

Project Manual & Specifications

For the Relocation of the

Lakeville Train Station

Salisbury, CT 06068

DATE: April 24, 2026

Bid Set



Owner:	Town of Salisbury
By:	_____
Architect:	Crosskey Architects, LLC
By:	_____
Contractor:	
By:	_____
Bonding Company:	
By:	_____

Crosskey Architects LLC
Architecture | Preservation | Planning



750 Main Street, Suite 150, Hartford, CT 06103

Phone: 860-724-3000

www.crosskey.com

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SECTION 00 01 02

PROJECT DIRECTORY

PROJECT:	7 Ethan Allen Street Salisbury, CT 06068
OWNER:	Town of Salisbury 27 Main Street P.O. Box 548 Salisbury, CT 06068 Phone: 860-435-5170
ARCHITECT:	Crosskey Architects LLC 750 Main Street Suite 150 Hartford, CT 06103 Phone: 860-724-3000
CIVIL ENGINEER: ENGINEER:	Alfred Benesch & Company 120 Hebron Avenue Glastonbury, CT 06033 Phone: 860-633-3841
STRUCTURAL ENGINEER:	Cirrus Structural Engineering 19 Lower Woodland Terrace Columbia, CT 06237 Phone: 860-337-0200
MECHANICAL/ ELECTRICAL ENGINEER:	Acorn Consulting Engineers, Inc. Farms Village Plaza 244 Farms Village Road, West Simsbury, CT 06092 Phone: 860-651-1949

END OF SECTION

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END OF SECTION

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END OF SECTION

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DOCUMENT 00 11 16

INVITATION TO BID

OWNER:

Town of Salisbury
27 Main Street
P.O. Box 548
Salisbury, CT 06068
Phone: 860-435-5170

ARCHITECT:

Crosskey Architects, LLC.
750 Main Street
Suite 150
Hartford, CT 06103

TO ALL BIDDERS

1. The Town of Salisbury will receive bids on or before **3:00 p.m., May 29, 2026** at 27 Main Street, P.O. Box 548, Salisbury, CT 06068.
2. A mandatory site examination will be held at **2:00 PM, May 13, 2026** at the project site: **7 Ethan Allen Street, Salisbury, CT**. All General Contractors submitting a bid are required to attend.
3. Bids will be received for furnishing all labor, materials, tools and equipment necessary for the project scope of work consisting of **the relocation of the existing train station building to a new foundation on the existing site along with associated site work.**
4. The Contract will include demolition, general construction work, site improvements, new building foundation construction, and all other work necessary for or incidental to the completion of the project.
5. The successful bidder will be required to furnish 100% Performance and Payment Bond or Bonds, in the forms included in the Specifications, as well as a certified statement of financial condition, as of a date not exceeding ninety (90) days prior to the date thereof.
6. Proposed form of Contract Documents, including Plans and Specifications, are on file at the office of the above-mentioned Town Office and can be transmitted electronically.
7. The Owner reserves the right to reject any or all bids and to waive any informalities in bidding. All Bid Documents must be completely filled in when submitted.
8. No bid shall be withdrawn for a period of ninety (90) days subsequent to the opening of bids or until the next work day immediately following said period, if such period ends on a weekend or a State holiday, without the consent of the above-mentioned Owner.

9. General Information:

Readiness to Proceed

The bidder selected to perform the work described herein shall apply for building permits

immediately after entering into a construction contract with the owner. The duration of construction should be indicated on each bidders bid form.

Permits and Certificates of Occupancy

The General Contractor selected to perform the construction activities will be responsible for obtaining and paying for all building permits. Also, it is the express responsibility of the Contractor to obtain Certificates of Occupancy and present them to the owner at the conclusion of construction.

Utilities

All utilities required by the Contractor during construction will be provided by the Owner.

Payment

The Contractor will present a request for payment together with the appropriate original lien waivers. Payment will be made within 15 calendar days after the Owner receives all appropriate documentation.

Insurance Requirements

As part of the response to this request for proposals and upon request by the owner at any time, evidence of the following must be provided to the owner. The bidder shall submit a statement indicating awareness and acceptance of CHFA insurance requirements for G.C's.

General Liability: General Liability insurance on a policy form no less broad than ISO form CG 00 01, written on an "occurrence" form shall be maintained. Minimum required limits are either the limit carried by the Mortgagor or the limits shown below, whichever is greater. If the policy covers more than one location, the policy aggregate must apply per location.

General Aggregate:	\$2,000,000
Products and Completed Operations Aggregate:	\$1,000,000
Personal and Advertising Injury:	\$1,000,000
Each Occurrence:	\$1,000,000
Fire Damage (any one fire):	\$100,000
Medical Expense (any one person):	\$5,000

Automobile Liability: The minimum required limit of insurance is \$1,000,000 per accident, covering all owned, non-owned, leased or rented motor vehicles. If no owned vehicles, only non-owned or hired motor vehicle coverage is required.

Workers' Compensation and Employers' Liability: Required Limits: Workers' Compensation: Statutory

Employers' Liability:	Bodily Injury by Accident:	\$1,000,000
	Bodily Injury by Disease:	\$1,000,000
	Bodily Injury by Each Employee:	\$1,000,000

Umbrella or Excess Liability: The minimum required limit of Umbrella/Excess liability coverage shall be \$5,000,000. CHFA reserves the right to require additional limits of umbrella/excess liability coverage.

END OF DOCUMENT

DOCUMENT 00 21 13

INSTRUCTIONS TO BIDDERS

PART 1. SUMMARY

1.01 DOCUMENT INCLUDES

- A. Invitation
 - 1. Bid Submission
 - 2. Intent
 - 3. Work Identified in the Contract Documents
 - 4. Contract Time
- B. Bid Documents and Contract Documents
 - 1. Definitions
 - 2. Contract Documents Identification
 - 3. Availability
 - 4. Examination
 - 5. Queries/Addenda
 - 6. Product/System Substitutions
- C. Site Assessment
 - 1. Site Examination
 - 2. Preview of the site
- D. Qualifications
 - 1. Qualifications
 - 2. Subcontractors/Suppliers/Others
- E. Bid Submission
 - 1. Submission Procedure
 - 2. Bid Ineligibility
- F. Bid Enclosures/Requirements
 - 1. Security Deposit
 - 2. Performance Assurance
 - 3. Bid Form Requirements
 - 4. Fees for Changes in the Work
 - 5. Bid Form Signature
 - 6. Additional Bid Information
- G. Offer Acceptance/Rejection
 - 1. Duration of Offer
 - 2. Acceptance of Offer

1.02 RELATED DOCUMENTS

- A. Document 00 11 16 - Invitation To Bid.
- B. Document 00 41 13 - Bid Form.

PART 2. INVITATION

2.01 BID SUBMISSION

- A. Bids signed and under seal, executed, and dated will be received by the offices of the Town of Salisbury, 27 Main Street, P.O. Box 548, Salisbury, CT 06068, **before 3:00 p.m.** local time on the **29th** day of **May, 2026**, or via email at townhall@salisburyct.us
Attn: Lakeville Trainstation Relocation.

- B. Offers submitted after the above time may be returned to the Bidder unopened.
- C. Amendments to the submitted offer will be permitted if received in writing prior to Bid closing and if endorsed by the same party or parties who signed and sealed the offer.
- D. Owner reserves the right to reject any or all bids and waive any bid procedures or formalities.

2.02 INTENT

- A. Contract in accordance with the Contract Documents.

2.03 WORK IDENTIFIED IN THE CONTRACT DOCUMENTS

- A. Work of this proposed Contract comprises general construction & renovation, site development, environmental abatement, demolition, structural, mechanical, electrical Work.
- B. Location: 7 Ethan Allen Street, Salisbury, Ct 06068

2.04 CONTRACT TIME

- A. Perform the Work in **120** calendar days.
- B. The Bidder may suggest a revision to the Contract Time with a specific adjustment to the Bid Price.

PART 3. BID DOCUMENTS AND CONTRACT DOCUMENTS

3.01 DEFINITIONS

- A. Bid Documents: Contract Documents supplemented with Invitation to Bid, Instructions to Bidders, Bid Form and Appendix A, Bid securities, identified herein.
- B. Contract Documents: Defined in AIA A201 Article 1 including issued Addenda.
- C. Bid, Offer, or Bidding: Act of submitting an offer under seal.
- D. Bid Price: Monetary sum identified by the Bidder in the Bid Form.

3.02 CONTRACT DOCUMENTS IDENTIFICATION

- A. The Contract Documents are identified as the **Relocation of the Lakeville Train Station, 7 Ethan Allen Street, Salisbury, CT** prepared by the Architect, Crosskey Architects LLC, located at 750 Main Street, Suite 150, Hartford, CT and identified in the Project Manual.

3.03 AVAILABILITY

- A. Bid Documents may be obtained electronically by emailing townhall@salisburyct.us
- B. Bid Documents are made available only for the purpose of obtaining offers for this project. Their use does not grant a license for other purposes.

3.04 EXAMINATION

- A. Bid Documents may be viewed at the office of the Architect.

- B. Upon receipt of Bid Documents verify that documents are complete. Notify Architect should the documents be incomplete.
- C. Immediately notify the Architect upon finding discrepancies or omissions in the Bid Documents.

3.05 QUERIES/ADDENDA

- A. All questions about the project should be directed by e-mail only to Michael Weissbrod, at mweissbrod@crosskey.com, with a copy to townhall@salisburyct.us no later than 3:00pm on **May 21, 2026**. Answers to all received questions shall be forwarded to all bidders no later than **May 26, 2026**.
- B. Addenda may be issued during the Bidding period. All Addenda become part of the Contract Documents. Include resultant costs in the Bid Price.
- C. Verbal answers are not binding on any party.
- D. Clarifications requested by Bidders must be in writing not less than 7 days before date set for receipt of Bids. The reply will be in the form of an Addendum, a copy of which will be forwarded to known recipients.

3.06 PRODUCT/SYSTEM SUBSTITUTIONS

- A. Substitute products will be considered if submitted as an attachment to the Bid Form.
- B. The submission shall provide sufficient information to determine acceptability of such products.
- C. Provide complete information on required revisions to other Work to accommodate each substitution, the value of additions to or reductions from the Bid Price, including revisions to other Work.
- D. Provide Products as specified unless substitutions are submitted in this manner and subsequently accepted.
- E. Approval to submit substitutions prior to submission of Bids is not required.
- F. **Contractor shall reimburse Owner for Architect's time spent reviewing substitutions.**

PART 4. SITE ASSESSMENT

4.01 SITE EXAMINATION

- A. Examine the project site before submitting a bid.

4.02 PREBID CONFERENCE

- A. A mandatory pre-bid walk-thru of the site will be conducted on **May 13, 2026 at 2:00 PM** at the project site.
- B. All general contract and major subcontract Bidders are invited.
- C. Representatives of the Owner and Architect will be in attendance.

- D. Information relevant to the Bid Documents will be recorded in an Addendum, issued to Bid Document recipients.

PART 5. QUALIFICATIONS

5.01 SUBCONTRACTORS/SUPPLIERS/OTHERS

- A. The Owner reserves the right to reject a proposed Subcontractor for reasonable cause.
- B. Refer to AIA Article 5 of General Conditions.

PART 6. BID SUBMISSION

6.01 SUBMISSION PROCEDURE

- A. Bidders shall be solely responsible for the delivery of their Bids in the manner and time prescribed.
- B. Submit three copies of the executed offer on the Bid Forms provided, signed and sealed with the required security in a closed opaque envelope, clearly identified with Bidder's name, project name and Owner's name on the outside.
- C. Improperly completed information, irregularities in security deposit or bid bond, may be cause not to open the Bid Form envelope and declare the Bid invalid or informal.
- D. An abstract summary of submitted Bids will be made available to all Bidders following Bid opening.

6.02 BID INELIGIBILITY

- A. Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, may at the discretion of the Owner, be declared unacceptable.
- B. Bid Forms, Appendices, and enclosures which are improperly prepared may at the discretion of the Owner, be declared unacceptable.
- C. Failure to provide security deposit, bonding or insurance requirements may at the discretion of the Owner, invalidate the Bid.

PART 7. BID ENCLOSURES/REQUIREMENTS

7.01 SECURITY DEPOSIT

- A. Bids shall be accompanied by a security deposit as follows:
 - 1. Bid Bond of a sum no less than 5 percent of the Bid Price/Sum on AIA A310 Bid Bond Form.
 - OR
 - 2. Certified check in the amount of 5% of the Bid Price.
- B. Endorse the Bid Bond in the name of the Owner as obligee, signed and sealed by the Contractor as principal and the Surety.
- OR

- C. Endorse the certified check in the name of the Owner.
- D. The security deposit will be returned after delivery to the Owner of the required Performance and Labor and Materials Payment Bond(s) by the accepted Bidder.
- E. Do not include the cost of Bid Security in the Bid Price.
- F. After a Bid has been accepted, all securities will be returned to the respective Bidders.
- G. If no contract is awarded, all security deposits will be returned.
- H. Bonding Company be listed on the most recent IRS Circular 570.

7.02 PERFORMANCE ASSURANCE

- A. Accepted Bidder: Provide a Performance and Payment bond as described in Document 00 60 50.1 - Supplementary General Conditions.
- B. Include the cost of performance assurance bonds in the Bid Price and identify the cost when requested by the Owner.

7.03 BID FORM REQUIREMENTS

- A. Complete all requested information in the Bid Form and Appendices.

7.04 FEES FOR CHANGES IN THE WORK

- A. Include in the Bid Form, the overhead and profit fees on own Work and Work by Subcontractors, applicable for Changes in the Work, whether additions to or deductions from the Work on which the Bid Price is based.
- B. Include in the Bid Form, the fees proposed for subcontract work for changes (both additions and deductions) in the Work. The Contractor shall apply fees as noted, to the Subcontractor's gross (net plus fee) costs on additional work.

7.05 BID FORM SIGNATURE

- A. The Bid Form shall be signed by the Bidder, as follows:
 - 1. Sole Proprietorship: Signature of sole proprietor in the presence of a witness who will also sign. Insert the words "Sole Proprietor" under the signature. Affix seal.
 - 2. Partnership: Signature of all partners in the presence of a witness who will also sign. Insert the word "Partner" under each signature. Affix seal to each signature.
 - 3. Corporation: Signature of a duly authorized signing officer(s) in their normal signatures. Insert the officer's capacity in which the signing officer acts, under each signature. Affix the corporate seal. If the Bid is signed by officials other than the President and Secretary of the company, or the President/Secretary/Treasurer of the company, a copy of the by-law resolution of the Board of Directors authorizing them to do so, must also be submitted with the Bid Form in the Bid envelope.
 - 4. Joint Venture: Each party of the joint venture shall execute the Bid Form under their respective seals in a manner appropriate to such party as described above, similar to the requirements of a Partnership.

7.06 ADDITIONAL BID INFORMATION

- A. Appendix A – List of Allowances

- B. Appendix B – List of Unit Prices
- C. Appendix C – List of Alternates
- D. Appendix D – List of Subcontractors

PART 8. OFFER ACCEPTANCE/REJECTION

8.01 DURATION OF OFFER

- A. Bids shall remain open to acceptance and shall be irrevocable for a period of ninety (90) days after the Bid closing date.

8.02 ACCEPTANCE OF OFFER

- A. The Owner reserves the right to accept or reject any or all offers.
- B. The Owner will select the lowest responsible bid from a qualified bidder. Lowest bid means the lowest price offered in section 00 41 13, 1. Offer.

END OF DOCUMENT

DOCUMENT 00 41 13

BID FORM

TO: Town of Salisbury
27 Main Street
P.O. Box 548
Salisbury, Ct 06068

PROJECT: Relocation of the Lakeville Train Station
7 Ethan Allen Street
Salisbury, CT 06068

Date: _____

Submitted by:
(full name)

(full address)

1. OFFER

Having examined the Place of the Work and all matters referred to in the Instructions to Bidders and the Contract Documents prepared by Crosskey Architects LLC, Architect for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Price of:

\$ _____ (\$ _____) dollars.

We have included herewith, the required security deposit/Bid Bond as required by the Instruction to Bidders.

Sales tax is not included in the Bid Price, as the Owner is tax exempt.

All Cash Allowances described in Section 01 26 00 - Contract Considerations are included in the Bid Price.

2. ACCEPTANCE

This offer shall be open to acceptance and is irrevocable for 90 days from the Bid closing date.

If this Bid is accepted by the Owner within the time period stated above, we will:

Execute the Agreement within 15 days of receipt of acceptance of this Bid.

Furnish the required Performance and Labor & Material Bonds within 7 days of receipt of acceptance of this Bid.

Commence work within 15 days after executing the agreement.

If this Bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required Bond(s), the security deposit shall be forfeited as damages to the Owner by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this Bid and the Bid upon which the Contract is signed.

In the event our Bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

3. CONTRACT TIME

If this Bid is accepted, we will:

Complete the Work in **one hundred twenty (120)** calendar days from acceptance of this Bid.

4. CHANGES TO THE WORK

When the Architect establishes that the method of valuation for Changes in the Work will be net cost plus a percentage fee in accordance with General Conditions, our percentage fee will be:

_____percent overhead and profit on the net cost of our own Work;

_____percent on the cost of work done by any Subcontractor.

On work deleted from the Contract, our credit to the Owner shall be the Architect approved net cost plus _____of the overhead and profit percentage noted above.

5. ADDENDA

The following Addenda have been received. The modifications to the Bid Documents noted therein have been considered and all costs thereto are included in the Bid Price.

Addendum # _____ Dated _____

Addendum # _____ Dated _____

Addendum # _____ Dated _____

6. APPENDICES

Submit Appendices in Document 00 43 20 - Supplements to Bid Forms as directed in Document 00 11 16 – Instructions to Bidders.

7. BID FORM SIGNATURE(S)

The Corporate Seal of

(Bidder - please print the full name of your Proprietorship, Partnership, or Corporation)

was hereunto affixed in the presence of:

(Authorized signing officer

(Title)

(Seal)

(Authorized signing officer

(Title)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

END OF DOCUMENT

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DOCUMENT 00 43 20

SUPPLEMENTS TO BID FORM

TO: Town of Salisbury
27 Main Street
P.O. Box 548
Salisbury, Ct 06068

PROJECT: Relocation of the Lakeville Train Station
7 Ethan Allen Street
Salisbury, CT 06068

Date: _____

Submitted by:
(full name)

(full address)

In accordance with Document 00 21 13 - Instructions to Bidders and Document 00 41 13 - Bid Form, we include the Supplements To Bid Form Appendices listed below. The information provided shall be considered an integral part of the Bid Form.

These Appendices are as follows:

Document 00 43 21 – Appendix A – List of Allowances: Include the listing of allowances specifically requested in the Contract Documents.

Document 00 43 22 - Appendix B – List of Unit Prices: Include a listing of unit prices specifically requested by the Contract Documents.

Document 00 43 23 - Appendix C – List of Alternatives: Include the cost variation to the Bid Price applicable to the Work described in Section 01 26 00.

Document 00 43 24 - Appendix D – List of Subcontractors: Include the names of all Subcontractors and the portions of the Work they will perform.

SUPPLEMENTS TO BID FORM SIGNATURE(S)

The Corporate Seal of

(Bidder - please print the full name of your Proprietorship, Partnership, or Corporation)

was hereunto affixed in the presence of:

(Authorized signing officer Title)

(Seal)

(Authorized signing officer Title)

(Seal)

END OF SUPPLEMENTS TO BID FORM

DOCUMENT 00 43 21

APPENDIX A - LIST OF ALLOWANCES

The following is the list of Allowances referenced in the bid submitted by:

(Bidder) _____

TO: Town of Salisbury
27 Main Street
P.O. Box 548
Salisbury, Ct 06068

PROJECT: Relocation of the Lakeville Train Station
7 Ethan Allen Street
Salisbury, CT 06068

Dated _____ and which is an integral part of the Bid Form.

Each allowance includes all equipment, tools, labor, permits, fees, overhead and profit, etc. incidental to completion of the work involved and the disposal of surplus or unsuitable material in accordance with the Plans and Specifications or as directed by the Architect.

UNIT PRICES:

ITEM DESCRIPTION	ALLOWANCE
For testing & Inspections	\$ 5,000.00

END OF SECTION

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DOCUMENT 00 43 22**APPENDIX B - LIST OF UNIT PRICES**

The following is the list of Unit Prices referenced in the bid submitted by:

(Bidder) _____

TO: Town of Salisbury
27 Main Street
P.O. Box 548
Salisbury, Ct 06068

PROJECT: Relocation of the Lakeville Train Station
7 Ethan Allen Street
Salisbury, CT 06068

Dated _____ and which is an integral part of the Bid Form.

We propose and agree that, should the amount of work required be increased or decreased, by a request of the Owner, the following Unit Prices will be the basic price for computing extra cost or credit. It is understood that the right is reserved by the above mentioned Owner to reject or negotiate any or all of the Unit Prices.

Each Unit Price includes all equipment, tools, labor, permits, fees, overhead and profit, etc. incidental to completion of the work involved and the disposal of surplus or unsuitable material in accordance with the Plans and Specifications or as directed by the Architect. Unit Prices will be decreased ten percent (10%) if change requested is a reduction in work.

