piled parallel to one another; can be removed by standard log loading equipment; will not damage standing trees; will not interfere with drainage; and will not roll.

(e) Removal to designated locations. Remove construction slash and debris to designated locations; and

(f) Piling. Pile construction slash in designated areas.

203.06 Acceptance. Removal of structures and obstructions will be evaluated under Subsection 106.02.

Backfilling and compacting of cavities left by structures will be evaluated under Section 209.

Measurement

203.07 Measure the Section 203 pay items listed in the bid schedule according to Subsection 109.02.

Payment

203.08 The accepted quantities will be paid at the contract price per unit of measurement for the Section 203 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

211 - Roadway Obliteration

211.01_Forest_4_18_2018

211 – Full Re contour Roadway Obliteration

211.01_0402_03_01_2011

Delete Section 211 in its entirety and replace with the following.

Description.

211.01 This work consists of obliterating or decommissioning roads, including decompaction to 16 inches or to the depth of compaction, recontouring to the natural slope profile, mulching and planting with native material, and other incidental work. This includes furnishing all labor, equipment, supervision, transportation, supplies, and incidentals.

This work also consists of the removal of culverts and restoration of stream channels, including pumping or diverting of live streams, in channel rock placement, and other miscellaneous items required for execution of the work.

Roadway obliteration methods are designated as follows:

(a) Method 1. Obliterate the roadway by restoring to approximate original ground contours. Keep excavated material within the original construction limits. Finish slopes to provide gradual transitions in slope adjustments without noticeable breaks. The finished surface shall remain rough not allowing water to flow directly down the fall line of the finished slope.

211.02 Definitions

(a) Coarse woody debris – woody material greater than 3-inch diameter on the small end and longer than 6 feet in length, including live trees removed from the roadway.

(b) **Native mulch** – includes topsoil, organic material, and coarse woody debris broken into smaller pieces that exist in the vicinity of the road.

(c) Soil and vegetative transplants – vegetation, which includes the plant or organic matter on the surface of the ground and the root system, transplanted from the roadway or adjacent area onto prepared (de-compacted and recontoured) roadway. Transplanted material contains sufficient root mass and surrounding soil to maintain and incorporate nutrients, soil microbes and other organisms. Vegetative material includes native shrubs, sod, and bunch grass.

Obliteration Requirements

211.03 Conform to the following when obliterating roadways:

(a) Vegetation removal. Remove vegetation including dead woody debris, trees, stumps, roots, and other vegetation within the limits of the immediate obliteration area prior to starting excavation operations and pile temporarily until recontouring has been completed. Preserve suitable vegetation in road prism to be transplanted after compacted soil has been loosened. Place clearing slash back on top of recontoured road segments and completed channel side slopes in stable positions that do not interfere with stream channel flow according to Subsection 211.03(e).

(b) Decompaction of roadbed. Loosen compacted soil down to 16 inches over the entire width of the roadbed and ditches using a track hoe excavator bucket.

(c) Recontouring of roadway. Following decompaction of the roadway, pull the fill material up and place on the loosened roadbed between the top of cut and original ground, forming a slope approximating natural contours as shown on the plans, but also retaining a rough surface to slow the flow of water across the new fill slope. Fill in all ditches and other water traps and remove all berms. Blend all finished slopes to match the surrounding terrain. Notify the inspector a minimum of 48 hours in advance of areas where full recontouring may not be achievable. If full recontouring is determined not to be practical or attainable by the CO, the CO may approve a partial recontour at a specific site.

(d) Transplanting of vegetative material. Transplant soil and vegetative material clumps from the road surface and adjacent areas into the recontoured road prism at a minimum rate of 30 plantings per 100 lineal feet of roadway measured along centerline. Excavate transplanting clumps of sufficient size to maintain root systems and adequate soil to enhance favorable growth. If the soil and vegetative clump breaks up and cannot be maintained, transplant the loose material right side up as best as possible.

(e) Treatment of the recontoured roadway surface. Cover the disturbed area with a combination of transplants, native mulch, coarse woody debris, or agricultural straw (certified weed-free). If the transplants, native mulch, and course woody debris cannot meet the minimum coverage requirements of 50% coverage then coverage will be augmented with agricultural straw to obtain a minimum of 50% to a maximum of 80% ground coverage. The priority of coverage is as follows; soil and vegetative transplants, native mulch, and coarse woody debris, then apply agricultural straw at a rate of 1 bale per 400 square feet only when necessary to achieve the required coverage. Avoid burying any cover material. The end goal of the treatment should be to match the adjacent landscape coverage as closely as possible.

Place the course woody debris in various size classes over the recontoured roadway in a perpendicular pattern to the newly constructed slope to impede and slow the flow of water across the new slope.

Do not leave vegetation removed under Subsection 211.03(a) "hung-up" in remaining live vegetation.

(f) Treatment of stream channel crossings. For intermittent and perennial stream channels remove all fills and recontour to the original ground slopes.