UNIT PRICES:

<u>ITEM DESCRIPTION</u>	<u>PRICE/UNIT</u>
1. Price to replace existing 10x3 sill in areas of deterioration. Drawings assume 10 LF of replacement.	\$ _____ per L/FT
2. Price to provide new brick to match existing. Base bid to assume 85% reuse and 15% new.	\$ _____ per SF

END OF SECTION

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DOCUMENT 00 43 23

APPENDIX C - LIST OF ALTERNATES

The following is the list of Alternates referenced in the bid submitted by:

(Bidder) _____

TO: Town of Salisbury
27 Main Street
P.O. Box 548
Salisbury, Ct 06068

PROJECT: Relocation of the Lakeville Train Station
7 Ethan Allen Street
Salisbury, CT 06068

Dated _____ and which is an integral part of the Bid Form.

The following amounts shall be added to or deducted from the Bid Price. Refer to Section 01 26 00 – Contract Modification Procedures Part 1.9 Alternates. This form requests a "difference" in bid price by adding to or deducting from the base bid price using the Alternates listed below.

To be determined at a later date.

(Add) \$ _____

END OF SECTION

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DOCUMENT 00 43 24

APPENDIX D - LIST OF SUBCONTRACTORS

Herewith is the list of Subcontractors referenced in the bid submitted by:

(Bidder) _____

TO: Town of Salisbury
27 Main Street
P.O. Box 548
Salisbury, Ct 06068

PROJECT: Relocation of the Lakeville Train Station
7 Ethan Allen Street
Salisbury, CT 06068

Dated _____ and which is an integral part of the Bid Form.

In accordance with the bid documents, we hereby submit a completed List of Subcontractors. The Owner reserves the right to reject a proposed Subcontractor for reasonable cause. Refer to AIA Article 5 of General Conditions.

The following work will be performed (or provided) by Subcontractors and coordinated by us. This list comprises the all of the subcontractors to be employed on this project:

<i>WORK SUBJECT</i>	<i>SUBCONTRACTOR</i>	<i>CONTRACT VALUE</i>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

END OF SECTION

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DOCUMENT 00 60 01.1

AGREEMENT - AIA

1 AGREEMENT

AIA Document A101 Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum (2007 Edition), forms the basis of Contract between the Owner and Contractor.

END OF SECTION

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DRAFT AIA® Document A101™ – 2007

Standard Form of Agreement Between Owner and Contractor *where the basis of payment is a Stipulated Sum*

AGREEMENT made as of the « » day of « » in the year « »
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

«»« »
«»
« »
« »

and the Contractor:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

for the following Project:
(Name, location and detailed description)

«»
«»
« »

The Architect:
(Name, legal status, address and other information)

«Crosskey Architects LLC»« »
«750 Main Street; Suite 150
Hartford, CT 06103»
«Telephone Number: 86-724-3000»
« »

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

AIA Document A201™-2007, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.

(Insert the date of commencement if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)

« »

If, prior to the commencement of the Work, the Owner requires time to file mortgages and other security interests, the Owner's time requirement shall be as follows:

« »

§ 3.2 The Contract Time shall be measured from the date of commencement.

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than « » (« ») days from the date of commencement, or as follows:

(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work.)

<< >>

Portion of Work

Substantial Completion Date

, subject to adjustments of this Contract Time as provided in the Contract Documents.

(Insert provisions, if any, for liquidated damages relating to failure to achieve Substantial Completion on time or for bonus payments for early completion of the Work.)

<< >>

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be << >> (\$ << >>), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

<< >>

§ 4.3 Unit prices, if any:

(Identify and state the unit price; state quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price Per Unit (\$0.00)

§ 4.4 Allowances included in the Contract Sum, if any:

(Identify allowance and state exclusions, if any, from the allowance price.)

Item	Price

ARTICLE 5 PAYMENTS

§ 5.1 PROGRESS PAYMENTS

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

<< >>

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the << >> day of a month, the Owner shall make payment of the certified amount to the Contractor not later than the << >> day of the << >> month. If an Application for Payment is received by the Architect after the application date fixed above, payment shall be made by the Owner not later than << >> (<< >>) days after the Architect receives the Application for Payment. *(Federal, state or local laws may require payment within a certain period of time.)*

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form and supported

by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

- .1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of « » percent (« » %). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.9 of AIA Document A201™–2007, General Conditions of the Contract for Construction;
- .2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of « » percent (« » %);
- .3 Subtract the aggregate of previous payments made by the Owner; and
- .4 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201–2007.

§ 5.1.7 The progress payment amount determined in accordance with Section 5.1.6 shall be further modified under the following circumstances:

- .1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and
(Section 9.8.5 of AIA Document A201–2007 requires release of applicable retainage upon Substantial Completion of Work with consent of surety, if any.)
- .2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201–2007.

§ 5.1.8 Reduction or limitation of retainage, if any, shall be as follows:

(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Sections 5.1.6.1 and 5.1.6.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)

« »

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 FINAL PAYMENT

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 12.2.2 of AIA Document A201–2007, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

« »

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 INITIAL DECISION MAKER

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A201–2007, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker.

(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

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§ 6.2 BINDING DISPUTE RESOLUTION

For any Claim subject to, but not resolved by, mediation pursuant to Section 15.3 of AIA Document A201–2007, the method of binding dispute resolution shall be as follows:

(Check the appropriate box. If the Owner and Contractor do not select a method of binding dispute resolution below, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.)

☐ Arbitration pursuant to Section 15.4 of AIA Document A201–2007

☐ Litigation in a court of competent jurisdiction

☐ Other *(Specify)*

<< >>

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2007.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2007.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2007 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

(Insert rate of interest agreed upon, if any.)

<< >> % << >>

§ 8.3 The Owner's representative:

(Name, address and other information)

<< >>
<< >>
<< >>
<< >>
<< >>
<< >>

§ 8.4 The Contractor's representative:

(Name, address and other information)

<< >>
<< >>
<< >>
<< >>
<< >>
<< >>

§ 8.5 Neither the Owner's nor the Contractor's representative shall be changed without ten days written notice to the other party.

§ 8.6 Other provisions:

<< >>

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 9.1.1 The Agreement is this executed AIA Document A101–2007, Standard Form of Agreement Between Owner and Contractor.

§ 9.1.2 The General Conditions are AIA Document A201–2007, General Conditions of the Contract for Construction.

§ 9.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

§ 9.1.4 The Specifications:

(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

<< >>

Section	Title	Date	Pages

§ 9.1.5 The Drawings:

(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

<< >>

Number	Title	Date

§ 9.1.6 The Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding requirements are not part of the Contract Documents unless the bidding requirements are also enumerated in this Article 9.

§ 9.1.7 Additional documents, if any, forming part of the Contract Documents:

- 1 AIA Document E201™–2007, Digital Data Protocol Exhibit, if completed by the parties, or the following:

<< >>

.2 Other documents, if any, listed below:

(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201–2007 provides that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor’s bid are not part of the Contract Documents unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)

<< >>

ARTICLE 10 INSURANCE AND BONDS

The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A201–2007.

(State bonding requirements, if any, and limits of liability for insurance required in Article 11 of AIA Document A201–2007.)

Type of insurance or bond

Limit of liability or bond amount (\$0.00)

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*

<< >>< >>

(Printed name and title)

CONTRACTOR *(Signature)*

<< >>< >>

(Printed name and title)

DRAFT AIA® Document A101™ – 2017

Exhibit A

Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

for the following **PROJECT**:
(Name and location or address)

« »
« »
« »

THE OWNER:
(Name, legal status and address)

THE CONTRACTOR:
(Name, legal status and address)

« »
« »
« »

TABLE OF ARTICLES

- A.1 GENERAL
- A.2 OWNER'S INSURANCE
- A.3 CONTRACTOR'S INSURANCE AND BONDS
- A.4 SPECIAL TERMS AND CONDITIONS

ARTICLE A.1 GENERAL

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A201™–2017, General Conditions of the Contract for Construction.

ARTICLE A.2 OWNER'S INSURANCE

§ A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by Section A.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

§ A.2.2 Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual general liability insurance.

ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document is intended to be used in conjunction with AIA Document A201™–2017, General Conditions of the Contract for Construction. Article 11 of A201™–2017 contains additional insurance provisions.

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§ A.2.3 Required Property Insurance

§ A.2.3.1 Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ A.2.3.1.1 Causes of Loss. The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. Sub-limits, if any, are as follows:

(Indicate below the cause of loss and any applicable sub-limit.)

Causes of Loss	Sub-Limit

§ A.2.3.1.2 Specific Required Coverages. The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses. Sub-limits, if any, are as follows:

(Indicate below type of coverage and any applicable sub-limit for specific required coverages.)

Coverage	Sub-Limit

§ A.2.3.1.3 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section A.2.3.1 or, if necessary, replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

§ A.2.3.1.4 Deductibles and Self-Insured Retentions. If the insurance required by this Section A.2.3 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

§ A.2.3.2 Occupancy or Use Prior to Substantial Completion. The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1 have consented in writing to the continuance of coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

§ A.2.3.3 Insurance for Existing Structures

If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.2.3.1, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

§ A.2.4 Optional Extended Property Insurance.

The Owner shall purchase and maintain the insurance selected and described below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. For each type of insurance selected, indicate applicable limits of coverage or other conditions in the fill point below the selected item.)

- [☐] **§ A.2.4.1 Loss of Use, Business Interruption, and Delay in Completion Insurance**, to reimburse the Owner for loss of use of the Owner's property, or the inability to conduct normal operations due to a covered cause of loss.

☐ ☐

- [☐] **§ A.2.4.2 Ordinance or Law Insurance**, for the reasonable and necessary costs to satisfy the minimum requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project.

☐ ☐

- [☐] **§ A.2.4.3 Expediting Cost Insurance**, for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property.

☐ ☐

- [☐] **§ A.2.4.4 Extra Expense Insurance**, to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above the total costs that would normally have been incurred during the same period of time had no loss or damage occurred.

☐ ☐

- [☐] **§ A.2.4.5 Civil Authority Insurance**, for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance.

☐ ☐

- [☐] **§ A.2.4.6 Ingress/Egress Insurance**, for loss due to the necessary interruption of the insured's business due to physical prevention of ingress to, or egress from, the Project as a direct result of physical damage.

☐ ☐

- [☐] **§ A.2.4.7 Soft Costs Insurance**, to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects, engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses.

☐ ☐

§ A.2.5 Other Optional Insurance.

The Owner shall purchase and maintain the insurance selected below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance.)

- [« »] **§ A.2.5.1 Cyber Security Insurance** for loss to the Owner due to data security and privacy breach, including costs of investigating a potential or actual breach of confidential or private information. *(Indicate applicable limits of coverage or other conditions in the fill point below.)*

« »

- [« »] **§ A.2.5.2 Other Insurance**
(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage

Limits

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General

§ A.3.1.1 Certificates of Insurance. The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. The certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy or policies.

§ A.3.1.2 Deductibles and Self-Insured Retentions. The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.

§ A.3.1.3 Additional Insured Obligations. To the fullest extent permitted by law, the Contractor shall cause the commercial general liability coverage to include (1) the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, CG 20 32 07 04.

§ A.3.2 Contractor's Required Insurance Coverage

§ A.3.2.1 The Contractor shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:
(If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)

« »

§ A.3.2.2 Commercial General Liability

§ A.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than « » (\$ « ») each occurrence, « » (\$ « ») general aggregate, and « » (\$ « ») aggregate for products-completed operations hazard, providing coverage for claims including

- .1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;
- .2 personal injury and advertising injury;
- .3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
- .4 bodily injury or property damage arising out of completed operations; and

.5 the Contractor's indemnity obligations under Section 3.18 of the General Conditions.

§ A.3.2.2.2 The Contractor's Commercial General Liability policy under this Section A.3.2.2 shall not contain an exclusion or restriction of coverage for the following:

- .1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.
- .2 Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor.
- .3 Claims for bodily injury other than to employees of the insured.
- .4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.
- .5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.
- .6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.
- .7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.
- .8 Claims related to roofing, if the Work involves roofing.
- .9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.
- .10 Claims related to earth subsidence or movement, where the Work involves such hazards.
- .11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

§ A.3.2.3 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Contractor, with policy limits of not less than « » (\$ « ») per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage.

§ A.3.2.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as the coverages required under Section A.3.2.2 and A.3.2.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ A.3.2.5 Workers' Compensation at statutory limits.

§ A.3.2.6 Employers' Liability with policy limits not less than « » (\$ « ») each accident, « » (\$ « ») each employee, and « » (\$ « ») policy limit.

§ A.3.2.7 Jones Act, and the Longshore & Harbor Workers' Compensation Act, as required, if the Work involves hazards arising from work on or near navigable waterways, including vessels and docks

§ A.3.2.8 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ A.3.2.9 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ A.3.2.10 Coverage under Sections A.3.2.8 and A.3.2.9 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ A.3.2.11 Insurance for maritime liability risks associated with the operation of a vessel, if the Work requires such activities, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ A.3.2.12 Insurance for the use or operation of manned or unmanned aircraft, if the Work requires such activities, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate.

§ A.3.3 Contractor's Other Insurance Coverage

§ A.3.3.1 Insurance selected and described in this Section A.3.3 shall be purchased from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

(If the Contractor is required to maintain any of the types of insurance selected below for a duration other than the expiration of the period for correction of Work, state the duration.)

« »

§ A.3.3.2 The Contractor shall purchase and maintain the following types and limits of insurance in accordance with Section A.3.3.1.

(Select the types of insurance the Contractor is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. Where policy limits are provided, include the policy limit in the appropriate fill point.)

- [« »] **§ A.3.3.2.1** Property insurance of the same type and scope satisfying the requirements identified in Section A.2.3, which, if selected in this section A.3.3.2.1, relieves the Owner of the responsibility to purchase and maintain such insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3. The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below. The Contractor shall disclose to the Owner the amount of any deductible, and the Owner shall be responsible for losses within the deductible. Upon request, the Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below:
(Where the Contractor's obligation to provide property insurance differs from the Owner's obligations as described under Section A.2.3, indicate such differences in the space below. Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)

« »

- [« »] **§ A.3.3.2.2 Railroad Protective Liability Insurance**, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate, for Work within fifty (50) feet of railroad property.
- [« »] **§ A.3.3.2.3 Asbestos Abatement Liability Insurance**, with policy limits of not less than « » (\$ « ») per claim and « » (\$ « ») in the aggregate, for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos-containing materials.
- [« »] **§ A.3.3.2.4** Insurance for physical damage to property while it is in storage and in transit to the construction site on an "all-risks" completed value form.
- [« »] **§ A.3.3.2.5** Property insurance on an "all-risks" completed value form, covering property owned by the Contractor and used on the Project, including scaffolding and other equipment.
- [« »] **§ A.3.3.2.6 Other Insurance**
(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage**Limits****§ A.3.4 Performance Bond and Payment Bond**

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows:

(Specify type and penal sum of bonds.)

Type

Penal Sum (\$0.00)

Payment Bond

Performance Bond

Payment and Performance Bonds shall be AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™, current as of the date of this Agreement.

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

« »

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DOCUMENT 00 60 10.1

PERFORMANCE BOND & PAYMENT BOND - AIA

1. GENERAL CONDITIONS

AIA Document A312 PERFORMANCE BOND & PAYMENT BOND (2010 Edition), are the Bond Forms to be provided for this project.

Bonding company for Performance & Payment bond to possess a rating of 'A' or better and be listed on the most recent IRS Circular 570.

END OF SECTION

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DRAFT AIA® Document A312™ – 2010

Performance Bond

CONTRACTOR:

(Name, legal status and address)

<< >>< >
<< >>

SURETY:

(Name, legal status and principal place of business)

<< >>< >
<< >>

OWNER:

(Name, legal status and address)

<<>>
<<>>
<<>>

CONSTRUCTION CONTRACT

Date: << >>

Amount: \$ << >>

Description:

(Name and location)

<<>>
<<>>

BOND

Date:

(Not earlier than Construction Contract Date)

<< >>

Amount: \$ << >>

Modifications to this Bond: << >> None << >> See Section 16

CONTRACTOR AS PRINCIPAL

Company: (Corporate Seal)

SURETY

Company: (Corporate Seal)

Signature:

Name and << >>< >

Title:

(Any additional signatures appear on the last page of this Performance Bond.)

Signature:

Name and << >>< >

Title:

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or BROKER:

<< >>
<< >>
<< >>

OWNER'S REPRESENTATIVE:

(Architect, Engineer or other party:)

<<>>
<<>>
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ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

- .1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;
- .2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
- .3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

- .1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
- .2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

- .1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
- .2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and
- .3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 **Balance of the Contract Price.** The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 **Construction Contract.** The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 **Contractor Default.** Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 **Owner Default.** Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 **Contract Documents.** All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

« »

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		SURETY	
Company:	(Corporate Seal)	Company:	(Corporate Seal)
Signature:		Signature:	
Name and Title:	« »« »	Name and Title:	« »« »
Address:	« »	Address:	« »

W

A

R

D

DRAFT AIA® Document A312™ – 2010

Payment Bond

CONTRACTOR:

(Name, legal status and address)

<< >>< >
<< >>

SURETY:

(Name, legal status and principal place of business)

<< >>< >
<< >>

OWNER:

(Name, legal status and address)

<<>>
<< >>
<<>>

CONSTRUCTION CONTRACT

Date: << >>

Amount: \$ << >>

Description:

(Name and location)

<<>>
<<>>

BOND

Date:

(Not earlier than Construction Contract Date)

<< >>

Amount: \$ << >>

Modifications to this Bond: ☐ << >> None ☐ << >> See Section 18

CONTRACTOR AS PRINCIPAL

Company: (Corporate Seal)

SURETY

Company: (Corporate Seal)

Signature:

Name and << >>< >

Title:

Signature:

Name and << >>< >

Title:

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or BROKER:

<< >>
<< >>
<< >>

OWNER'S REPRESENTATIVE:

(Architect, Engineer or other party:)

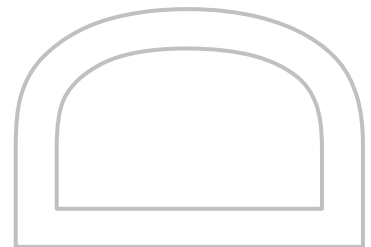
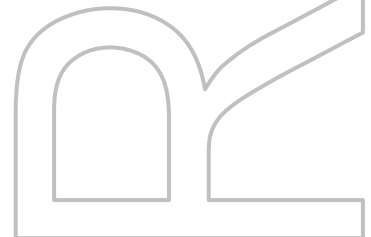
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This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.



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§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

- .1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
- .2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- .1 the name of the Claimant;
- .2 the name of the person for whom the labor was done, or materials or equipment furnished;
- .3 a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- .4 a brief description of the labor, materials or equipment furnished;
- .5 the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- .6 the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- .7 the total amount of previous payments received by the Claimant; and
- .8 the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

« »

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL

Company:

(Corporate Seal)

SURETY

Company:

(Corporate Seal)

Signature:

Name and Title:

Address:

« »« »

« »

Signature:

Name and Title:

Address:

« »« »

« »

DOCUMENT 00 60 20.1

GENERAL CONDITIONS – AIA A201

1. GENERAL CONDITIONS

AIA Document A201 General Conditions of the Contract for Construction (2017 Edition) are the General Conditions between the Owner and Contractor.

END OF SECTION

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DRAFT AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

<< >>
<< >>

THE OWNER:

(Name, legal status and address)

<< >>< >>
<< >>

THE ARCHITECT:

(Name, legal status and address)

<< >>< >>
<< >>

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6	CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
7	CHANGES IN THE WORK
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13	MISCELLANEOUS PROVISIONS
14	TERMINATION OR SUSPENSION OF THE CONTRACT
15	CLAIMS AND DISPUTES

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For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set

forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately

suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3** whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not

have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will

similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the

Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;

- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor

change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term “day” as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor’s control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor’s Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor’s subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot

be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§ 11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to

the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance,

the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the

Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

SECTION 01 10 10

SUMMARY

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Contract Description.
- B. Work Covered by Contract Documents
- C. Phase Construction
- D. Work under separate Contracts
- E. Owner-furnished Products
- F. Work Restrictions
- G. Specifications and Drawing Conventions

1.2 PROJECT INFORMATION

- A. Project Identification:
 - 1. Project Location: 7 Ethan Allen Street, Salisbury, CT
- B. Owner:
 - 1. Owner's Point of Contact: TBD
- C. Architect: Crosskey Architects, llc, 750 Main Street, Suite 150, Hartford, CT 06103
 - 1. Architect's Point of Contact: TBD
- D. Construction Manager: TBD

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 - 1. Relocation of an historic train station to a new location on the existing site. Demolish the existing building foundation, construct a new foundation, ramps & stairs and provide various site improvements.
- B. Type of Contract:

1.4 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the work of this Contract with work performed under separate contracts.
- B. Subsequent Work: Owner will award separate contract(s) for the following additional work to be performed at site following Substantial Completion. Completion of that work will depend on the successful completion of preparatory work under this Contract.

1.5 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on the use of public streets and with other requirements of authorities having jurisdiction.
- B. On-site Work Hours: Limit work in the existing building to normal business working hours of 8:00am to 5:00pm, Monday through Friday, unless otherwise indicated.

1. Weekend Hours: 9:00am to 5:00pm
 2. Hours for Core Drilling or similar noisy activities shall be limited to the hours of 10:00am to 5:00pm.
- C. Noise Vibration and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
1. Notify Construction Manager not less than two days in advance of proposed disruptive operations.
- D. Non Smoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows or outdoor-air intakes.
- E. Controlled Substances: Use of Tobacco Products and other controlled substances within the existing building is not permitted.
- F. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor Personnel working on Project Site.

1.6 SPECIFICATION AND DRAWING CONVENTIONS

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

Not Used.

END OF SECTION

SECTION 01 14 01

PRESERVATION AND RESTORATION OF SITE FEATURES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes
 - 1. Protection restoration of existing improvements.
 - 2. Restoration of existing improvements.
- B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

PART 2 PRODUCTS

2.1 TREE PROTECTION FENCING

- A. Tree protection shall be as shown on the Drawings.

PART 3 EXECUTION

3.1 IDENTIFICATION OF EXISTING FEATURES

- A. Prior to commencing construction activities, Contractor shall identify and delineate those areas or specific improvements that are not to be disturbed. Areas or specific improvements within the Limits of Work/Contract Limits and general work areas which are not to be disturbed shall be clearly marked or fenced. Monuments and markers shall be protected before construction operations commence. Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting designated areas, specific improvements, monuments, and markers at the Project Site.
- B. Prior to commencing construction activities, Contractor shall conduct a "walk-down" of the Project Site with Engineer and/or Owner. The purpose of such "walk-down" is to document pre-construction conditions of items/areas of concern.
 - 1. Contractor shall make note of any damage visible on items/areas of concern, with reference to specific location.
 - 2. [Engineer or Owner must be present for "walk-down" to be considered valid.]

3.2 PROTECTION OF EXISTING FEATURES

- A. General
 - 1. All areas or specific improvements, including but not limited to vegetation, utilities, poles, wires, fences, curbing, property-line markers, and other structures, which must be preserved in place without being temporarily or permanently relocated shall be carefully supported and otherwise protected from damage by Contractor.

2. As excavation approaches underground structures, digging by machinery shall be discontinued and the excavation shall be done by means of hand tools.

B. Pavements

1. On paved surfaces to remain, Contractor shall not use or operate tractors, bulldozers, or other power-operated equipment, or store tools, equipment or materials which may cut or otherwise damage such surfaces.
2. All surfaces, which have been damaged by Contractor's operations, shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of construction operations. Such restoration shall meet the approval of Engineer.

C. Utilities

1. Safeguard and protect from damage any utility to remain in service. Before excavating near any utility, notify the utility owner, coordinate protective work, and comply with the utility owners' requirements.
2. All utility services shall be supported by suitable means so that the services shall not fail when tamping and settling occurs.
3. Where known utilities are encountered, notify Engineer and document location and type of utility before proceeding with work in such area.
4. When uncharted or incorrectly charted utilities are encountered, stop work and notify Engineer. Cooperate with the utility owners in maintaining their utilities in operation prior to resuming work.

- D. Retaining Structures:** Provide bracing, shoring, sheeting, sheet piling, underpinning or other retaining structures necessary to guard against any movement or settlement of existing or new construction, utility systems, paving, or other improvements. Contractor assumes responsibility for the strength and adequacy of retaining structures, and for the safety and support of construction, utilities or paving, and for any movement, settlement or damage thereto.

3.3 REPLACEMENT

- A. In case of damage, Contractor shall notify the appropriate party so that proper steps may be taken to repair any and all damage done. When the Owner does not wish to make the repairs themselves, all damage shall be repaired by Contractor, or, if not promptly done by him, Engineer may have the repairs made at the expense of Contractor.
- B. Contractor shall patch, repair and/or replace all adjacent materials and surfaces damaged through the prosecution of work at no expense to Owner. All repair and replacement work shall match the existing in-kind. Final acceptance of said work shall be at the sole judgement of Owner.

3.4 RELOCATION

- A. If certain existing structures are encountered that in the opinion of Engineer require temporary or permanent relocation or removal, Engineer may order in writing that Contractor undertake

all or part of such work or to assist the Owner in performing such work. For such occurrences, Contractor shall be compensated as applicable, as extra work.

1. In removing existing structures, Contractor shall use care to avoid damage to the material, and Engineer shall include for payment only those new materials, which, in his judgment, are necessary to replace those unavoidably damaged.
- B. The structures to which the provisions of the preceding two paragraphs shall apply include structures which (1) are not indicated on the drawings or otherwise provided for, (2) encroach upon or are encountered near and substantially parallel to the edge of the excavation, and (3) in the opinion of Engineer will impede progress to such an extent that satisfactory construction cannot proceed until they have been changed in location, removed (to be later restored), or replaced. (See Item 3.19, "Sub-Surface Obstructions" also). Contractor shall protect items/areas of concern:

3.5 LAND RESOURCES

- A. Contractor shall confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, Contractor shall identify any land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without approval. Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subarticles.
- B. Trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques. Contractor shall restore any such landscape features damaged or destroyed during construction operations.
 1. Trees which are to remain are shown on the Drawings. Unless specifically authorized by Engineer, no construction equipment or materials shall be placed or used within the drip line of trees shown on the drawings to be saved/to remain. No excavation or fill shall be permitted within the drip line of trees to be saved/to remain except as approved by Engineer.
 2. No ropes, cables, or guys shall be fastened to or attached to any tree(s) for anchorage unless specifically authorized by Engineer. Where such special use is permitted, Contractor shall provide effective protection to prevent damage to the tree.

3.6 WIND PROTECTION

- A. Should high wind warnings be issued by the U.S. Weather Bureau, Contractor shall take every precaution to minimize danger to persons, to the work, and to adjacent properties.

3.7 TREE PROTECTION FENCING

- A. Install fencing completely around all trees to be protected within the project area as shown on the Drawings or as directed by Engineer. Install fencing before any construction activities commence and maintain in place until final grading and seeding is complete and accepted.

- B. Contractor shall not place, or stockpile, any construction or excavation materials within the drip line of any trees. Vehicle and construction equipment shall not be parked, nor left running (idling), within the drip line of any tree.
- C. Any excavation within the drip line of trees to be protected shall be performed by hand, unless otherwise directed by Engineer.
- D. Where construction equipment must pass within the drip line of trees to remain, Contractor shall install wooden tree protection on the trunk of the tree, as detailed, and as directed by Engineer.
- E. Where excavation requires the cutting of tree roots, roots shall be cut with sharp cutting tools and reburied as soon as possible. Until roots can be reburied, the exposed roots are to be covered with wet burlap to prevent roots from drying out. The burlap is to be kept wet until the roots can be reburied.
- F. Where cutting of tree root system has occurred, Contractor shall water the tree root system to the extent of the tree canopy with at least ½ inch of water within 72 hours of when the damage occurred.
- G. When less than ½ inch of water has fallen during a 7-day period, Contractor shall water the tree root system to the extent of the tree canopy with at least ½ inch of water.
- H. Trees damaged by construction activities are to be repaired within 72 hours using current arboricultural standards. Those trees determined by Engineer to be damaged beyond repair shall be removed and replaced by Contractor at no additional cost to Owner.

END OF SECTION

SECTION 01 21 00

ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.
- C. Related Sections include the following:
 - 1. Section 01 26 00 – Contract Modification Procedures
 - 2. Sections 2 through 48 Sections for items of Work covered by allowances.

1.3 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

1.4 SUBMITTALS

- A. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 LUMP-SUM ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner under allowance and shall include taxes, freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by

Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. Refer to Section 00 43 21.

END OF SECTION

SECTION 012500

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1.3 ACTION SUBMITTALS

- A. Substitution Requests: Submit five copies, or via electronic format, of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use CSI Form 13.1A (example can be found after this section).
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in

- delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
 - n. Sample of Warranty (ies) with side-by-side comparison with that specified.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution provides sustainable design characteristics that specified product provided for achieving LEED prerequisites and credits.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed.

PART 3 – EXECUTION

(Not Used)

END OF SECTION

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Crosskey Architects LLC

SUBSTITUTION REQUEST

(After the Bidding/Negotiating Phase)

Substitution Request Number: _____

Project: _____ From: _____

_____ Date: _____

To: _____ A/E Project Number: _____

_____ Contract For: _____

Re: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Installer: _____ Address: _____ Phone: _____

History: ☐ New product ☐ 1-4 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

☐ Point-by-point comparative data attached — REQUIRED BY A/E

Reason for not providing specified item: _____

Similar Installation:

Project: _____ Architect: _____ Address: _____

Owner: _____

Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

Savings to Owner for accepting substitution: _____ (\$ _____).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

Crosskey Architects^{LLC}

SUBSTITUTION REQUEST

(After the Bidding/Negotiating Phase — Continued)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

Attachments: ☐

A/E's REVIEW AND RECOMMENDATION

- ☐ Approve Substitution - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures.
- ☐ Approve Substitution as noted - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures.
- ☐ Reject Substitution - Use specified materials.
- ☐ Substitution Request received too late - Use specified materials.

Signed by: _____ Date: _____

OWNER'S REVIEW AND ACTION

- ☐ Substitution approved - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures. Prepare Change Order.
- ☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures. Prepare Change Order.
- ☐ Substitution rejected - Use specified materials.

Signed by: _____ Date: _____

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Schedule of Values.
- B. Application for Payment.
- C. Change procedures.
- D. Defect Assessment.
- E. Measurement and Payment - Unit Prices.
- F. Alternates.
- G. Requests for Information
- H. Inspections for substantial completion and final completion

1.2 RELATED SECTIONS

- A. Owner - Contractor Agreement: Contract sum/price including allowances.
- B. Section 01 33 00 - Submittals: Schedule of Values.

1.3 SCHEDULE OF VALUES

- A. Submit typed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet. Contractor's standard form or electronic media printout will be considered.
- B. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.
- C. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification Section. Split line items into subcategories for materials and labor. Identify bonds, insurance and site mobilization costs.
- D. Include in each line item, the amount of each Allowance specified in this Section.
- E. Revise schedule with each Application For Payment, to list approved change orders.

1.4 APPLICATIONS FOR PAYMENT

- A. Submit on AIA Form G702 - Application and Certificate for Payment.
- B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

1.5 CHANGE PROCEDURES

- A. The Architect/Engineer will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized and will issue supplemental instructions.
- B. The Architect/Engineer may issue a Proposal Request, which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change, the period of time during which the requested price will be considered valid. Contractor will prepare and submit an estimate within seven days.

- C. The Contractor may propose a change by submitting request for change to the Architect/Engineer, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Sum/Price and Contract Time with full documentation in the form of unit costs and quantities for Material and Labor. Document any requested substitutions in accordance with Section 01 60 00.
 - 1. Stipulated Sum/Price Change Order: Based on Proposal Request and Contractor's fixed price quotation.
 - 2. Unit Price Change Order: For pre-determined unit prices and quantities, the Change Order will be executed on a fixed unit price basis. For unit costs or quantities of units of work, which are not pre-determined, execute Work under a Construction Change Authorization. Changes in Contract Sum/Price or Contract Time will be computed as specified for Time and Material Change Order.
- D. Construction Change Authorization: Architect/Engineer may issue a directive, on AIA Form G713 Construction Change Authorization signed by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum/Price or Contract Time. Contractor will promptly execute the change.
- E. Change Order Forms: AIA G701 Change Order.
- F. Execution of Change Orders: Architect will issue change orders for signature of parties as provided in the Conditions of the Contract.
- G. **Contractor shall reimburse Owner for Architect's time spent reviewing proposed change orders more than twice (original and 1 revision) for the same item or scope of work.**
- H. Contractor shall reimburse Owner for Architect's time spent evaluating an extensive number of claims submitted by the Contractor in connection with the Work.

1.6 DEFECT ASSESSMENT

- A. Replace the Work, or portions of the Work, not conforming to specified requirements.
- B. If, in the opinion of the Architect, it is not practical to remove and replace the Work, the Architect will direct an appropriate remedy or adjust payment.

1.7 MEASUREMENT AND PAYMENT - UNIT PRICES

- A. Authority: Measurement methods are delineated in the individual specification sections.
- B. Take measurements and compute quantities. The Architect will verify measurements and quantities.
- C. Unit Quantities: Quantities and measurements indicated in the Bid Form are for contract purposes only. Actual quantities provided shall determine payment.
- D. Payment Includes: Full compensation for required labor, products, tools, equipment, plant and facilities, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.8 ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work as required.
- C. Schedule of Alternates:
 - 1. Refer to Bid Form.

1.9 REQUESTS FOR INFORMATION

- A. Contractor shall reimburse Owner for Architect's time spent responding to the Contractor's requests for information where such information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor prepared coordination drawings, or prior Project correspondence or documentation.
- B. Refer to Section 01 31 00.

1.10 INSPECTIONS FOR SUBSTANTIAL COMPLETION AND FINAL COMPLETION

- A. Contractor shall reimburse Owner for Architect's time spent inspecting any portion of the Work more than twice to determine final completion or to determine whether such portion of the Work is substantially complete in accordance with the requirements of the Contract Documents."

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION

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SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Coordination.
- B. Requests for Information
- C. Field engineering
- D. Pre-construction conference.
- E. Site mobilization conference.
- F. Progress meetings.
- G. Pre-installation conferences.

1.2 COORDINATION

- A. Coordinate scheduling, submittals, and Work of the various Sections of Specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- C. Coordinate space requirements and installation of mechanical and electrical work, which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Coordinate completion and clean up of Work of separate sections in preparation for Substantial Completion.
- F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3 REQUESTS FOR INFORMATION (RFIs)

- A. Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
- B. RFI to include a detailed, legible description of item needing information or interpretation and the following:
 - 1. Project Date
 - 2. Date
 - 3. Name of Contractor
 - 4. Name of Architect
 - 5. RFI number, numbered sequentially
 - 6. RFI subject

7. Specification Section number, title and related paragraphs as appropriate.
 8. Drawing number and detail references, as appropriate.
 9. Field dimensions and conditions, as appropriate.
 10. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or Contract Sum, Contractor shall state impact in the RFI.
 11. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
- C. Architect will review each RFI, determine action required and respond. Allow ten working days for Architect's response for each RFI. RFIs received by Architect after 1:00pm EST will be considered as received the following day. If it is necessary for a Consultant to review an RFI allow for fifteen working days for both Architect and Consultant response for each RFI.
- D. Architect's action may include a request for additional information, in which Architect's time for response will date from the time of receipt of additional information.
- E. Architect's action that may result in a change to the Contract Time or Contract Sum may be eligible for Contractor to submit a Change Proposal in accordance with 01 26 00 Contract Modification Procedures.
1. If Contractor believe the RFI response warrants change in Contract Time of Contract Sum, notify the Architect in writing within ten business days or receipt of the RFI response.

1.4 FIELD ENGINEERING

- A. Employ a Land Surveyor registered in the State of Connecticut and acceptable to the Architect/Engineer.
- B. Contractor to locate and protect survey control and reference points.
- C. Control datum for survey is that established by Owner provided survey as shown on Drawings.
- D. Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.
- E. Submit a copy of registered site drawing and certificate signed by the Land Surveyor that the elevations and locations of the Work are in conformance with the Contract Documents.

1.5 PRECONSTRUCTION CONFERENCE

- A. Owner will schedule a conference after Notice of Award.
- B. Attendance Required: Owner, Architect/Engineer & Contractor.
- C. Agenda:
1. Execution of Owner-Contractor Agreement.
 2. Submission of executed bonds and insurance certificates.
 3. Distribution of Contract Documents.
 4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
 5. Designation of personnel representing the parties in Contract, and the

Architect/Engineer.

6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders and Contract closeout procedures.
7. Scheduling.

1.6 SITE MOBILIZATION CONFERENCE

- A. Owner will schedule a conference at the Project site prior to Contractor occupancy.
- B. Attendance Required: Owner, Architect/Engineer, and Contractor, Contractor's Superintendent & major Subcontractors.
- C. Agenda:
 1. Use of premises by Owner and Contractor.
 2. Owner's requirements.
 3. Construction facilities and controls provided by Owner.
 4. Temporary utilities provided by Owner.
 5. Survey and building layout.
 6. Security and housekeeping procedures.
 7. Schedules.
 8. Procedures for testing.
 9. Procedures for maintaining record documents.
 10. Requirements for start-up of equipment.
 11. Inspection and acceptance of equipment put into service during construction period.

1.7 PROGRESS MEETINGS

- A. G.C. shall Schedule and administer meetings throughout progress of the Work at maximum weekly intervals.
- B. G.C. will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings. G.C. shall record meetings and distribute copies within seven days to Contractor, Owner, participants, and those affected by decisions made.
- C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Architect/Engineer as appropriate to agenda topics for each meeting.
- D. Agenda:
 1. Review minutes of previous meetings.
 2. Review of Work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems, which impede planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Review of off-site fabrication and delivery schedules.
 7. Maintenance of progress schedule.
 8. Corrective measures to regain projected schedules.
 9. Planned progress during succeeding work period.
 10. Coordination of projected progress.
 11. Maintenance of quality and work standards.
 12. Effect of proposed changes on progress schedule and coordination.
 13. Other business relating to Work.

1.8 PREINSTALLATION CONFERENCES

- A. When required in individual specification Section, convene a pre-installation conference at work site prior to commencing work of the Section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific Section.
- C. Notify Architect/Engineer four days in advance of meeting date.
- D. Prepare agenda, preside at conference, record minutes, and distribute copies within two days after conference to participants, with two copies to Architect/Engineer.
- E. Review conditions of installation, preparation and installation procedures, and coordination with related work.

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION

SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following
 1. Periodic Construction Photographs
 2. Photographic documentation for submittal with Pay Requisitions.
 3. Final Completion Construction Photographs.

1.2 INFORMATIONAL SUBMITTALS

- A. Key Plan and Digital Photographs are to be submitted monthly with Pay requisitions, as documentation of the work completed.
- B. Key Plan: Submit key plan of project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- C. Digital Photographs: Submit image files within three days of taking photographs.
 1. Digital Camera: Minimum sensor resolution of 8 megapixels
 2. Format: Minimum 3200 x 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
 3. Identification: Provide the following information with each image description in file metadata tag:
 - a) Name of project
 - b) Name and contract information for photographer
 - c) Name of Architect and Construction Manager/ General Contractor
 - d) Name of Contractor
 - e) Date Photograph was taken
 - f) Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction

1.3 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 – PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 – EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs
- B. General: Take photographs using the maximum range of depth of field, and that are in focus,

- to clearly, show the work. Photographs with blurry or out-of-focus areas will not be accepted.
- C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Aerial Photography: Where applicable provide a monthly photograph of the project site & building each month of the Construction process for submission with pay requisitions/ for Owner records.
 - D. Architect-Directed Construction Photographs: From time to time, Architect will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since the last photographs were taken.
 - E. Final Completion Construction Photographs: Take 20 color photographs after the date of Substantial Completion for submission as project record documents. Architect will inform photographer of desired vantage points.
 - 1. Do not include Date Stamp.
 - F. Additional photographs: Architect or Construction Manager may request photographs in addition to periodic photographs specified. Additional photographs include, but are not limited to, the following:
 - 1. Three days notice will be given, where feasible
 - 2. In emergency situations, take additional photographs within 24 hours of request
 - 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a) Immediate follow-up when on-site events result in construction damage or losses
 - b) Owner's request for special publicity photographs

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including but not limited to the following:
 - 1. Submittal schedule.
 - 2. Shop Drawings.
 - 3. Product Data.
 - 4. Samples.
 - 5. Quality assurance submittals.
 - 6. Proposed "Substitutions/Equals".
 - 7. Warrantee samples.
 - 8. Coordination Drawings.
 - 9. O & M Manuals
- B. Administrative Submittals: Refer to other Division 01 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:
 - 1. Permits.
 - 2. Applications for Payment.
 - 3. Performance and payment bonds.
 - 4. Contractor's construction schedule.
 - 5. Daily construction reports.
 - 6. Construction Photographs.
 - 7. Insurance certificates.
 - 8. List of subcontractors.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 01 26 00 "Contract Modification Procedures" specifies requirements for submittal of requests for equals and substitutions.
 - 2. Section 01 26 00 "Contract Modification Procedures " specifies requirements for submittal of the Schedule of Values.
 - 3. Section 01 31 00 "Project Management and Coordination " specifies requirements governing preparation and submittal of required Coordination Drawings.
 - 4. Division 01 Section 01 31 00 " Project Management and Coordination " specifies requirements for submittal and distribution of meeting and conference minutes.
 - 5. Division 01 Section 01 40 00 "Quality Control" specifies requirements for submittal of inspection and test reports and mockups.
 - 6. Division 01 Section 01 77 00 "Contract Closeout" specifies requirements for submittal of Project Record Documents and warranties at project closeout.

1.3 DEFINITIONS

- A. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended and as identified in the Specification Divisions 02 - 48.
 - 1. Preparation of Coordination Drawings is specified in Section 01 31 00 "Project Management and Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.
- B. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.
- C. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

1.4 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
 - b. The Architect reserves the right to reject incomplete submitted packages.
 - 3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for re-submittals.
 - a. Allow 14 days for initial review. Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals.
 - b. If an intermediate submittal is necessary, process the same as the initial submittal.
 - c. Allow 14 days for reprocessing each submittal.
 - d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
- B. Submittal Preparation: Place a permanent label, title block or 8-1/2 inches x 11 inches cover page approved by the Architect, on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
 - 1. Unless otherwise noted or required by the Architect or Owner, each submittal shall be transmitted in electronic format to the Architect for review.
 - 2. Provide a space approximately 4 inches by 5 inches on the label, beside the title block or on the cover page on Shop Drawings to record the Contractor's review and approval markings and the action taken.
 - 3. Include the following information on the label for processing and recording action taken.