(1) Stream channel crossings with culverts. Notify the inspector a minimum of 48 hours in advance for stream channel work to ensure the inspector is present. For live stream crossings, install one or more sediment mats at an approved location downstream of the culvert that span the entire width of the stream prior to starting work. Construct a stream diversion using pipe, a lined open channel, pumps, or other approved methods to dewater the crossing prior to culvert removal. Dispose of metal culverts by removal from National Forest land. Treat removed log culverts as coarse woody debris and use as directed in Subsection 211.03(e).

   a. Reconstruct the stream channel width, depth, and banks after the drainage structure has been removed to have approximately the same dimensions and general shape as those outside the crossing area. Remove all bedding materials and incorporate into the surrounding recontouring work. Construct a uniform grade from the natural stream channel above the inlet location to the natural channel below the outlet to create a free draining, un-constricted channel for the entire length unless otherwise noted on the plans. Incorporate excavated material into the adjacent recontouring areas. Conserve suitable rock encountered for construction of stream grade control structures and individual rock placement in the new channel as shown on the plans and as directed by the engineer.
   b. Re-water the newly constructed channel slowly. Remove all stream diversion materials prior to final site rehab and remove the sediment mats from the impacted stream channel and lay them out flat on the adjacent recontoured roadbed.

(2) Stream channel crossings without culverts. Notify the inspector a minimum of 48 hours in advance for stream channel work to ensure inspector is present. Prior to crossing open stream channels with live water where the culvert has been previously removed, install one or more sediment mats at an approved location downstream of the crossing that span the entire width of the stream prior to starting work. Place logs suitable for support of crossing equipment in the channel parallel to the stream bank. Provide sufficient spacing between the logs so that the stream flow is not constricted. Remove all fill material down to original ground and incorporate into the surrounding recontouring work.

Remove the crossing logs following the final equipment crossing and utilize as coarse woody debris as directed in Subsection 211.03(e). Remove the sediment mats from the stream channel and lay them out flat on the adjacent recontoured roadbed, Rehabilitate all disturbed stream channel side slopes and adjacent recontoured roadway areas that drain onto the stream channel side slopes using soil and vegetative transplants, native mulch, and certified weed free straw as necessary to obtain a minimum ground coverage of 95%.

(g) Treatment of ditch relief culverts. Treat ditch relief culverts as follows:

Remove vegetation and de-compact the roadway in accordance with Subsections 211.03(a) and (b).

Remove the culvert and appurtenances in its entirety and dispose of by removal from National Forest land.

Perform the work required by Subsections 211.03(c) through 211.03(e).

(h) Treatment of seeps and wet areas. Treat seeps and wet areas as follows:

Remove vegetation and de-compact the roadways in accordance with Subsections 211.03(a) and (b).

Shape the hillslope to drain water across the roadway. Rehabilitate all disturbed wet area and drain side slopes and adjacent recontoured roadway areas using soil and vegetative transplants, native mulch, and certified weed free straw as necessary to obtain a minimum ground coverage of 80%.

211.04 Acceptance. Roadway obliteration will be evaluated under Subsection 106.02

Measurement

211.05 Measure the Section 211 items listed in the bid schedule according to Subsection 109.02.

Payment

211.06 The accepted quantities will be paid at the contract price per unit of measurement for the Section 211 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05. Payment for treatment of stream channel crossings, treatment of seeps and wet areas, treatment of ditch relief culverts, and removal and disposal of culverts is indirect to Pay Item 21101.

Proposed Pay Items:

Item Number	Description	Unit of Measurement
*21101	Roadway Obliteration, Method 1	Mile

* Item is Contract Quantity per FP-14, subsection 109.02(b)

301 - Untreated Aggregate Courses

301.03_National_7_17_2017

Add the following to Subsection 301.03:

301.03 General.

Written approval of the roadbed is required before placing aggregate.

For pit run or grid-rolled material, furnish material smaller than the maximum size, no gradation will be required otherwise. After processing on the road, remove all oversize material from the road and dispose as directed by the CO.

Provide additives or binder, if required, at the proportions specified.

Develop and use Government furnished sources according to Section 105.

If the aggregate is produced and stockpiled before placement, handle, and stockpile according to Section 314.

302 - Minor Crushed Aggregate

302.04_National_7_18_2017

Add the following to Subsection 302.04 and 302.04(a)

302.04 Placing Crushed Aggregate.

Written approval of the surface is required before placing aggregate.

(a) Roadway aggregate.
For pit run or grid-rolled material, furnish material smaller than the maximum size, no gradation will be required otherwise. After processing on the road, remove all oversize material from the road and dispose as directed by the CO.

303 - Road Reconditioning

303.07_National_7_18_2017

Add the following to Subsection 303.07:

303.07 Roadway Reconditioning.

Remove cattle guard decks. Clean the deck and the area beneath the cattle guard of soil and other material to the bottom of the original foundation over the entire width of the installation. Dispose of waste at designated sites or according to Subsection 204.14. Reinstall the cattle guard deck.

633 - Permanent Traffic Control

633.00_National_11_8_2016

Delete the first sentence of Subsection 633.02 and replace with the following:

633.02 Material.

Conform to the MUTCD, USDA Forest Service EM-7100-15, and the following Section and Subsections:

Make the following changes to Subsection 633.03:

633.03 General.

Delete the first paragraph of Subsection 633.03 and replace with the following:

Furnish and install permanent traffic control devices according to the MUTCD, USDA Forest Service EM-7100-15 and permanent traffic control plans. Provide traffic control devices that are crashworthy.

Add the following sentence to Subsection 633.03:

Sign panel layout proofs shall be approved by the CO prior to ordering.

Add the following to Subsection 633.05(a):

633.05 (a) Fabrication.

(3) Protective Overlay Film. When specified, cover the entire face of a sign with a clear high-performance, solvent-resistant, ultraviolet-stabilized, pressure-sensitive adhesive, protective overlay film. Use 3M Scotch lite Premium Protective Overlay Film Series 1160 or approved equivalent.

(4) Edge Film. When specified, edge film shall be 3 inches wide vinyl film that is pressure-sensitive, premium quality, clear, and ultraviolet-resistant.