- a. Project Name.
 - b. Date.
 - c. Name and address of the Architect, Construction Administrator, and Owner Representative.
 - d. Name and address of the Contractor.
 - e. Name and address of the subcontractor.
 - f. Name and address of the supplier.
 - g. Name of the manufacturer.
 - h. Number and title of appropriate Specification Section.
 - i. Drawing number and detail references, as appropriate.
 - j. Indicate either initial or resubmittal.
 - k. Indicate deviations from Contract Documents.
 - l. Indicate if "equal" or "substitution".
- C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect using a transmittal form. Copy the Construction Administrator on the transmittal. The Architect will return all submittals to the Contractor after action is taken with a complete copy of the submittal package. The Architect will not accept submittals received from sources other than the Contractor.
1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.
- D. **Contractor shall reimburse Owner for Architect's time spent reviewing proposed submittal or shop drawing more than twice (original and 1 revision) for the same item.**
- E. **Multiple submittals for the same product (i.e. submitted by different multiple subcontractors, and/or for different buildings on a multi-building projects, etc.) will be rejected. The General Contractor shall submit a single submittal for each project that will be applied for the entire project.**

1.5 SUBMITTAL SCHEDULE

- A. After development and review by the Owner and Architect acceptance of the Contractor's Construction or CPM schedule prepare a complete schedule of submittals. Submit the schedule to the Construction Administrator within thirty (30) days of Contract Award.
1. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor's Construction or CPM Schedule.
 2. Prepare the schedule in chronological order. Provide the following information:
 - a. Schedule date for the initial submittal.
 - b. Related section number.
 - c. Submittal category (Shop Drawings, Product Data, or Samples).
 - d. Name of Subcontractor.
 - e. Description of the part of Work covered.
 - f. Scheduled date for resubmittal.
 - g. Scheduled date for the Architect's final release of approval.
- B. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time

required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's Contractor's Construction or CPM Schedule.
 2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first **[insert Number of Days]** days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
- C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each specification section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same specification section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow **[Fourteen Days]** days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination with related submittals not yet received. Additional time will be required if processing must be delayed to permit review of related subsequent submittals.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow **[Ten Days]** days for review of each resubmittal.
 4. Mass Submittals: Six (6) or more submittals in one (1) day or twenty (20) or more submittals in one (1) week. If "Mass Submittals" are received, Architect's review time stated above may be extended as necessary to perform proper review. Architect will review "Mass Submittals based upon priority determined by Architect after consultation with Owner and Contractor.
- E. Distribution: Following response to the initial submittal, distribute copies to the Construction Administrator, Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- F. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.6 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report recording the following information concerning events at the site, and submit duplicate copies to the Construction Administrator at weekly intervals:
1. List of subcontractors at the site.
 2. Approximate count of personnel at the site.
 3. High and low temperatures, general weather conditions.
 4. Accidents and unusual events.
 5. Meetings and significant decisions.
 6. Stoppages, delays, shortages, and losses.
 7. Meter readings and similar recordings.
 8. List of equipment on site and identify if idle or in use.
 9. Orders and requests of governing authorities.
 10. Change Orders received, start and end dates.
 11. Services connected, disconnected.
 12. Equipment or system tests and startups.
 13. Partial Completion's, occupancies.
 14. Substantial Completion's authorized.
 15. Equals or Substitutions approved or rejected.

1.7 SHOP DRAWINGS

- A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
- B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:
1. Dimensions.
 2. Identification of products and materials included by sheet and detail number.
 3. Compliance with specified standards.
 4. Notation of coordination requirements.
 5. Notation of dimensions established by field measurement.
 6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches.
 7. Submit electronic copy of shop drawings for review. The electronic submission may be done via email to the Architect or via the Contractor's online cloud system (I.e., 'Procore'). The Architect will return the reviewed shop drawing in the same manner it was transmitted by the Contractor. The reviewed shop drawing may included mark-ups and/or action items and/or corrections and/or modifications required.
 8. Details shall be large scale and/or full size.

- C. The Contractor shall review the Shop Drawings, stamp with this approval, and submit them with reasonable promptness and in orderly sequence so as to cause no delay in his Work or in the Work of any subcontractor. Shop Drawings shall be properly identified as specified for item, material, workmanship, and project number. At the submission, the Contractor shall inform the Architect, in writing of any deviation in the shop drawings from the requirements of the Contract Documents.
- D. The Architect will review and comment on shop drawings with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the project and with the information given in the Contract Documents. Refer to Article 5 of the General Conditions. Shop Drawings received by the Architect that indicate insufficient study of drawings and specifications, illegible portions or gross errors, will be rejected outright. Such rejections shall not constitute an acceptable reason for granting the Contractor additional time to perform the work.
- E. The Contractor shall make any corrections required by the Architect and shall resubmit the required number of corrected copies of Shop Drawings until fully reviewed.
- F. Upon final review submit revisions in same format as submitted, for use by the Construction Administrator.
- G. The Architect's review and comments on Shop Drawings shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents.
- H. Only final reviewed Shop Drawings are to be used on the Project site.
- I. The Work installed shall be reviewed in accordance with the Shop Drawings and the drawings and specifications. Final Review of the Shop Drawings by the Architect shall constitute acceptance by the Owner and the Architect of a variation or departure that is clearly identified. If the contractor believes notations made by the A/E increases the value or scope of the CD's, the contractor must provide written notice to the CA within seven (7) days of this issue. Final reviewed Shop Drawings shall not replace or be used as a vehicle to issue or incorporate change orders or substitutions. Substitutions shall be submitted in accordance with Division 01 Section 01 25 00 "Substitution Procedures".

1.8 SHOP DRAWING FOR FIRE PROTECTION SYSTEMS

- A. Shop drawings for fire protection systems shall comply with all of the requirements in the section above "Shop Drawings". In addition Sprinkler system shop drawings and hydraulic calculations must be stamped by a professional engineer licensed in the state of Connecticut. Contractor shall coordinate the number of sets required by the local jurisdiction and submit for their review.

1.9 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, schedules, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
 - 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
 - a. Manufacturer's printed recommendations.

- b. Compliance with trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
 - f. Notation of coordination requirements.
2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
3. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.
4. Submittals: Submit electronic copy of submittal for review. Each submittal shall be submitted as a single 'PDF' document. The electronic submission may be done via email to the Architect or via the Contractor's online cloud system (I.e., 'Procore'). The Architect will return the reviewed submittal in the same manner it was transmitted by the Contractor. The reviewed submittal may include mark-ups and/or action items and/or corrections and/or modifications required.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - a. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
 - b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.10 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
 1. Store, mount or display Samples on site in the manner to facilitate review of qualities indicated. Prepare Samples to match the Architect's sample. Include the following:
 - a. Specification Section number and reference.
 - b. Generic description of the Sample.
 - c. Sample source.
 - d. Product name or name of the manufacturer.
 - e. Compliance with recognized standards.
 - f. Availability and delivery time.
 2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least three (3) multiple units that show approximate limits of the variations.

- b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
 - c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.
 - d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.
- 3. Preliminary Submittals: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices, unless otherwise noted in specification section.
 - a. The Architect will review and return preliminary submittals with the Architects notation, indicating selection and other action.
- 4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit three (3) sets. The Architect will return one (1) set marked with the action taken.
- 5. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.
- B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
 - 1. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the Project standard.
 - a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.11 QUALITY ASSURANCE SUBMITTALS

- A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.
- B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.
 - 1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.
- C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 01 Section 01 40 00 "Quality Control."

1.12 ARCHITECT'S ACTION

- A. Except for submittals for the record or information, where action and return is required, the Architect will review each submittal, mark to indicate action taken, and return promptly.
 - 1. Compliance with specified characteristics is the Contractor's responsibility.
- B. Action Stamp: The Architect will stamp each submittal with a uniform, action stamp. The Architect will mark the stamp appropriately to indicate the action taken, as follows:
 - 1. **Furnish as Corrected:** When the Architect marks a submittal "**Furnish as Corrected**," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Submit corrected copies for record. Final payment depends on that compliance.
 - 2. Returned for Resubmittal: When the Architect marks a submittal "Rejected, or Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
 - a. Do not use, or allow others to use, submittals marked "**Rejected, or Revise and Resubmit**" at the Project Site or elsewhere where Work is in progress.
 - 3. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Architect will return the submittal marked "**Reviewed**."
- C. Unsolicited Submittals: The Architect will discard unsolicited submittals without action.

PART 2 – PRODUCTS

(Not Applicable)

PART 3 – EXECUTION

(Not Applicable)

END OF SECTION

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SECTION 01 35 16

ALTERATION PROJECT PROCEDURES

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Products and installation for patching and extending Work.
- B. Transition and adjustments.
- C. Repair of damaged surfaces, finishes, and cleaning.

1.2 RELATED SECTIONS

- A. Section 01 31 00 – Project Management and Coordination: Work sequence, Owner occupancy, Maintenance of utility services.
- B. Section 01 31 00 – Project Management and Coordination, Cutting and patching.
- C. Section 01 50 00 – Construction Facilities and Temporary Controls: Temporary enclosures, Protection of installed work, Cleaning during construction.
- D. Section 02 41 18 – Structure Moving
- E. Section 02 41 19 – Selective Dismantling and Demolition

PART 2 – PRODUCTS

2.1 PRODUCTS FOR PATCHING AND EXTENDING WORK

- A. New Materials: As specified in product Sections; match existing Products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspection and testing Products where necessary, referring to existing Work as a standard.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify that demolition is complete, and areas are ready for installation of new Work.
- B. Beginning of restoration work means acceptance of existing conditions.

3.2 PREPARATION

- A. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.
- B. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.
- C. Remove debris and abandoned items from area and from concealed spaces.
- D. Prepare surface and remove surface finishes to provide for proper installation of new work and finishes.
- E. Close openings in exterior surfaces to protect existing work and salvage items from weather and extremes of temperature and humidity. Insulate ductwork and piping to prevent condensation in exposed areas.

3.3 INSTALLATION

- A. Coordinate work of alterations and renovations to expedite completion sequentially and to accommodate Owner occupancy.
- B. Project & Finishes: Complete in all respects including operational mech./elec. work.
- C. Remove, cut, and patch Work in a manner to minimize damage and to provide a means of restoring Products and finishes to original or specified condition.
- D. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.
- E. Install Products as specified in individual Sections.

3.4 TRANSITIONS

- A. Where new Work abuts or aligns with existing, perform a smooth and even transition. Patched Work to match existing adjacent Work in texture and appearance.
- B. When finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect/Engineer.

3.5 ADJUSTMENTS

- A. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
- B. Where a change of plane of 1/4 inch or more occurs, submit recommendation for providing a smooth transition for Architect/Engineer review or request instructions from Architect/Engineer.
- C. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.
- D. Fit work at penetrations of surfaces.

3.6 REPAIR OF DAMAGED SURFACES

- A. Patch or replace portions of existing surfaces, which are damaged, lifted, discolored, or showing other imperfections.
- B. Repair substrate prior to patching finish.

3.7 FINISHES

- A. Finish surfaces as specified in individual Product Sections.
- B. Finish patches to product uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.8 CLEANING

- A. In addition to cleaning specified in Section 01 77 00, clean Owner occupied areas of work.

END OF SECTION

SECTION 01 40 00

QUALITY CONTROL

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Quality assurance and control of installation.
- B. References.
- C. Field samples.
- D. Mock-up.
- E. Inspection and testing laboratory services.
- F. Manufacturers' field services and reports.

1.2 RELATED SECTIONS

- A. Section 01 30 00 – Submittals Procedures: Submission of Manufacturers' Instructions and Certificates.
- B. Section 01 60 00 – Product Requirements: Requirements for material and product quality.

1.3 QUALITY ASSURANCE/CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply fully with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform work by persons qualified to produce workmanship of specified quality.
- F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.
- G. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

1.4 REFERENCES

- A. Conform to reference standard by date of issue current on date for receiving bids.
- B. Obtain copies of standards when required by Contract Documents.
- C. Should specified reference standards conflict with Contract Documents, request clarification for Architect/Engineer before proceeding.
- D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.5 FIELD SAMPLES

- A. Install field samples at the site as required by individual specifications Sections for review.
- B. Acceptable samples represent a quality level for the Work.
- C. Where field sample is specified in individual Sections to be removed, clear area after field sample has been accepted by Architect/Engineer.

1.6 MOCK-UP

- A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.
- B. Assemble and erect specified items, with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Where mock-up is specified in individual Sections to be removed, clear area after mock-up has been accepted by Architect/Engineer.

1.7 INSPECTION AND TESTING LABORATORY SERVICES

- A. Owner will appoint and employ services of an independent firm to perform inspection and testing. Contractor shall pay for services from an allowance specified in Section 01 31 00.
- B. The independent firm will perform inspections, tests, and other services specified in individual specification Sections and as required by the Architect/Engineer.
- C. Reports will be submitted by the independent firm to the Architect/Engineer, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
- D. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.
 - 1. Notify Architect/Engineer and independent firm 24 hours prior to expected time for operations requiring services.
 - 2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
- E. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Architect/Engineer. Contractor shall pay for required retesting.
- F. Testing and source quality control may occur on or off the project site. Perform off-site testing as required by the Architect or the Owner.
- G. Testing does not relieve Contractor to perform Work to contract requirements.

1.8 MANUFACTURERS' FIELD SERVICES AND REPORTS

- A. Submit qualifications of observer to Architect/Engineer 30 days in advance of required observations. Observer subject to approval of Architect/Engineer.
- B. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of

surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment as applicable, and to initiate instructions when necessary.

- C. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- D. Submit report within 30 days of observation to Architect/Engineer for review.

1.9 TOLERANCES

- A. Monitor fabrication and installation tolerance control of Products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust Products to appropriate dimensions; position before securing Products in place.

PART 2 – PRODUCTS

(Not used)

PART 3 – EXECUTION

(Not used)

END OF SECTION

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SECTION 01 50 00

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Temporary Utilities: Electricity, lighting, heat, telephone service, water, and sanitary facilities.
- B. Temporary Controls: Barriers, enclosures and fencing, protection of the Work, and water control.
- C. Construction Facilities: Access roads, truck access routes, parking, progress cleaning, and project signage.

1.2 TEMPORARY ELECTRICITY

- A. Cost: By Contractor; Provide and pay for power service required from Utility source.
- B. Provide temporary electric feeder from electrical service at location as directed.
- C. Contractor will pay cost of energy used.
- D. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.
- E. Provide main service disconnect and overcurrent protection at convenient location, feeder switch at source distribution equipment.
- F. Permanent convenience receptacles may be utilized during construction.
- G. Provide adequate distribution equipment, wiring, and outlets to provide single-phase branch circuits for power and lighting.

1.3 TEMPORARY LIGHTING

- A. Provide and maintain incandescent lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft.
- B. Provide and maintain 1 watt/sq ft lighting to exterior staging and storage areas after dark for security purposes.
- C. Provide and maintain 0.25 watt/sq ft H.I.D. lighting to interior work areas after dark for security purposes.
- D. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- E. Maintain lighting and provide routine repairs.
- F. Permanent building lighting may be utilized during construction.

1.4 TEMPORARY HEAT

- A. Provide and pay for heat devices and heat as required to maintain specified conditions for construction operations.
- B. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.
- C. Maintain minimum ambient temperature of 50 degrees F (10 degrees C) in areas where construction is in progress, unless indicated otherwise in specifications.

1.5 TEMPORARY VENTILATION

- A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.6 TELEPHONE & FACSIMILE SERVICE

- A. Provide, maintain and pay for telephone and facsimile service to field office at time of project mobilization.

1.7 TEMPORARY WATER SERVICE

- A. Provide, maintain and pay for suitable quality water service required.
- B. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

1.8 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures.

1.9 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide protection for plant life designated to remain. Replace damaged plant life.
- C. Protect non-owned vehicular traffic, stored materials, site and structures from damage.
- D. Provide temporary roofing as required.

1.10 TEMPORARY FENCING

- A. Construction: Commercial grade chain link fence.
- B. Provide 6-foot high fence around construction sites; equip with vehicular and pedestrian gates with locks.

1.11 WATER CONTROL

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

1.12 EXTERIOR ENCLOSURES

- A. Provide temporary insulated weather-tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification Sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.
- B. Provide temporary roofing as required.

1.13 PROTECTION OF INSTALLED WORK

- A. Protect installed Work and provide special protection where specified in individual specification Sections.
- B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to minimize damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic from landscaped areas.

1.14 SECURITY

- A. Provide security and facilities to protect Work, and operations from unauthorized entry, vandalism, or theft.

1.15 ACCESS ROADS/TRUCK ACCESS ROUTES

- A. Construct and maintain temporary roads accessing public thoroughfares to serve construction area.
- B. Extend and relocate as Work progress requires. Provide detours necessary for unimpeded traffic flow.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Existing on-site roads may be used for construction traffic.
- F. Follow truck access routes as shown on drawings attached to this specification section, pages 01 50 00-5 & 01 50 00-6.

1.16 PARKING

- A. Arrange for temporary parking to accommodate construction personnel.
- B. When site space is not adequate, provide additional off- site parking.

1.17 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Remove waste materials, debris, and rubbish from site periodically and dispose off-site.

1.18 PROJECT IDENTIFICATION

- A. Temporary Signs - Provide three (3) project signs of exterior grade plywood and wood frame construction, painted, with die cut vinyl, self-adhesive letters and self-adhesive logo, to Owner's design and colors.
- B. Erect on site at location established by Architect/Engineer.
- C. No other signs are allowed without Owner permission except those required by law.

1.19 FIELD OFFICES

- A. Office: Weather-tight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture, drawing rack and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- C. Locate office on site in existing building or job trailer.

1.20 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary above grade or buried utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION

SECTION 01 57 13

TEMPORARY EROSION AND SEDIMENTATION CONTROLS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Installation of temporary erosion and sedimentation control measures
 - 2. Maintenance of temporary erosion and sedimentation control measures.
 - 3. Monitoring of site condition and installation of supplemental temporary erosion and sedimentation control measures.
 - 4. Sediment removal and disposal
 - 5. Temporary seeding or other surface stabilization measures.
 - 6. Removal of temporary erosion and sedimentation control measures.
 - 7. Monitoring, documentation, and recordkeeping.
 - 8. Installation of permanent erosion control materials.
 - 9. Final cleanup.
- B. Erosion and sediment control techniques include, but are in no way limited to, silt fence, hay bales, drainage structure inserts/filters, mulching with hay/straw, netting/matting, grassing, stone dikes/berms/check-dams, compost blankets and berms, barriers, diversions, traps, basins, and appurtenances which will ensure that erosion and sediment pollution will be either eliminated or maintained within acceptable limits.
- C. The measures specified herein are the minimum requirements which Contractor shall comply to control erosion and siltation throughout execution of the work. Contractor shall provide additional work if necessary to control erosion and siltation throughout the duration of the construction as conditions dictate, or as directed by Engineer.
- D. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.
- E. Contractor is responsible for all health and safety.

1.2 SUBMITTALS

- A. Submit material specifications and shop drawings for all materials furnished under this Section.
- B. Prior to the start of the construction, submit schedule for the construction of required stormwater detention basins, temporary and permanent erosion and sedimentation control measures, clearing and grubbing, grading, structures at watercourses, construction, and paving.

- C. During construction, submit to Engineer schedule changes that affect timing of construction.
- D. Submit copies of all inspection and maintenance report forms.

1.3 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Regulations of Connecticut State Agencies (RCSA)
 - 1. 22a-315-10 through 19, Soil and Water Conservation
- C. Connecticut Department of Energy and Environmental Protection (DEEP)
 - 1. Connecticut Guidelines for Soil Erosion and Sediment Control, DEEP Bulletin 34, State of Connecticut Council on Soil and Water Conservation, 2002.
- D. State of Connecticut Department of Transportation (ConnDOT)
 - 1. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 819, 2024 and any supplements.

1.4 PERMIT CONDITIONS

- A. Contractor and Subcontractors are bound to comply with any project-related permits obtained by Owner or Engineer for the work of the project. Such permits will affect performance of the work, and Contractor and Subcontractors are bound to comply with requirements of such permit and representations contained in permit application as though Contractor and Subcontractor were the Permittee/permit-holder. Requirements and conditions set forth in Owner or Engineer-obtained project-related permits and permit applications shall be binding on Contractor just as any Specification would be.

1.5 QUALITY CONTROL

- A. Contractor shall be responsible for the timely installation and maintenance of all sedimentation control devices necessary to prevent the erosion of soil or movement of sediment from construction activities to off-site areas via surface runoff or underground drainage systems. Measures in addition to those shown on the Drawings necessary to prevent the movement of sediment off site shall be installed, maintained, removed, and cleaned up at the expense of Contractor.
- B. Where additional erosion and sedimentation control measures are required beyond what is indicated on the Drawings or herein, comply with applicable sections of the Connecticut Guidelines for Soil Erosion and Sediment Control, DEEP Bulletin 34, State of Connecticut Council on Soil and Water Conservation, 2002.
- C. If applicable, comply with applicable provisions of the Connecticut Department of Energy and Environmental Protection (DEEP) General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities, (DEEP-WPED-GP-015), latest revision thereof. Conditions of such General Permit, other conditions of approval or authorizations, and associated Stormwater Pollution Control Plan (SWPCP) shall become part of the Contract Documents.

- D. Engineer has the authority to order immediate, additional, temporary control measures to prevent contamination of adjacent streams or other watercourses, or other areas of water impoundment and damage by erosion.
- E. If Engineer observes construction procedures and operations that jeopardize erosion control provisions, Engineer will notify Contractor. If such construction procedures and operations are not corrected promptly, Engineer may suspend the performance of any or all construction until corrections have been made, and such suspension shall not be the basis of any claim by Contractor for additional compensation, nor for an extension of time to complete the Work.
- F. Should construction materials be washed away or otherwise rendered ineffective in the opinion of Engineer during the progression of the Work, Contractor shall replace the installations at no additional cost to the Owner.

1.6 COORDINATION WITH PERMANENT EROSION CONTROL PROVISIONS

- A. Coordinate temporary erosion and sedimentation control measures with permanent erosion control features to the extent practical to ensure economical, effective and continuous erosion control throughout construction and post-construction periods.

PART 2 PRODUCTS

2.1 HAY BALES

- A. Hay bales shall be made of cut hay with forty (40) pounds minimum weight and 120 pounds maximum weight. Bales shall be free of rotten or degraded hay, significant splits or voids. Hay bales shall be held together with a minimum of two bands made of either wire or heavy twine.
- B. Stakes to anchor the bales shall be a minimum of 36 inches long and made of hardwood with a minimum dimension of 1½-inch by 1½-inch normal size. Metal stakes may be used instead of wooden stakes. Metal stakes shall be round, “U,” “T,” “L,” or “C” shaped with a minimum weight of 0.5 pounds per foot.
- C. Replace individual hay bales upon loss of 30% of original mass or volume, whichever is less.

2.2 SILT FENCE

- A. Woven Polypropylene geotextile having a minimum weight of 3.1 ounces per square yard conforming to the following:

1. Mechanical and Physical Properties of Silt Fence Geotextile

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Weight	ASTM D 3776	oz/yd ²	5.6
Grab Tensile Strength	ASTM D 4632	Pounds	60
Grab Elongation (Max percent)	ASTM D 4632	Percent (%)	15–30
Trapezoidal Tear	ASTM D 4533	Pounds	30
Puncture	ASTM D 4833	Pounds	30
Mullen Burst	ASTM D 3786	psi	150–200
Permittivity	ASTM D 4491	Sec ⁻¹	0.15

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Flow Rate	ASTM D 4491	gal/min/ft ²	15–20
Apparent Opening Size	ASTM D 4751	(U.S. Sieve)	30–35
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	70

- B. Silt fence shall be constructed of a minimum thirty-six (36) inch wide continuous woven geotextile. The material shall have a high sediment filtration capacity, high slurry flow and minimum clogging characteristics. Edges of the fabric shall be finished to prevent the outer fibers from pulling away from the geotextile. Geotextile shall be free of defects or flaws that significantly affect its physical and/or filtering properties.
- C. Fabric shall be securely fastened to stakes a minimum of 42 inches long and made of hardwood with a minimum dimension of 1½ inch by 1½ inch normal size such that a 6 to 8 inch length of fabric is unattached at the bottom for anchorage in soil. Metal stakes may be used instead of wooden stakes. Metal stakes shall be round, “U,” “T,” “L,” or “C” shaped with a minimum weight of 0.5 pounds per foot. Stakes shall be spaced not greater than ten feet apart. When required, wire or another type of support shall be constructed between the geotextile fabric and the posts to improve the load carrying capacity of the silt fence.

2.3 CATCH BASIN INSERT

- A. Manufactured “bag type” catch basin insert of woven polypropylene geotextile with integral lifting loops or straps conforming to the following:

1. Mechanical and Physical Properties of Catch Basin Insert

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Grab Tensile Strength	ASTM D 4632	Pounds	315
Grab Elongation (Max percent)	ASTM D 4632	Percent (%)	30
Trapezoidal Tear	ASTM D 4533	Pounds	40x50 (min)
Puncture	ASTM D 4833	Pounds	135 (min)
Mullen Burst	ASTM D 3786	psi	420 (min)
Permittivity	ASTM D 4491	gal/min/sq ft	0.7
Flow Rate	ASTM D 4491	gal/min/ft ²	50-200
Apparent Opening Size	ASTM D 4751	(U.S. Sieve)	20-40
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	80 (min)

Note: Catch basin inserts for catch basins with curb openings shall be equipped with integral curb deflector.

2.4 STRAW MULCH

- A. Straw mulch shall be comprised of threshold straw of oats, wheat, barely, or rye that is free from noxious weeds, mold or other objectionable material. Straw mulch shall contain at least 50 percent by weight of material to be 10-in or longer. Straw shall be in an air-dry condition and suitable for placement with blower equipment. Straw mulch shall be utilized on all newly

graded areas with slopes exceeding 5% to protect areas against washouts and erosion unless other erosion control measures are provided.

2.5 FILTER BERM COMPOST

- A. Where establishing vegetation is not planned, compost shall be a decomposed, weed free organic matter source derived from agricultural, food, or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. Compost shall possess a moisture content of 30 to 60% and a organic matter content of 25 to 100%. The maximum particle length shall be 6", and 100% passing a 3", 90 to 100% passing a 1", 70% to 100% passing a 3/4", and 30% to 75% passing a 1/4" screen. However, no more than 50% passing a 1/4" screen in high rainfall/flow rate situations.
- B. Where establishing vegetation is planned, compost shall be use a well decomposed, stable, weed free organic matter source derived from agricultural, food, or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. Compost shall possess a moisture content of 30 to 60%, a pH of 6.0 to 8.5 and an organic matter content of 25 to 65%. The maximum particle length shall be 6", and 100% passing a 3", 90 to 100% passing a 1", 70% to 100% passing a 3/4", and 30% to 75% passing a 1/4" screen. However, no more than 60% passing a 1/4" in high rainfall/flow rate situations. It shall contain no substances toxic to plants, shall possess no objectionable odors, and shall not resemble the raw material from which it was derived.

2.6 COMPOST SOIL BLANKET

- A. Compost soil blankets may be utilized on slopes of up to 2:1.
- B. Slightly scarify slopes and remove large clods, rocks, stumps, roots larger than 2 inches in diameter and debris on slopes, where vegetation is to be established. This soil preparation step may be eliminated where approved by the Landscape Architect/Designer, or where seeding or planting isn't planned. Track (compact) slope using a bulldozer before applying compost.
- C. Apply compost at the following rates:

Compost Application Rates

Annual Rainfall/Flow Rate	Total Precipitation & Rainfall Erosivity Index	Application Rate for Slopes to be Vegetated (Note 1)	Application Rate for Slopes not being Unvegetated
Low	1"-25" & 20-90	1/2"-3/4"	1"-1 1/2"
Average	26"-50" & 91-200	3/4"-1"	1 1/2"-2"
High	51" and above, & 201 and above	1"-2"	2"-4"

- D. Lower application rates indicated for slopes to be vegetated should only be used in conjunction with seeding, and for compost blankets applied during the prescribed planting season for the particular region.
- E. Compost shall be uniformly applied using an approved spreader unit, including bulldozers, side discharge manure spreaders, etc. Track (compact) the compost layer using a bulldozer or other appropriate equipment. (This step may be eliminated where impractical or where deemed

unnecessary by the Landscape Architect/Designer.) Alternatively, apply compost using a pneumatic (blower) unit, or other unit that propels the product directly at the soil surface, thereby preventing water from moving between the soil-compost interface. Thorough watering may be used to improve settling of the compost. Apply compost layer approximately 3 feet (90 cm) over the top of the slope, or overlap it into existing vegetation.

- F. On highly unstable soils, use compost in conjunction with appropriate structural measures.
- G. Dry or hydraulic seeding may be completed following compost application, as required, or during the compost application itself, where a pneumatic unit is used to apply the compost.

2.7 STONE CHECK DAM

- A. Stone shall be graded as follows:

Gradation of Stone for Check Dam (ConnDOT M.01.01 Grading No. 3)

Sieve	Percent Passing by Weight
2 1/2"	100
2"	90–100
1 1/2"	35–70
1	0–15
1/2"	0–5

Stone shall be sound, tough, durable, angular, not subject to disintegration, on exposure to water, or weathering, be chemically stable and shall be suitable in all other respects for the purpose intended.

- B. Geotextile may be used under the stone to provide a stable foundation and to facilitate removal of the stone.

2.8 EROSION CONTROL SEED MIXTURE

Erosion Control Seed

Species (Note 1)	Application Rate, Pounds Per Acre	Application rate, Pounds Per 1,000 sf	Optimum Seed Depth, inches (Note 2)	Optimum Seeding Dates (Note 3)
Annual ryegrass <i>Lolium multiflorum</i>	40	1.00	0.5	3/1–6/15 and 8/1–10/15
Perennial ryegrass <i>Lolium perenne</i>	40	1.00	0.5	3/15–7/1 and 8/1–10/15
Winter Rye <i>Secale cereale</i>	120	3.00	1.00	4/5–7/1 and 8/15–10/15
Oats <i>Avena sativa</i>	86	2	1	3/1–6/15 and 8/1–9/15
Winter Wheat <i>Triticum aestivum</i>	120	3	1	4/15–7/1 and 8/15–10/15
Millet <i>Echinochloa crusgalli</i>	20	.5	1	5/15–7/15
Sudangrass <i>Sorghum sudanese</i>	30	.7	1	5/15–8/1

Species (Note 1)	Application Rate, Pounds Per Acre	Application rate, Pounds Per 1,000 sf	Optimum Seed Depth, inches (Note 2)	Optimum Seeding Dates (Note 3)
Buckwheat Fagopyrum esculentum	15	.4	1	4/1–9/15
Weeping lovegrass Eragrostis cymbula	5	.2	.25	6/1–7/1
ConnDOT All Purpose Mix	150	3.4	.5	3/1–6/15 and 8/1–10/15

Notes:

1 – Listed species may be used in combinations to obtain a broader time spectrum. If used in combinations, reduce each species planting rate by 20% of that listed

2 – Seed at twice the indicated depth for sandy soils.

3 – May be planted throughout summer if soil moisture is adequate or can be irrigated. Fall seeding may be extended 15 days in the coastal towns

2.9 EROSION CONTROL MATTING

- A. Temporary Erosion Control Blanket shall be 1) Curlex® Excelsior Blanket, as manufactured by American Excelsior Company, 2) ERO-MAT® V75S(FD), as manufactured by Verdyl Plant Research, Ltd., or 3) Landlok® S2 RD, as manufactured by SI® Geosolutions, or 4) approved equal.
- B. Degradable Erosion Control Fabric Netting shall be Landlok® 407 GR, as manufactured by 1) SI® Geosolutions, or 2) GeoJute® as manufactured by Belton Industries, Inc., or 3) BioNet® S150BN™ Double Net Straw Blanket, as manufactured by North American Green, or 4) approved equal.
- C. Long-Term and Non-degradable Turf Reinforcement Mats shall be 1) Pyramat®, as manufactured by SI® Geosolutions, or 2) Recyclex® Turf Reinforcement Matting, as manufactured by American Excelsior Company, or 3) Vmax3 C350™, as manufactured by North American Green, or 4) approved equal.
- D. Erosion control matting shall be secured with staples or an alternative attachment device such as geotextile pins or plastic pegs as recommended by the manufacturer. The Contractor shall submit a sample of the alternative attachment device for the Engineer's approval prior to installation.

PART 3 EXECUTION

3.1 GENERAL

- A. Install erosion and sedimentation control measures as shown on the Drawings prior to any site disturbance.
- B. No work shall be started until erosion control schedules and installation have been accepted by Engineer.

- C. Engineer has the authority to control the surface area of each material exposed by construction operations and to direct Contractor to immediately provide permanent or temporary pollution control measures to prevent contamination of adjacent watercourses or other areas of water impoundment. Every effort shall be made by Contractor to prevent erosion on the site and abutting properties or areas.
- D. Contractor shall construct all permanent erosion and sediment control features at the earliest practical time as outlined in the accepted schedule. Temporary erosion and sediment control measures shall be used to correct conditions that develop during construction, which were unforeseen, but are needed prior to installation of permanent control features, or that are needed temporarily to control erosion or sedimentation which develops during construction operations.
- E. Contractor shall limit as necessary the surface area of the earth material exposed to sufficiently maintain and protect the slopes to prevent pollution. Where erosion is likely to be a problem, clearing and grubbing operations shall be scheduled and performed so that grading operations and permanent erosion and sediment control features can follow immediately thereafter, if conditions permit; otherwise, temporary control measures will be required between successive construction stages.
- F. Erosion control measures shall be maintained by Contractor, and he shall remove such installations only upon completion of the work and the site is stabilized or when authorized to do so by Engineer.
- G. Contractor shall operate all equipment and perform all construction operations so as to minimize pollution. Contractor shall cease any of his operations, which will increase pollution during rainstorms.
- H. Failure by Contractor to control erosion, pollution, and siltation shall be cause for the Engineer to employ outside assistance to provide the necessary corrective measures. The cost of such assistance, including engineering costs, will be charged to Contractor and appropriate deductions made to Contractor's payment.

3.2 HAY BALES

- A. Hay bales shall be positioned as indicated on the Drawings and/or as necessary to prevent off site movement of sediment produced by, or as a result of, construction activities, or as direct by the Engineer.
- B. Hay bales shall be utilized on all catch basins and drainage facilities on the Project Site to prevent the entry of sediments or other debris. Maintain such protection throughout execution of the work until such drainage facilities have been abandoned/removed.
- C. Bales shall be placed lengthwise with ends of adjacent bales tightly abutting one another to form a continuous barrier. Bales shall be entrenched to a depth of 4 inches and backfilled, with the backfill placed toward the potential source of runoff and sediment. All bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms. Each bale shall be anchored with a minimum of two stakes, driving the first stake in each bale towards the previously laid bale to drive the bales together. Stakes must be driven a minimum of 18 inches into the ground. Loose hay shall be inserted between bales as required to prevent water from escaping between the bales.

3.3 GEOTEXTILE SILT FENCE

- A. Install a filter fabric silt fence prior to construction and remove after full surface restoration has been achieved. Install silt fence as indicated on the Drawings and/or as necessary to prevent off site movement of sediment produced by, or as a result of, construction activities.
- B. Install as follows:
 - 1. Hand shovel excavate a small trench a minimum of six inches wide by six inches deep on the upslope side of the desired fence line location.
 - 2. Unroll the siltation fence system, position the post in the back of the trench (downhill side), and hammer the post at least 12 inches into the original ground.
 - 3. Fabric rolls shall be spliced at posts. The fabric shall be overlapped six inches, folded over and securely fastened to posts.
 - 4. Lay the bottom 6 inches of the fabric into the trench to prevent undermining by storm water run-off.
 - 5. Backfill the trench and compact. Compaction is necessary to prevent the run-off from eroding the backfill.
 - 6. For slope and swale installations, extend the ends of the trench sufficiently up slope such that the bottom end of the fence will be higher than the top of the lowest portion of the fence.

3.4 CATCH BASIN INLET SEDIMENT CONTROL

- A. Install catch basin inlet sediment control devices in each exiting catch basin as long as it remains in use in accordance with manufacturer's guidelines at the locations shown on the Drawings.
- B. A catch basin sediment filter shall be installed and changed/cleaned per the manufacturer's recommendations, or as directed by the **(Insert Name)**, during construction.
- C. New catch basins shall have a filter installed immediately upon completion of construction. In addition, a hay bale, or similar, barrier shall be installed around the new basin and maintained in place until binder is placed or disturbed areas draining to it are stabilized.
- D. Catch basins with curb openings shall have filter fabric covering the opening and the edges of the fabric shall be secured. A filter boom shall also be placed over the opening.

3.5 TEMPORARY SEDIMENT BASINS

- A. Temporary sedimentation basins shall be employed as required during construction. Sedimentation shall be periodically removed from the basins and from behind erosion and sedimentation control devices. The Contractor shall direct all possible site runoff to the temporary sedimentation basins.
- B. The temporary sedimentation basins shall be maintained from the start of construction until construction of the permanent detention basins is completed and perimeter areas are stabilized.

3.6 TEMPORARY MULCHING

- A. Apply temporary mulch to areas where rough grading has been completed but final grading is not anticipated to begin within 30 calendar days of the completion of rough grading or where final grading has been completed but seeding is not anticipated for 20 days.

- 1. Straw/Hay Mulch

- Exposure Period: 6 months

- Application Method: By hand or machine

- Application Rate: 110 lbs/1,000 square feet.

- 2. Bark Chips/Shredded Bark

- Exposure Period: Less than one year

- Application Method: By hand or machine

- Application Rate: 6 cubic yards /1,000 square feet.

3.7 TEMPORARY EROSION CONTROL MATS

- A. Erosion control mats shall be furnished, installed, maintained, and later removed in ditches or swales, on embankment slopes, and excavation slopes at the locations shown on the Drawings in accordance with the manufacturer's recommendations.
- B. All areas shall be smooth graded and compacted. Remove all rocks, dirt clods, vegetation and other obstructions that may cause damage to the mats.
- C. Unroll mats parallel to the direction of water flow and lay flat against the ground. Overlap roll ends 1–2 feet with upslope mat on the top to prevent uplift of mat end by water flow. Overlay adjacent edges of mat by six inches. Extend mat 2–3 feet above the crest of steep slopes and anchor by excavating a 6-inch-deep trench, and secure end of mat in trench, backfill and compact. Secure mat to the ground using staples or pins furnished by manufacturer of mat.
- D. When no longer required, as determined by the Engineer, temporary erosion control mats shall become the property of the Contractor and be removed and properly disposed.
- E. Ground disturbances, including holes and depressions caused by the installation and removal of the temporary erosion control blanket shall be backfilled and repaired.

3.8 INSPECTIONS AND MAINTENANCE

- A. Contractor is responsible to maintain the sediment and erosion control features at all times throughout the project duration and until the completion certification and approval has been issued.
- B. Regular erosion and sediment control system inspections shall be conducted by Contractor throughout the project duration. At a minimum, Contractor shall conduct daily inspections and maintain erosion control systems in good operating condition. Report the results of the inspection and the recommended maintenance and/or repair requirements to Engineer.
- C. Additional inspections may be required and/or directed prior to, or immediately following, a storm event >0.1 inches. Repairs shall be made as necessary.

- D. In the event that the sedimentation and erosion control measures employed by Contractor prove to be inadequate as determined by the Engineer, Contractor shall adjust operations to the extent necessary to prevent erosion and sediment transport.
- E. Surface water shall be pumped to maintain excavations free of water. Comply with applicable requirements of the Connecticut Department of Environmental Protection, specifically those requirements related to the management of stormwater and dewatering wastewaters associated with construction activities.
- F. Hay bales and/or silt fences.
 - 1. Remove accumulated sediment once it builds up to one-half of the height of the bale or fabric.
 - 2. Replace damaged or degraded bales as necessary or when directed by the Engineer.
 - 3. Replace damaged fabric, or patch with a 2-ft minimum overlap. Overlaps may only be made at fence posts.
 - 4. Make other repairs as necessary to ensure that the bales/fence is filtering all runoff.
- G. Erosion Control Mats shall be inspected at least once a week. Areas where the mat has become dislodged from the soil surface or become torn shall be re-graded and re-seeded as necessary and the mat re-installed. When repetitive failures occur at the same location review conditions and modify erosion control measures to reduce failure rate. Temporary erosion control blanket damaged during the progress of work or resulting from the Contractor's vehicles, equipment, or operations shall be repaired or replaced at the expense of the Contractor.
- H. Clean catch basin inlet sediment control devices in accordance with manufacturer's guidelines.
- I. Any catch basins that collect sediment as a result of Contractor's work shall be thoroughly cleaned out by Contractor.

END OF SECTION

SECTION 01 5714

TEMPORARY DUST CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnishing and spreading water, calcium chloride, and/or mulch on the subgrade, or in other areas of a Project Site or associated off-site areas, for the purpose of controlling dust emissions.
- B. The requirements set forth in this section of the specifications apply to all phases and areas of construction.
- C. Contractor is responsible for all health and safety.

1.2 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Regulations of Connecticut State Agencies (RCSA)
 - 1. RCSA Section 22a-174-1 through 43, Abatement of Air Pollution.
- C. ASTM International (ASTM)
 - 1. ASTM D98, Standard Specification for Calcium Chloride.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Only water, calcium chloride, and mulch are approved for dust control. No asphalt or petroleum-based products may be utilized for dust control.
- B. Water used shall be clean, non-polluted water obtained from sources approved by Engineer.
- C. Calcium chloride, ASTM D98. Calcium chloride in pellet form and flake form shall be acceptable.
 - 1. Calcium chloride shall be packaged in moisture proof bags or in airtight drums with the manufacturer, name of product, net weight, and percentage of calcium chloride guaranteed by the manufacturer legibly marked on each container.
 - 2. Engineer may reject calcium chloride failing to meet the requirements of the aforementioned specifications or which has become caked or sticky in shipment.
- D. Mulch
 - 1. Straw mulch: Threshold straw of oats, wheat, barely, or rye that is free from noxious weeds, mold or other objectionable material. Straw mulch shall contain at least 50 percent by weight of material to be 10-in or longer.

2. Wood chips: Processed tree trimmings free of trash or other physical contaminants such as metal and plastic.

PART 3 EXECUTION

3.1 GENERAL

- A. Dust control shall be the responsibility of Contractor and dust control operations shall meet the requirements of the State of Connecticut Department of Environmental Protection.
- B. Construction sequencing shall be organized and conducted in a manner to leave existing pavement or ground coverings in place until just prior to earth excavation for the purpose of minimizing the migration of dust beyond the Project Limits into the surrounding area.
- C. Engineer reserves the right to conduct active dust monitoring using visual methods and may utilize particulate measurement equipment during the course of the work. If the amount of fugitive dust and/or particulate generated during the work is deemed unacceptable in the Engineer's judgment or exceeds baseline Project Site conditions at Engineer's monitoring locations, Engineer may require Contractor to stop work and implement corrective measures. No claim for delay will be considered for work stoppage based upon the results of Engineer's active dust monitoring results.
- D. Stockpiled materials from which particle have the potential of becoming airborne shall be securely covered with a temporary waterproof covering made of polyethylene, polypropylene, hypalon, or approved equal. The covers must be in place at all times when work with the stockpiles is not occurring.
- E. Subcontractor shall sweep all adjacent roads and neighboring parking lots and driveways that are impacted by the work. Whenever dirt is tracked from the site it shall be cleaned as necessary to prevent it from becoming a nuisance or hazard. At a minimum, adjacent streets shall be swept once per week.

3.2 WATER

- A. The application of water shall be under the control of Engineer at all times. It shall be applied only at the locations, and at such times, and in the amount as may be directed by Engineer. Quantities of water wasted or applied without authorization will not be paid for.
- B. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding or pollution.
- C. Contractor shall have available and maintain in an operable condition at all times, sufficient equipment for the purpose of applying water for dust control.
- D. Watering equipment shall consist of pipelines, tanks, tank trucks, distributors, pumps, meters, hose or other devices, approved by Engineer, which are capable of applying a uniform spread of water over the surface. A suitable device for a positive shut-off and for regulating the flow of water shall be located so as to permit positive operator control.
- E. Applications of water for dust suppression include, but are not necessarily limited to, the following:
 1. Demolition activities, material handling, material processing, and loading.

2. Earthwork.
3. Open excavation faces and dust-prone areas of the work.
4. Temporary access roads and roadway surfaces within and around the Project Site.

3.3 CALCIUM CHLORIDE

- A. Calcium chloride shall be applied only at the locations, at such times and in the amount as may be directed by the Engineer and only in areas that will not be adversely affected by the application. Refer to Section 01 3543 – Environmental Protection.
- B. Calcium chloride shall be uniformly applied at the rate of one and one-half (1½) pounds per square yard (lb/yd²) or at any other rate as directed by Engineer. Application shall be by means of a mechanical spreader, or other approved methods. The number and frequency of applications shall be to Engineer's satisfaction.

3.4 MULCH FOR DUST CONTROL

- A. Coordinate the use of mulch for dust control with erosion and sedimentation control measures.
- B. Straw mulch shall be applied at a rate of 100 pounds per 1,000 square feet (100 lb/1,000 ft²).
- C. Wood chips or wood mulch shall be applied at such a rate as to form a layer one (1) inch thick.

3.5 OTHER DUST CONTROL MEASURES

- A. A temporary seed mixture may be spread in lieu of, or in addition to mulch over areas where the suspension of grading work in disturbed areas is expected to be more than 30 calendar days and as directed by Engineer.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Products.
- B. Transportation and handling.
- C. Storage and protection.
- D. Product options.
- E. Substitutions.

1.2 RELATED SECTIONS

- A. Section 00 21 13 - Instructions to Bidders: Product options and substitution procedures.
- B. Section 01 40 00 - Quality Control: Product quality monitoring.

1.3 PRODUCTS

- A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.
- B. Provide interchangeable components of the same manufacturer, for similar components.

1.4 TRANSPORTATION AND HANDLING

- A. Transport and handle Products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to assure that Products comply with requirements, quantities are correct, and Products are undamaged.
- C. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.5 STORAGE AND PROTECTION

- A. Store and protect Products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive Products in weather-tight, climate controlled enclosures.
- B. For exterior storage of fabricated Products, place on sloped supports, above ground.
- C. Provide off-site storage and protection when site does not permit on-site storage or protection.
- D. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.
- E. Store loose granular materials on solid flat surfaces in a well-drained area. Provide mixing with foreign matter.
- F. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- G. Arrange storage of Products to permit access for inspection. Periodically inspect to assure Products are undamaged and are maintained under specified conditions.

1.6 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

1.7 SUBSTITUTIONS

- A. Architect/Engineer will consider requests for Substitutions only within 15 days after date of Owner-Contractor Agreement.
- B. Substitutions may be considered when a Product becomes unavailable through no fault of the Contractor.
- C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- D. A request constitutes a representation that the Contractor:
 - 1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
 - 2. Will provide the same warranty for the Substitution as for the specified Product.
 - 3. Will coordinate installation and make changes to other Work, which may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension, which may subsequently become apparent.
 - 5. **Will reimburse Owner for review and/or redesign services associated with approval by architect, engineer and other authorities.**
- E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- F. Substitution Submittal Procedure:
 - 1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
 - 2. Submit shop drawings, Product data, and certified test results attesting to the proposed Product equivalence.
 - 3. The Architect will notify Contractor, in writing, of decision to accept or reject request.

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

(Not used)

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous demolition and construction waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
 - 1. Section 02 41 19 "Selective Dismantling and Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.

1.2 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total non-hazardous solid waste generated by the Work. Facilitate recycling and salvage of materials

1.4 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 7 days of date established for commencement of the work

1.5 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in tons
 - 4. Quantity of waste salvaged, both estimated and actual in tons.
 - 5. Quantity of waste recycled, both estimated and actual in tons.
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Qualification Data: For waste management coordinator.

1.6 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements.
- B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.7 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
1. Distribute waste management plan to everyone concerned within three days of submittal return.
 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site.
5. Protect items from damage during transport and storage.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size.

B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 4-inch size.

- D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 - 1. Pulverize masonry to maximum 4-inch size.
 - 2. Clean and stack undamaged, whole masonry units on wood pallets.
- E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- F. Metals: Separate metals by type.
 - 1. Structural Steel: Stack members according to size, type of member, and length.
 - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- H. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- J. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- K. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
 - 1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- L. Carpet Tile: Remove debris, trash, and adhesive.
 - 1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- M. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- N. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
 - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.

2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.
- D. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.
- E. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION

SECTION 01 75 16

STARTUP PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Starting systems.
- B. Demonstration and instructions.

1.02 RELATED SECTIONS

- A. Section 01 40 00 - Quality Control: Manufacturers field reports.
- B. Section 01 77 00 - Contract Closeout: System operation and maintenance data and extra materials.

1.03 STARTING SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect/Engineer and Owner seven days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions, which may cause damage.
- D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of responsible Contractors' personnel in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report in accordance with Section 01 40 00 that equipment or system has been properly installed and is functioning correctly.

1.04 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. Demonstrate Project equipment instructed by a qualified manufacturers' representative who is knowledgeable about the Project.
- C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and

maintenance.

- E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled times, at equipment location.
- F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.05 TESTING, ADJUSTING, AND BALANCING

- A. Contractor will employ services of an independent firm to perform testing and adjusting. Contractor shall pay for services.
- B. Reports will be submitted by the independent firm to the Architect/Engineer indicating observations and results of tests and indicating compliance or non-compliance with specified requirements and with the requirements of the Contract Documents.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 77 00

CONTRACT CLOSEOUT

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Closeout Procedures.
- B. Final Cleaning.
- C. Adjusting.
- D. Project Record Documents.
- E. Operation and Maintenance Data.
- F. Warranties.
- G. Spare Parts and Maintenance Materials.

1.2 RELATED SECTIONS

- A. Section 01 50 00 - Construction Facilities and Temporary Controls: Progress cleaning.
- B. Section 01 75 16 – Demonstration & Training: System start-up, testing, adjusting, and balancing.

1.3 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's inspection.
- B. Provide submittals to Architect/Engineer and Owner that are required by governing or other authorities.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.4 FINAL CLEANING

- A. Execute final cleaning prior to final inspection.
- B. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Clean equipment and fixtures to a sanitary condition.
- D. Replace filters of operating equipment.
- E. Clean debris from roofs, gutters, downspouts, and drainage systems.
- F. Clean site; sweep paved areas, rake clean landscaped surfaces.
- G. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.5 ADJUSTING

- A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.6 PROJECT RECORD DOCUMENTS

- A. Maintain on site, one set of the following record documents; record actual revisions to the Work:
 - 1. Contract Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other Modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Store Record Documents separate from documents used for construction.
 - 7. Record information concurrent with construction progress.
- B. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and Modifications.
- C. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish first floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original Contract Drawings.
- D. Delete Architect/Engineer title block and seal from all documents.
- E. Submit documents to Architect/Engineer with claim for final Application for Payment.
- F. Project record documents may be submitted electronically if acceptable to the Owner. Confirm with Owner for requirements.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit one set prior to final inspection, bound in 8-1/2 x 11 inch (216 x 279 mm) text pages, three D side ring capacity expansion binders with durable plastic covers. If acceptable to Owner, submission may be electronic. Confirm with Owner for requirements.
- B. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
- C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified, type on 30 pound white paper if printed.
 - Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
 - Part 2: Operation and maintenance instructions, arranged by system and subdivided by

specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:

- a. Significant design criteria.
- b. List of equipment.
- c. Parts list for each component.
- d. Operating instructions.
- e. Maintenance instructions for equipment and systems.
- f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

Part 3: Project documents and certificates, including the following:

- a. Shop drawings and product data.
 - b. Air and water balance reports.
 - c. Certificates.
 - d. Photocopies of warranties and bonds.
- E. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with Architect/Engineer comments. Revise content of documents as required prior to final submittal.
- F. Submit final volumes revised, within ten days after final inspection.

1.8 WARRANTIES

- A. Provide notarized copies.
- B. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.
- C. Provide Table of Contents and assemble in three D side ring binder with durable plastic cover. If acceptable to Owner, submission may be electronic. Confirm with Owner for requirements.
- D. Submit prior to final Application for Payment.
- E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.9 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.
- B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

PART 2 – PRODUCTS

(Not used)

PART 3 – EXECUTION

(Not used)

END OF SECTION

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SECTION 02 41 13

UTILITY DEMOLITION AND ABANDONMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Termination of utility services.
 - 2. Demolition or abandonment of drainage, sewer, and water pipe
 - 3. Demolition or abandonment of miscellaneous below-grade utilities and related facilities including but not necessarily limited to electric and communications ducts, steam lines, and gas lines.
 - 4. Demolition or abandonment of manholes, catch basins, vaults, and similar utility structures.
 - 5. Demolition or abandonment of above-grade utilities and related facilities including but not necessarily limited to electric, telephone, cable systems, and data communications.
- B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.2 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR).
 - 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. State of Connecticut.
 - 1. State of Connecticut Solid Waste Management Regulations, Sections 22a-209 including any amendments thereto.
 - 2. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 819, 2024 and any supplements.
- D. ASTM International (ASTM)
 - 1. ASTM C33 – Standard Specification for Concrete Aggregates.
 - 2. ASTM C55 – Standard Specification for Concrete Building Brick.
 - 3. ASTM C91 – Standard Specification for Masonry Cement.
 - 4. ASTM C94 – Standard Specification for Ready-Mixed Concrete.

5. ASTM C144 – Standard Specification for Aggregate for Masonry Mortar.
6. ASTM C 150 – Standard Specification for Portland Cement.
7. ASTM C230 – Standard Specification for Flow Table for Use in Tests of Hydraulic Cement.
8. ASTM C270 – Standard Specification for Mortar for Unit Masonry.
9. ASTM C387 – Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
10. ASTM C476 – Standard Specification for Grout for Masonry.
11. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

1.3 SAFETY

- A. Conduct the work of this Section in conformance with applicable regulations, including those relating to warning signs, excavation safety, sheeting, shoring, and stabilization.
- B. Provide and maintain barricades, signs, lights, etc., required for the protection of personnel, materials and property. Temporary barricades, etc. shall conform all applicable codes and regulations, and shall be lighted at night with lanterns, flares and reflectorized paint as required for safety. Adapt barricades, signs, lights, etc. to evolving site conditions throughout the progress of the work.
- C. Provide other safety devices as required, including adaptation of such safety devices to changing site conditions, to prevent unauthorized entry to construction areas and open excavations. Provide warning signs and other temporary construction safety devices necessary for proper completion of the work in compliance with applicable safety regulations.
- D. Contractor shall properly design and furnish all labor, materials, equipment, and tools necessary to construct permanent or temporary excavation support systems, including, but not necessarily limited to, sheet piling, trench shields, trench boxes, timber trench shoring, pneumatic/hydraulic shoring, steel sheeting or sheeting using other materials, sloping, and benching.
- E. Any time an excavation is to remain open, at a minimum, provide full enclosure with safety barriers and fencing, warning signs, and additional safety control measures as appropriate for the condition.

1.4 SUBMITTALS

- A. Abandonment procedures required by the owner of each utility prior to performing the work of utility termination/cutting/capping/plugging.
- B. Material specifications and shop drawings for all materials and equipment furnished under this section, prior to performing the work of utility abandonment.
- C. Schedule indicating the timing of termination for each utility.
- D. Copies of permits, licenses, approvals, insurance, or bonds associated with termination of utility service.

- E. Copies of utility termination letters confirming termination of service from each utility owner/operator.
- F. Quality Control Submittals (prior to commencement of work)
 - 1. Schedule of demolition activities.
 - 2. Methods of demolition, including sequence and equipment proposed for same.
- G. Contract Closeout Submittals (prior to authorization of final payment):
 - 1. As-built drawings showing locations of all terminated/cut/capped/plugged utilities and service disconnections at or before project close-out.

1.5 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- B. Utility Mark-out
 - 1. Prior to commencing work, comply with utility mark-out requirements of the Call-Before-You-Dig System (1-800-922-4455).
 - 2. Verify the location of all subsurface utilities marked through the Call-Before-You-Dig System.
 - 3. Not all subsurface facilities or structures will be identified through the Call-Before-You-Dig System. Confirm the location of other subsurface utilities and other subsurface facilities or structures prior to commencing work. Field-mark utilities as required.
- C. Utility Coordination
 - 1. Inform all utility owners of the necessity of test pit work. Provide reasonable advance notice to allow for coordination.
 - 2. Coordinate the excavation of all test pits with the respective utility owners having facilities in the vicinity of the test pit location.
 - 3. If so desired by the respective utility owners, all or part of the work under this Section may be accomplished by their crews and/or supervised by them.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Comply with the material specifications required by the owner of each utility. Where such material specifications may conflict with this Specification, utility owner's requirements shall prevail.
- B. Gravel Borrow: Conform to applicable Specifications.
- C. Sand: ASTM C33.

- D. Portland Cement: ASTM C150, Type II.
- E. Masonry Cement: ASTM C91.
- F. Mortar Aggregate: ASTM C144, standard masonry type, clean, dry, free of deleterious materials.
- G. Concrete: Design of mix in accordance with ASTM C94; ASTM C150, Type II Portland Cement, washed and graded sand, and aggregate with maximum size of 1-inch; or pre-packaged concrete mix with maximum aggregate size of 1-inch, ASTM C387. Minimum 28-day compressive strength of 4,000 psi.
- H. Masonry Mix: Washed and graded mason sand, lime, and Portland Cement, ASTM C270; or pre-packaged, dry, sand/lime/cement mortar mixture, ASTM C387. Minimum 28-day compressive strength of 1,800 psi (Type S).
- I. Grout: Bagged, pre-mixed formulations of non-shrink grout shall meet the requirements of ASTM C1107, Grade B or site mixed, ASTM C476.
 - 1. Unconfined compressive strength: 7,500 psi at 28 days.
 - 2. Grout shall be non-metallic, non-gaseous, and non-shrink when tested in accordance with ASTM C1107 Grade B or C at a fluid consistency (flow cone) of 20 to 30 seconds. Thirty-minute-old grout shall flow through the flow cone after slight agitation, in temperatures of 40 degrees F to 90 degrees F.
 - 3. Mix Design: Obtain prior written approval of Engineer for any proposed mix design. Mix design shall include the proportions of hydraulic cement, potable water, fine aggregates, expansive agent, and any other necessary additive or admixture.
 - 4. Grout shall be mixed to a flowable consistency as determined by ASTM C230. All bagged material shall be clearly marked with the manufacturer's name, date of production, batch number, and written instructions for proper mixing, placement and curing of the product.
 - 5. Contractor may formulate and design a grout mix for use on the project in lieu of using a pre-bagged product.
- J. Water: Potable.
- K. Solid Concrete Masonry Unit: ASTM C55, sized per pipe diameter to minimize requirements for cutting.

PART 3 EXECUTION

3.1 GENERAL

- A. Verify site conditions before proceeding with demolition work. Field check the accuracy of the Drawings and inspect structures, utilities, and other site features prior to start of work and notify Engineer in writing, of any hazardous conditions and/or discrepancies.
- B. Existing utilities at the Project Site have not been clearly defined as to location, size, and as-built condition, and all utility information shown on the Drawings or described herein must be considered approximate.

- C. Primary structures and other site features are shown on the Drawings; other smaller structures and features not shown on the Drawings may exist and shall be demolished as part of the work of this Section at no additional cost.
- D. Contractor shall have sole responsibility for verification of actual field conditions. Contractor shall bear full responsibility for obtaining information regarding the location, layout, and as-built configuration of existing site improvements, including aspects of such improvements which are not readily visible, including but not necessarily limited to above-ground and underground utilities, utility structures, their connections, and other above- and below-grade construction that may affect, or be affected by, the work of this Section.
- E. Utility services to buildings outside the limits of work shall be maintained and all resulting costs or charges shall be the responsibility of Contractor.
- F. Although surficial features such as manholes, catch basins, valves and junction boxes may be visible and/or shown on the Drawings, Contractor is required to perform exploratory excavations as he deems appropriate to ascertain the location and nature of all subsurface utilities components which are to be terminated, abandoned, or demolished, or otherwise affected by the work.
- G. Provide all required coordination with owners of the various utilities serving, or present at, the Project Site as required to complete termination, demolition and abandonment work.
- H. Prior to physically cutting, disconnecting, demolishing or abandoning any facility, verify that service has been terminated and no active connections remain.
- I. Coordinate as required for permanent termination of service, temporary termination of service, relocation of facilities, abandonment of facilities, demolition of facilities, cutting, capping, plugging, and bracing.
- J. Comply at all times with the procedures for terminations of utility services as required by the owner of each utility.
- K. When utilities are encountered that are not indicated on the Drawings, notify Engineer before proceeding with the work.

3.2 PROTECTION OF UTILITIES

- A. Locate and identify existing utilities that are to remain and protect them from damage. Provide protection as required such as marking, blocking, bracing, stabilizing, supporting, and retaining.
- B. Before excavating near any utility, notify the utility owner, coordinate protective work, and comply with the utility owners' requirements.
- C. When uncharted or incorrectly charted utilities are encountered during excavation, stop work and notify Engineer immediately. Cooperate with the utility owners in maintaining their utilities in operation prior to resuming work.
- D. Utilities to remain which are damaged by Contractor shall be repaired/replaced to the satisfaction of the utility owner at Contractor's expense.
- E. Retaining Structures

1. Provide bracing, shoring, sheeting, sheet piling, underpinning or other retaining structures necessary to guard against any movement or settlement of existing or new construction, utilities, paving, light standards, piping or conduit. Assume responsibility for the strength and adequacy of retaining structures, and for the safety and support of construction, utilities or paving, and for any movement, settlement or damage thereto.

3.3 UTILITY TERMINATION

- A. Termination: Where “Terminate” is indicated, permanently terminate utility service as indicated on the Drawings in accordance with each utility owner’s specific requirements, or coordinate with the utility owner in those cases where the utility owner will perform termination.
- B. Coordinate and secure required permits, licenses, approvals, insurance, or bonds associated with termination of service.
- C. Coordinate inspections by utility company personnel, or if privately-owned, coordinate inspections by qualified, authorized personnel on behalf of the utility owner.
- D. Provide completed and executed utility termination forms as required by each utility owner’s requirements.
- E. Secure any required utility termination letters from each utility which confirm that service has been terminated and no active connections remain.
- F. Termination Procedure
 1. Water
 - a. Do not impact any water pipe that may be constructed of asbestos-containing materials unless asbestos abatement specifications are part of the contract documents and the work is completed by qualified personnel in accordance with the requirements contained therein.
 - b. Cut and cap water pipe as indicated on the Drawings or in accordance with the water utilities’ requirements. Do not leave “dead-end” pipe runs.
 - c. Provide restraining blocks at all capped ends.
 2. Electrical and Communications
 - a. Remove conductors to nearest structure unless otherwise indicated. Plug openings in structures per the details or in accordance with the utilities’ requirements.
 - b. Cut and cap conduits at each end. Caps shall match conduit type.
 - c. Direct-Bury Cable: Comply with the cable owner’s requirements.
 - d. Secure termination documentation.
 3. Gas
 - a. Comply with gas company requirements.
 4. Steam

- a. Prior to impacting any steam pipe, confirm that no asbestos-containing materials are present, or confirm that all asbestos-containing materials have been properly abated.
- b. Provide concrete plug at open ends.

3.4 UTILITY ABANDONMENT

A. Abandonment: Where “Abandon” or “Abandon in-place” is indicated, terminate utility service, cut, cap and otherwise separate the facility from portions to remain and implement abandonment procedure as defined herein.

B. Sewer and Drainage Systems

1. Less than 6 inches in diameter: Provide 6-inch concrete plug at open ends on either side of the length to be abandoned as indicated on the Drawings.
2. Greater than 6 inches in diameter: Fill abandoned section with grout/flow-fill and provide 6-inch concrete plugs on either side of the length to be abandoned as indicated on the Drawings.
 - a. Where the filling of pipe is called-for, submit plan of proposed procedure to the owner of such utility and Engineer for approval.
 - b. Filling of pipe shall be with pressure (pumping) methods.
3. Where the filling of pipe or conduit is called-for, Contractor shall submit a plan of his proposed procedure to the owner of such utility and Engineer for approval.
4. All structures which are to be abandoned in-place shall have their tops or roof slabs removed and floor slabs broken so as to permit the free passage of water.
5. Unless otherwise indicated, structures which are to be abandoned in-place may be demolished such that only that portion of the structure from finished grade to a point five feet below finished grade are removed.

C. Water Pipe

1. Do not impact any water pipe that may be constructed of asbestos-containing materials unless asbestos abatement specifications are part of the contract documents and the work is completed by qualified personnel in accordance with the requirements contained therein.
2. Cut and cap water pipe on either side of the length to be abandoned as indicated on the Drawings.
3. Provide restraining blocks at all capped ends of water pipe to remain in service.

D. Electrical and Communications

1. Remove conductors to nearest structure unless otherwise indicated.
2. Cut and cap conduits on either side of the length to be abandoned as indicated on the Drawings. Caps shall match conduit type.

- E. Gas
 - 1. Comply with gas company requirements.
- F. Steam
 - 1. Prior to impacting any steam pipe, confirm that no asbestos-containing materials are present, or confirm that all asbestos-containing materials have been properly abated.
 - 2. Provide concrete plug on either side of the length to be abandoned as indicated on the Drawings.
- G. Utility Structures
 - 1. Comply with utility owner's requirements.
 - 2. All structures which are to be abandoned in-place shall have their tops or roof slabs removed and floor slabs broken so as to permit the free passage of water.
 - 3. Unless otherwise indicated, structures which are to be abandoned in-place may be demolished such that only that portion of the structure from finished grade to a point five feet below finished grade are removed.
 - 4. Backfill to match adjacent grade and restore surface area to match adjacent grade unless otherwise indicated.

3.5 UTILITY DEMOLITION

- A. Where "Remove," "Demolish," or "R&D" is indicated on the Drawings, such facility or structure shall be completely removed and disposed-of, after termination.
- B. Subsurface Utilities: Demolition shall include complete removal of the utility system and any associated concrete encasement, catch basins and related structures; sanitary sewerage manholes, pumps, and related facilities; valves, backflow devices, vents, reducers, couplings, meters, hydrants, fittings, thrust blocks, anchors; vaults, pull boxes, splice boxes, and handholes; or other ancillary components of the utility located within the limits to be demolished. The plugging or capping of utilities at the limit of demolition shall be as indicated on the Drawings. Where no plugging or capping is shown, comply with the requirements for utility termination at the limit of demolition.
- C. Above-grade Utilities: Demolition shall include complete removal of the utility system and any associated utility poles, guys, wires, transformers, light standards, utility and light pole foundations, supports and ancillary equipment.
- D. Do not demolish any utility until termination and plugging/capping has been completed and verified.
- E. Prior to the demolition of any lighting system, verify that power supplies which may be shared with other lighting systems outside the Project Limits have been segregated.
- F. Asbestos-Containing Materials

1. Do not impact any asbestos-insulated utility where “Remove” or “Demolish” is indicated on the Drawings until all asbestos-containing materials have been properly abated and verification of same has been either
 - a. Completed and verified by qualified personnel; or
 - b. If asbestos abatement specifications are part of the contract documents the work has been completed by Contractor’s qualified personnel or subcontractor in accordance with the requirements contained therein.
2. Do not impact any asbestos-containing pipe where “Remove” or “Demolish” is indicated on the Drawings unless asbestos abatement specifications are part of the contract documents and the work is completed by qualified personnel in accordance with the requirements contained therein. If asbestos abatement specifications are not part of the contract documents coordinate with Owner’s abatement contractor for completion of the work.

3.6 MATERIAL DISPOSITION

A. Salvage of Utility Materials

1. If requested by the utility owner, frames and covers of manholes and catch basins to be demolished or abandoned shall remain the property of the utility owner. They shall be removed and transported to a designated storage area by Contractor.
2. Notify the utility owner at least 24 hours before salvaged materials are transport so that the exact place and time for delivery can be arranged.
3. Other utility materials which are to be salvaged or reused are indicated on the Drawings.

B. Disposal of Utility Materials

1. The loading of utility demolition materials for disposal shall be performed in a manner that prevents materials and activities from generating excessive dust and ensure minimum interference with roads, sidewalks and streets both onsite and offsite.
2. Transport of all materials off-site shall be in accordance with applicable Department of Transportation Regulations. All utility demolition materials leaving the site shall become the property of Contractor.
3. Disposal of utility demolition materials shall be conducted in accordance with all applicable regulations and occur only at facilities approved/licensed or permitted by the Connecticut Department of Energy and Environmental Protection.
4. Disposal of Demolition Materials: All materials resulting from utility demolition shall be removed from the Project Site by Contractor for disposal, reuse, salvage or recycling. Disposal shall be conducted in accordance with all applicable regulations.

3.7 FILL AND BACKFILL

- A. Backfill excavations from utility work in accordance with Specification Section 31 2310 – Earthwork.
- B. Backfill excavations from utility work in accordance with applicable Specification Sections.

- C. [No backfill is required. Provide OSHA-compliant barriers or smooth edges of all excavations to produce a stable slope, with smooth grade transitions and no vertical cuts from top of slope to lower limits of the excavation in compliance with the requirements of OSHA. Maximum slope into any excavated area under ideal soil conditions shall be 1 Horizontal to 2 Vertical (1H:2V).]

3.8 DOCUMENTATION

A. Field Identification

1. Physically mark the location of each subsurface utility termination with a surveyor's stake, with such stake identifying the utility type and depth below grade. Where the use of stakes at a utility termination location may be inappropriate, Contractor shall provide staking at an adjacent location(s) and include appropriate offset dimensions or other suitable demarcation.

B. As-Built Drawings

1. Provide as-built documentation for each utility termination, including location, depth, and method and material of construction for termination. Such as-built documentation shall be noted on the appropriate Drawings.
2. Contractor shall be solely responsible for complying with the requirements of local permitting authorities for preparation and submittal of as-built drawings. The requirements for the preparation of as-built drawings as defined herein shall be considered the minimum requirements of Engineer, but shall in no way relive Contractor from satisfying the requirements of local permitting authorities.
3. As work progresses, record the following on two (2) sets of Drawings:
4. All changes and deviations from the design in location, grade, size, material, or other feature as appropriate.
5. Any uncharted locations of utilities or other subsurface feature encountered during installation, including the characteristics of such uncharted utility or subsurface feature such as utility type, size, depth, material of construction, etc.
6. Recording of changes shall be clearly and neatly marked in red pen or pencil. All changes shall be noted on the appropriate Drawing sheets.
7. Make measurements from fixed, permanent points on the Project Site to accurately locate the work completed. Such measurements shall consist of at least three (3) ties showing the distance of each item relative to each of the fixed, permanent points.
8. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall also contain any additional information required by Engineer.

3.9 CLEAN UP

- #### **A.**
1. Contractor shall remove all debris, residuals, and materials at the conclusion of utility termination, demolition, and abandonment activities.

END OF SECTION

SECTION 02 41 18

STRUCTURE MOVING

PART 1 – GENERAL

1.1 SUMMARY

A Section includes:

1. Lifting, shoring, bracing, and moving of existing historic wood-framed train station building.
2. Temporary support systems required to maintain structural integrity during relocation.
3. Transport of structure to new adjacent foundation location.
4. Placement and alignment of structure onto new foundations.

B Related Sections:

1. 01 35 00 – Historic Protection Requirements
2. 03 30 00 – Cast-in-Place Concrete
3. 06 10 00 – Rough Carpentry
4. 31 23 00 – Excavation and Fill

1.2 REFERENCES

- A** Secretary of the Interior's Standards for the Treatment of Historic Properties
- B** ASCE 37 – Design Loads on Structures During Construction
- C** Applicable state and local moving regulations

1.3 PERFORMANCE REQUIREMENTS

- A** Maintain structural stability and geometry of building throughout lifting and moving operations.
- B** Limit differential movement to 1/2 inch maximum unless otherwise approved.
- C** Prevent damage to historic framing, exterior cladding, trim, and interior finishes.
- D** Maintain building plumb within 1/4 inch in 10 feet after placement.

1.4 SUBMITTALS

- A** Structure Moving Plan sealed by a Professional Engineer, including lifting scheme, bracing, load calculations, and sequence.
- B** Monitoring Plan including crack gauges and level points.
- C** Protection Plan for historic elements.
- D** Contractor qualifications demonstrating similar historic moves.

1.5 QUALITY ASSURANCE

- A Structure mover shall specialize in historic relocation with minimum 5 years experience.
- B Engage a Professional Engineer experienced in temporary structures and historic framing.

1.6 PRE-MOVE DOCUMENTATION

- A Document existing conditions with photographs and written survey.
- B Review documentation with Owner and Architect prior to move.

1.7 PROJECT CONDITIONS

- A Verify soil veering conditions and clearance requirements.
- B Coordinate utility disconnections and site preparation.

PART 2 – PRODUCTS

2.1 MATERIALS

- A Temporary structural steel beams designed for lifting loads.
- B Synchronized hydraulic jacking system.
- C Hardwood or engineered cribbing.
- D Temporary bracing materials for lateral stability

PART 3 – EXECUTION

3.1 PREPARATION

- A Install temporary bracing to prevent racking.
- B Disconnect structure from existing foundation.
- C Install lifting beams with minimal removal of historic fabric.

3.2 LIFTING OPERATIONS

- A Lift structure uniformly using synchronized jacks.
- B Monitor differential movement and structural response.
- C Pause operations if movement limits are exceeded.

3.3 MOVING OPERATIONS

- A Move structure along prepared path using rollers or dollies.
- B Maintain continuous support and stable bearing.

- C Protect structure from vibration and impact.

3.4 PLACEMENT OF NEW FOUNDATION

- A Align structure with new foundation.
- B Lower uniformly and verify bearing conditions.
- C Shim as required for uniform support.

3.5 TOLERANCES

- A Location: within 1 inch
- B Elevation: within 1/2 inch
- C Level: within 1/4 inch in 10 feet

3.6 FIELD QUALITY CONTROL

- A Monitor elevations and movement throughout operations.
- B Record observations and measurements.

3.7 REPAIRS

- A Repair damage caused by moving operations.
- B Match historic materials and follow preservation standards.

3.8 CLEANING AND RESTORATION

- A Remove temporary elements.
- B Restore disturbed areas to original condition.

END OF SECTION

SECTION 02 41 19

SELECTIVE DISMANTLING AND DEMOLITION

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A Dismantling of structural elements
- B Dismantling of historic finishes.
- C Dismantling of existing gutters and rainwater leaders.
- D Dismantling of basement utilities and mechanical systems.

1.2 RELATED SECTIONS

- A Section 02 44 00 – Temporary Shoring and Protection

1.3 REFERENCES

- A Comply with all similarly applicable demolition standards of the Connecticut State Building Code
- B Comply with all applicable OSHA requirements.

1.4 SUBMITTALS

- A Submit certificates attesting to legal disposal of refuse materials if requested by the Engineer.

1.5 PROTECTION

- A Provide for the uninterrupted safety of workers and adjacent structures to remain as well as the general public during all phases of the work. Provide warning signs, and barricades as required to maintain a separated, safe, secure site.
- B Protect all elements which are to remain and all historic elements to be retained and/or re-set. Do not dismantle anything other than what is specifically indicated on the contract documents unless specifically requested to do so in writing by the Engineer.

PART 2 – PRODUCTS

2.1 MATERIALS AND PRODUCTS

- A Provide products and materials which are incidental to the dismantling and demolition work, disposing of these or salvaging them for re-use as best suits the project conditions.

PART 3 – EXECUTION

3.1 SITE REVIEW

- A Perform full review of site to verify extent of dismantling and to plan for coordination with other trades.

3.2 DISMANTLING OPERATIONS

- A Carefully study each item to be dismantled and determine the safest, least disturbing and potentially damaging method of disassembly. Number the items that are to be re-used, photograph them and make a sketch of assembled items. Number each component with an appropriate non-permanent method of marking and note the points of contact or intersection and their orientation. Take photographs of all elements to be worked on before and after the work.
- B Dismantle the specific items and store items designated for re-use or salvage in a safe place.
- C Notify the Architect/Engineer immediately if any damage has occurred to any of the dismantled items and propose appropriate methods of repair.

END OF SECTION

SECTION 02 41 23

SITE DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. General Site Demolition.
 - 2. Demolition of site structures, retaining walls, signage, light standards, foundations and appurtenances, pavement, curbing, and similar site improvements.
 - 3. Filling of voids and excavations resulting from site demolition.
- B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.2 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR).
 - 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. State of Connecticut.
 - 1. State of Connecticut Solid Waste Management Regulations, Section 22a-209 including any amendments thereto.

1.3 DEFINITIONS

- A. Demolition: Any operation including the dismantling or wrecking of a structure, assembly, appurtenance, or any portion thereof, including major and minor components, parts, and systems. Demolition shall be inclusive of the removal, handing, processing, segregation, loading, and proper off-site disposition of materials. Demolition shall be interpreted as complete and total removal unless otherwise indicated. The term Remove shall be synonymous with Demolition.
- B. Bulky Waste: Land clearing debris and non-contaminated or hazardous waste material resulting directly from demolition activities other than Clean Fill, including such materials as tree stumps, tree tops, concrete, wood, brick, plaster, roofing materials, wallboard, metals, carpeting, insulation, furniture, and furnishings. Bulky Waste shall include Construction and Demolition Debris and Construction and Demolition Waste.

1.4 SAFETY

- A. Conduct the work of this Section in conformance with applicable regulations, including those relating to warning signs, excavation safety, sheeting, shoring, and stabilization.
- B. Provide and maintain barricades, signs, lights, etc., required for the protection of personnel, materials and property. Temporary barricades, etc. shall conform all applicable codes and regulations, and shall be lighted at night with lanterns, flares and reflectorized paint as required for safety. Adapt barricades, signs, lights, etc. to evolving site conditions throughout the progress of the work.
- C. Provide other safety devices as required, including adaptation of such safety devices to changing site conditions, to prevent unauthorized entry to construction areas and open excavations. Provide warning signs and other temporary construction safety devices necessary for proper completion of the work in compliance with applicable safety regulations.
- D. Contractor shall properly design and furnish all labor, materials, equipment, and tools necessary to construct permanent or temporary excavation support systems, including, but not necessarily limited to, sheet piling, trench shields, trench boxes, timber trench shoring, pneumatic/hydraulic shoring, steel sheeting or sheeting using other materials, sloping, and benching.
- E. Any time an excavation is to remain open, at a minimum, provide full enclosure with safety barriers and fencing, warning signs, and additional safety control measures as appropriate for the condition.

1.5 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- B. Utility Mark-out
 - 1. Prior to commencing work, comply with utility mark-out requirements of the Call-Before-You-Dig System (1-800-922-4455).
 - 2. Verify the location of all subsurface utilities marked through the Call-Before-You-Dig System.
 - 3. Not all subsurface facilities or structures will be identified through the Call-Before-You-Dig System. Confirm the location of other subsurface utilities and other subsurface facilities or structures prior to commencing work. Field-mark utilities as required.
- C. Utility Coordination
 - 1. Inform all utility owners of the necessity of test pit work. Provide reasonable advance notice to allow for coordination.
 - 2. Coordinate the excavation of all test pits with the respective utility owners having facilities in the vicinity of the test pit location.
 - 3. If so desired by the respective utility owners, all or part of the work under this Section may be accomplished by their crews and/or supervised by them.

1.6 REGULATORY REQUIREMENTS

- A. Comply with all applicable federal, state, and local safety and health requirements regarding all aspects of the work. Do not proceed until all permits or other approvals are secured.
- B. Contractor is bound to comply with any project-related permits or approval obtained by Owner, including all requirements of such permit and representations contained in permit application as though Contractor were the permittee. Requirements and conditions set forth in Owner-obtained project-related permits and permit applications shall be binding on Contractor just as any Specification would be.
- C. Do not close or obstruct roadways, sidewalks, hydrants, or other infrastructure without permits or authorization from local municipal authorities or other authorities having jurisdiction.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 IDENTIFICATION OF EXISTING FEATURES

- A. Prior to commencing construction activities, Contractor shall identify and delineate those areas or specific improvements that are not to be disturbed. Areas or specific improvements within the Limits of Work/Contract Limits and general work areas which are not to be disturbed shall be clearly marked or fenced. Monuments and markers shall be protected before construction operations commence. Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting designated areas, specific improvements, monuments, and markers at the Project Site.

3.2 PROTECTION OF EXISTING FEATURES

A. General

- 1. All areas or specific improvements, including but not limited to vegetation, utilities, poles, wires, fences, curbs, monuments/property-line markers, and other structures, which must be preserved in place without being temporarily or permanently relocated shall be carefully supported and otherwise protected from damage by Contractor.
- 2. As excavation/demolition work approaches underground structures, digging by machinery shall be discontinued and the excavation shall be done by means of hand tools.

B. Pavements

- 1. On paved surfaces to remain, Contractor shall not use or operate heavy equipment, other power-operated equipment, or store tools, equipment, or materials which may mar, cut, or otherwise damage such surfaces. If there is no alternative to the operation of heavy equipment, other power-operated equipment, or storage of tools, equipment, or materials on paved surfaces to remain, Contractor shall take all measures necessary to protect such surfaces.
- 2. All surfaces, which have been damaged by Contractor's operations, shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of construction operations. Such restoration shall meet the approval of Engineer and may include repair or complete replacement at Contractor's expense.

C. Planted Areas

1. All planted areas, including lawn/turf areas and landscaped areas, which have been damaged by Contractor's operations, shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of construction operations.

D. Utilities

1. Locate and identify existing utilities that are to remain and protect them from damage. Provide protection as required such as marking, blocking, bracing, stabilizing, supporting, and retaining.
2. For utility termination, removal, or abandonment, refer to Section 02 4113 – Utility Demolition and Abandonment.
3. Before excavating near any utility, notify the utility owner, coordinate protective work, and comply with the utility owners' requirements.
4. All utility services shall be supported by suitable means so that the services shall not fail when tamping and settling occurs.
5. Where known utilities are encountered, notify Engineer and document location and type of utility before proceeding with work in such area.
6. When uncharted or incorrectly charted utilities are encountered, stop work and notify Engineer. Cooperate with the utility owners in maintaining their utilities in operation prior to resuming work.

- E. Retaining Structures:** Provide bracing, shoring, sheeting, sheet piling, underpinning or other retaining structures necessary to guard against any movement or settlement of existing or new construction, utility systems, paving, or other improvements. Contractor assumes responsibility for the strength and adequacy of retaining structures, and for the safety and support of construction, utilities or paving, and for any movement, settlement or damage thereto.

3.3 SITE DEMOLITION

- A.** Conduct site demolition as shown on the Drawings.
- B.** Conduct site demolition operations in a manner that will prevent damage to adjacent structures, utilities, pavements and other facilities to remain.
- C.** Remove from the site and properly dispose of all materials resulting from site demolition operations.

3.4 DUST CONTROL

- A.** Implement fugitive dust suppression to prevent unacceptable levels of dust resulting from site demolition operations or other activities required by the Contract Documents. It shall be the Contractor's responsibility to supervise fugitive dust control measures and to monitor airborne particulate matter. Comply with applicable provisions of Section 01 5714 – Temporary Dust Control.

3.5 REPLACEMENT

- A. In case of damage, Contractor shall notify the appropriate party so that proper steps may be taken to repair any and all damage done. When the Owner does not wish to make the repairs themselves, all damage shall be repaired by Contractor, or, if not promptly done by him, Engineer may have the repairs made at the expense of Contractor.
- B. Contractor shall patch, repair and/or replace all adjacent materials and surfaces damaged through the prosecution of work at no expense to Owner. All repair and replacement work shall match the existing in-kind. Final acceptance of said work shall be at the sole judgment of Owner.

END OF SECTION

SECTION 02 44 00

TEMPORARY SHORING AND PROTECTION

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A Design and installation of all required temporary shoring, bracing and support to enable all necessary reconstruction and repair to be completed in a safe and expedient manner.

1.2 REFERENCES

- A. Comply with the following standard material specifications that apply to the materials used.

1.3 SUBMITTALS

- A Submit the following items to the Engineer for review:
 - 1. Drawings showing shoring, bracing, and temporary supports for the existing and re-installed structure as appropriate.

1.4 QUALITY ASSURANCE

- A Schedule all appropriate site visits and inspections with the design Engineer for the shoring system.
- B Comply with all referenced standards for the products employed

PART 2 – PRODUCTS

2.1 MATERIALS AND PRODUCTS

- A. Provide products and materials that are appropriate to the application and permitted by the Connecticut State Building Code.

PART 3 – EXECUTION

3.1 TEMPORARY SHORING, BRACING AND SUPPORT

- A The contractor shall be solely responsible for all means and methods of construction employed on this project including all temporary bracing, support and protection of the existing Structure. Contractor shall retain the services of a Connecticut registered professional structural engineer at his own expense if and as may be needed to maintain safe and stable conditions on the project. Any sequences of work or methods indicated or implied in the contract documents are present only as assumptions on which the design of the permanent installations are based and are to be considered as a suggested option for review by the contractor.

3.2 FIELD SURVEY AND ANALYSIS

- A Select shoring, bracing and support locations and measure all existing geometry and note existing conditions. Locate points of attachment and support that will best suit progress of work.

- B Perform a structural analysis of the areas to be affected by the work and determine loads on temporary shoring, bracing and support system.

3.3 DESIGN SHORING, BRACING AND SUPPORT

- A Shoring, bracing and support shall be designed to maintain existing lines and surfaces without deflection during work. Design shall be in accordance with gravity dead, live and wind load resistance requirements of the Connecticut State Building Code.
- B Design shall be sufficient for existing and new material loads and anticipated construction loads.
- C Design shall allow for distribution of loads to supporting structure and shall limit all movement to less than 1/4" at full loading and a given span length divided by 360 and within appropriate limits to prevent damage to the supported elements or materials. Stresses on supporting structure shall not exceed safe, commonly allowable stresses for the materials in consideration of their age and conditions.
- D Minimize use of side grain bearing timbers that may be susceptible to dimensional variations with changes in moisture and temperature.
- E Construct shoring, bracing and support in accordance with approved design submittal and proper and standard construction practice. Work shall be installed so as not to permanently mar or stain the exposed.

3.4 MAINTENANCE

- A Maintain shoring, bracing and support in a safe condition during all phases of work. Keep wood generally dry and of constant moisture content. Protect wood from swelling or shrinking with weather and humidity fluctuations.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B Related Sections
 - 1. Section 31 00 00 Earthwork

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Other Action Submittal:
 - 1. Design Mixtures: For each concrete mixture.

1.4 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. Comply with the following sections of ACI 301, unless modified by requirements in the Contract Documents.
 - 1. "General Requirements."
 - 2. "Formwork and Formwork Accessories."
 - 3. "Reinforcement and Reinforcement Supports."
 - 4. "Concrete Mixtures."
 - 5. "Handling, Placing, and Constructing."
 - a. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- C. Subsequent Work: Owner will award separate contract(s) for the following additional work to be performed at site following Substantial Completion. Completion of that work will depend on the successful completion of preparatory work under this Contract.

1.5 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on the use of public streets and with other requirements of authorities having jurisdiction.

PART 2 – PRODUCTS

2.1 FORMWORK

- A. Furnish formwork and formwork accessories according to ACI 301.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-draw steel wire into flat sheets.
- D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout Project.
- B. Portland Cement: ASTM C 150.
- C. Normal-Weight Aggregate: ASTM C 33, graded.
- D. Water: ASTM C 94/C 94M

2.4 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A

2.5 RELATED MATERIALS

- A. Vapor Retarder: Plastic sheet, ASTM E 1745, Class A or B.
- B. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

2.6 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth or cotton mats.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.

2.7 CONCRETE MIXTURES

- A. Comply with ACI 301 requirements for concrete mixtures.
- B. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, as follows:
 - 1. Minimum Compressive Strength: 4000 psi at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 - 3. Slump Limit: to suit placement.
 - 4. Air Content: Maintain within range permitted by ACI 301. Do not allow air content of trowel-finished floor slabs to exceed 3 percent

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and furnish batch ticket information:
 - 1. When air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 – EXECUTION**3.1 FORMWORK**

- A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.2 EMBEDDED ITEMS

- A Place and secure anchorage devices and other embedded items required for adjoining work attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- B vapor retarders
- C Install, protect, and repair vapor retarders according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended adhesive or joint tape.

3.3 STEEL REINFORCEMENT

- A Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.4 JOINTS

- A General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B Construction Joints: Locate and install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

3.5 CONCRETE PLACEMENT

- A Comply with ACI 301 for placing concrete.
- B Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
- C Consolidate concrete with mechanical vibrating equipment.

3.6 FINISHING UNFORMED SURFACES

- A General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface.
- C Do not further disturb surfaces before starting finishing operations.
- D Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, fluid-applied or direct-to-deck-applied membrane roofing, or sand-bed terrazzo.
- E concrete protecting and curing
- F General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.
- G Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

- H Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- I Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - d. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape

3.7 FIELD QUALITY CONTROL

- A Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B Tests: Perform according to ACI 301.
 - 1. Testing Frequency: One composite sample shall be obtained for each day's pour of each concrete mix exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof

3.8 REPAIRS

- A Remove and replace concrete that does not comply with requirements in this Section.

END OF SECTION

SECTION 03 32 00

SITE CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes
 - 1. Site cast-in-place concrete, including but not necessarily limited to, sidewalks, ramps, driveways, curbing, pads, bases, retaining walls, and thrust blocks.
 - 2. All facilities, labor, materials, tools, equipment, appliances, transportation, supervision, and related work necessary to complete the Work shown on the Drawings and as specified herein.
- B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.2 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR).
 - 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. ASTM International (ASTM)
 - 1. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 2. ASTM A706 – Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
 - 3. ASTM A767 – Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
 - 4. ASTM A775 – Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
 - 5. ASTM A996 – Standard Specification for Rail-Steel and Axle-Steel Deformed Bars or Concrete Reinforcement.
 - 6. ASTM A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - 7. ASTM C29 – Standard Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate

8. ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field.
9. ASTM C33 – Standard Specification for Concrete Aggregates.
10. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
11. ASTM C42 – Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
12. ASTM C70 – Standard Test Method for Surface Moisture in Fine Aggregate.
13. ASTM C94 – Standard Specification for Ready-Mixed Concrete.
14. ASTM C117 – Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing.
15. ASTM C127 – Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
16. ASTM C128 – Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
17. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
18. ASTM C138 – Standard Test Method for Density (“Unit Weight”), Yield, and Air Content (Gravimetric) of Concrete.
19. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete.
20. ASTM C150 – Standard Specification for Portland Cement.
21. ASTM C156 – Standard Test Method for Water Retention by Concrete Curing Materials.
22. ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete.
23. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete.
24. ASTM C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
25. ASTM C192 – Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
26. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
27. ASTM C233 – Standard Test Method for Air-Entraining Admixtures for Concrete.
28. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.
29. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

30. ASTM C311 – Standard Methods of Sampling and Testing Fly Ash and Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.
31. ASTM C387 – Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
32. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.
33. ASTM C566 – Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying.
34. ASTM C595 – Standard Specification for Blended Hydraulic Cements.
35. ASTM A 615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
36. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
37. ASTM C685 – Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
38. ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete.
39. ASTM C803 – Standard Test Method for Penetration Resistance of Hardened Concrete.
40. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
41. ASTM C979 – Standard Specification for Pigments for Integrally Colored Concrete.
42. ASTM C989 – Ground Granulated Blast-Furnace Slag for Use in Concrete Mortars.
43. ASTM C1064 – Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
44. ASTM A1078 – Standard Specification for Epoxy-Coated Steel Dowels for Concrete Pavement.
45. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
46. ASTM D1752 – Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
47. ASTM D2628 – Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
48. ASTM D4397 – Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
49. ASTM D5249 – Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints.
50. ASTM D5893 – Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.

- 51. ASTM E329 – Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
- D. Concrete Reinforcing Steel Institute (CRSI).
 - 1. CRSI Manual of Standard Practice, latest edition.
- E. State of Connecticut
 - 1. 2016 Connecticut State Building Code, including all Amendments, Supplements, and Errata.
- F. American Concrete Institute (ACI)
 - 1. ACI 224R – Control of Cracking on Concrete Structures.
 - 2. ACI 224.3R – Joints in Concrete Construction.
 - 3. ACI 301 – Specifications for Structural Concrete.
 - 4. ACI 302.1R – Guide for Concrete Floor or Slab Construction.
 - 5. ACI 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete.
 - 6. ACI 305R – Guide to Hot Weather Concreting.
 - 7. ACI 306R – Guide to Cold Weather Concreting.
 - 8. ACI 308R – Guide to Curing Concrete.
- G. American Welding Society (AWS).
 - 1. AWS A5.1/A5.1M (2004; Errata 2004) Carbon Steel Electrodes for Shielded Metal Arc Welding.
 - 2. AWS D1.4/D1.4M (2005; Errata 2005) Structural Welding Code – Reinforcing Steel.

1.3 SUBMITTALS

- A. Sampling and Testing Laboratory – Submit name and qualifications of commercial sampling and testing laboratory for Engineer’s approval. Submit applicable documentation of credentials, licenses, etc.
- B. Testing Agency – Submit name and qualifications of third-party in-field quality control Testing Agency for Engineer’s approval. Submit applicable documentation of credentials, licenses, etc.
- C. For each type of specially furnished concrete provide a description of methods and the sequence of placement.
- D. Manufacturer’s catalog data for the following items shall include printed instructions for admixtures, bonding agents, epoxy-resin adhesive binders, waterstops, and liquid chemical hardeners:
 - 1. Concrete Aggregates.
 - 2. Portland Cement.

3. Ready-Mix Concrete.
4. Form Facing Materials.
5. Reinforcement Materials.
6. Joint Materials.
7. Water-Vapor Barrier Subgrade Cover.
8. Bonding Materials.
9. Finish Materials.
10. Concrete Curing Materials.
11. Form release agent.
12. Concrete coloring additive.
13. Elastomeric joint sealant.
14. Preformed joint filler

E. Submit samples of the following:

1. Preformed joint filler.
2. Manufacturer's color charts showing full range of colors available.
3. Cured samples of elastomeric joint sealants in the color(s) selected.

F. Design Data

1. Mix Design data for each class of Ready-Mix Concrete shall be submitted at least 15 calendar days prior to start of specified work.
2. Mix Design data for each type of integrally-colored concrete mix called-for shall be submitted at least 15 calendar days prior to start of specified work.

G. Test Reports

1. Submit test reports for all testing conducted under this Section.

H. Certificates

1. Submit certificates for the following:
 - a. Concrete Design Mixes.
 - b. Concrete Aggregates.
 - c. Welding Procedures. Welding Procedures shall be in accordance with AWS D1.4/D1.4M. Certificates for Welder Qualifications shall be in accordance with the paragraph entitled, "Qualifications for Welding Work," of this section.

- d. Mill certificates for Steel Bar.
 - 2. Certificates for concrete shall contain project name, title/number, date, name of Contractor, name of concrete testing service, source of concrete aggregates, material manufacturer, brand name of manufactured materials, material name, values as specified for each material, and test results.
- I. Manufacturer's Instructions
- 1. Installation instructions shall indicate the manufacturer's recommended method and sequence of installation for the following items:
 - a. Admixtures
 - b. Bonding Materials
 - c. Waterstops
 - d. Liquid Chemical Hardener
- J. Joint Plan
- 1. Prior to initiation of concrete flatwork, submit proposed Construction Joint plan to Engineer for review and approval. Coordinate such plan with the joint patterns depicted on the Drawings.
- K. Delivery Tickets: Ready-mixed concrete manufacturer shall provide delivery tickets with each load of concrete delivered to the Project Site. Delivery tickets shall provide the following information:
- 1. Project name printed on ticket.
 - 2. Name of producer, identification of plant.
 - 3. Date and time of day.
 - 4. Type of material.
 - 5. Cubic yards of material loaded into truck.
 - 6. Project number, purchase order number, name of Contractor (if Contractor other than producer).
 - 7. Truck number for specific identification of truck.
 - 8. Individual aggregate, cement, water weights (masses) and any admixtures shall be printed on plant tickets.
 - 9. Water/cement ratio.
 - 10. Additional water allowance in gallons based on water/cement ratio for mix.

1.4 QUALITY ASSURANCE

- A. Dimensions, locations, and details of equipment pads, anchors, supports, and similar features indicated on the Drawings are approximate. Manufacturer's approved shop drawings of equipment to be supported, anchored, or contained thereby shall be consulted for exact location, size and details.
- B. Obtain each specified material from same source and maintain high degree of consistency in workmanship throughout Project.
- C. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- D. Welder qualifications: Welder qualifications shall be verified in accordance with AWS D1.4/D1.4M or under an equivalent qualification test approved in advance. Welders shall be permitted to do only the type of welding for which each is specifically qualified.
- E. Concrete testing: Concrete testing shall be performed by an approved Testing Agency/Testing Laboratory experienced in sampling and testing of concrete. Testing Agency/Testing Laboratory shall meet the requirements of ASTM E329.

1.5 MOCKUPS

- A. Where mockups are called-for, comply with the following:
 - 1. At location on the Project Site selected by Engineer, place and finish 100 square foot mockup section for examination. Mockup to be constructed by the installer who will actually perform the work for the Project.
 - 2. For accurate color, the quantity of concrete mixed to produce the sample should not be less than 3 cubic yards (or not less than 1/3 the capacity of the mixing drum on the ready-mix truck) and should always be in full cubic yard increments. Excess material shall be discarded according to local regulations.
 - 3. For colored concrete, record the amount of integral colorant, dry colorant, or chemical stain needed per square foot of application to establish coverage rates for the work.
 - 4. Construct mockup using processes and techniques intended for use on permanent work, including curing procedures. Include samples of control construction, and expansion joints in sample panels.
 - 5. Retain samples of cements, sands, aggregates and color additives used in mockup for comparison with materials used in remaining work.
 - 6. Accepted mockup provides visual standard for all work.
 - 7. Mockup shall remain through completion of work for use as a quality standard for finished work.
 - 8. Provide suitable protections to preclude damage to mockup.
 - 9. Remove mockup when directed.

1.6 TESTING

- A. Owner will retain a testing entity to perform observation and testing of the work under this Section. The testing entity's presence does not constitute supervision or direction of Contractor's work. Neither the presence of the testing entity nor any observations and testing performed by him, nor any notice or failure to give notice shall excuse Contractor from conformance with these Specifications or from defects discovered in his work.
- B. Testing shall include sampling and testing concrete materials proposed for use in the work and testing the design mix for each class of concrete.
- C. Tests will be required to determine whether the concrete being produced complies with the standard of quality and strength as specified.
- D. Additional Tests: Additional testing of in-place concrete shall be conducted when test results indicate that specified concrete strengths and other characteristics have not been attained. Additional testing shall consist of cored cylinders to determine adequacy of concrete or other non-destructive testing methods that may be approved by Engineer. Contractor shall pay for all such additional testing. Any holes made shall be patched by the Contractor at their expense.
- E. Testing Standards
 - 1. Sampling: ASTM C172. Collect samples of fresh concrete to perform tests specified.
 - 2. Concrete aggregate materials proposed for use in the work shall be sampled and tested in accordance with ASTM C33.
 - 3. Portland Cement shall be sampled and tested in accordance with ASTM C150.
 - 4. Slump Tests: ASTM C143. Take concrete samples during concrete placement. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cement ratio is not exceeded.
 - a. Frequency: Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 20 cubic yards (maximum) of concrete unless otherwise specified or called-for.
 - 5. Air Content: ASTM C231 (primary method) or ASTM C173 (secondary method).
 - a. Frequency: Test air-entrained concrete for air content at the same frequency as specified for slump tests.
 - 6. Temperature Tests: ASTM C1064.
 - a. Frequency: Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F) for each batch (minimum) or every 20 cubic yards (maximum) of concrete, unless otherwise specified or called-for, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.
 - 7. Compressive Strength Tests: ASTM C39. Make five test cylinders for each set of tests in accordance with ASTM C31. Take precautions to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days, and hold one cylinder in reserve.

- a. Frequency: Samples for strength tests of each mix design (class) of concrete placed each day shall be taken not less than once a day, nor less than once for each 150 cubic yards of concrete, nor less than once for each 5,000 square feet of surface area for slabs (including walks and sidewalks) or walls.
 - b. Standard: Each strength test result must be the average of two cylinders from the same concrete sample tested at 28 days. If the average of any three consecutive strength test results is less than f'_c or if any strength test result falls below f'_c by more than 450 psi, take a minimum of three cored cylinder samples from the in-place work represented by the low test cylinder results and test. Concrete represented by core test is considered structurally adequate if the average of three cores is equal to at least 85 percent of f'_c and if no single core is less than 75 percent of f'_c . Retest locations represented by erratic core strengths. Remove concrete not meeting strength criteria and provide new acceptable concrete. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete
- 8. Cored cylinders: ASTM C42.
 - 9. Penetration: ASTM C803.
- F. Concrete Replacement: Failure of any test or to follow proper installation procedures will require that the concrete be removed and properly replaced at the Contractor's expense.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Schedule delivery of concrete to provide consistent mix times from batching until discharge. Mix times shall meet manufacturers' written recommendations.
- B. Packaged materials shall be delivered to the project site in their original, unopened package or container bearing label clearly identifying manufacturer's name, brand name, material, weight or volume, and other pertinent information. Packaged materials shall be stored in their original, unbroken package or container in a weather-tight and dry place until ready for use in the work.
- C. Unpackaged aggregates shall be stored to avoid excessive segregation, contamination with other materials or other size aggregates, or freezing.
- D. Reinforcement and other metal items shall be protected from corrosion and shall be kept free from ice, grease, and other coatings that would destroy or reduce bond.
- E. Colored Admixture: Comply with manufacturer's instructions. Deliver colored admixtures in original, unopened packaging. Store in dry condition.

1.8 PROJECT CONDITIONS

- A. Pre-Job Conference
 - 1. One week prior to placement of concrete, Contractor shall coordinate and host a coordination meeting to discuss concrete application schedule, materials, and methods.
- B. Environmental Requirements
 - 1. Avoid placing concrete if rain, snow, or frost is forecast within 24-hours.
 - 2. Protect fresh concrete from rain, moisture, and freezing.

3. Schedule placement to minimize exposure to wind and hot sun before curing materials are applied.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT

- A. Cement: ASTM C 150. One brand and type of cement shall be used for formed concrete having exposed-to-view finished surfaces.
- B. Unless otherwise specified, cement shall be Type IA.

2.2 READY-MIX CONCRETE

- A. Ready Mix Concrete: Portland Cement Concrete, air-entrained, ASTM C94.
 1. Compressive Strength:
 - a. Unless otherwise indicated, minimum compressive strength at 28 days shall be 4,000 psi minimum.
 - b. Sidewalks, stairs and landings, pedestrian and vehicle ramps, and curbing: Minimum compressive strength at 28 days shall be 4,500 psi minimum.
 2. Water/cement ratio: Maximum 0.45.
 3. Air content by volume: 6 percent $\pm$ 1 percent, ASTM C231 (primary method) or ASTM C173 (secondary method).
 4. Slump: no less than 2 inches, not greater than 4 inches, ASTM C143.
 5. Standard Color: Natural grey.
 6. Colored Concrete: See the Article "Integral Colorant" herein if applicable.
- B. Aggregate
 1. Coarse aggregate: ASTM C33. Broken stone or gravel consisting of clean durable fragments of uniform quality throughout. It shall be free from soft, disintegrated pieces, mud, dirt, organic or other injurious material. Coarse aggregate of a size retained on a 1-inch square opening sieve shall not contain more than 8% of flat or elongated pieces, whose longest dimension exceeds five times their maximum thickness.
 2. Fine aggregate: ASTM C33. Sand consisting of clean, hard, durable, uncoated particles of quartz or other rock, free from lumps of clay, soft or flaky material, loam, organic or other injurious material. Fine aggregate shall contain not more than 3% of material finer than a #200 sieve, ASTM C117.
- C. Water: Potable quality.
- D. Admixtures
 1. Concrete shall contain a water reducing agent, ASTM C494, to minimize cement and water content of the concrete mix at the specified slump.

2. Air-Entraining Admixtures: ASTM C260.
3. Pozzolan: Fly ash or other pozzolans used as admixtures shall conform to ASTM C618, Class C or Class F with 4 percent maximum loss on ignition. Pozzolan may be used to replace a maximum of 15 percent (15 %) of cement by weight.
4. No calcium chloride or admixtures containing calcium chloride shall be added to the concrete. No admixtures other than those specified shall be used in the concrete without the specific written permission of Engineer in each case.

2.3 FORMS

- A. Forms shall be substantially built and adequately braced so as to withstand the liquid weight of concrete without deforming. All linings, studding, walling and bracing shall be such as to prevent bulging, spreading, or loss of true alignment while pouring and displacement of concrete while setting.
- B. All edge forms for sidewalk pavements, curbs and gutters shall be of sufficient rigidity and adequately braced to accurately maintain line and grade. Form work shall be designed so that sections may be fastened together to prevent vertical or horizontal movement of ends.
- C. Forms for curved sections shall be so constructed and placed that the finish surface of walls and edge of sidewalks, curbs and gutters will not deviated appreciably from the arc of the curve.
- D. Exposed vertical and horizontal edges of the concrete in structures shall be chamfered as indicated on the Drawings by the placing of moldings in the forms.
- E. Forms for Exposed Finish: Plywood, metal, metal-framed plywood faced, or other acceptable panel materials. Form work materials shall produce a smooth, continuous, straight, and level surface.
 1. Plywood shall be APA A-A, A-B or A-C, Class 1, Exterior Grade. Thickness shall be as required to prevent movement or deformation but shall not be less than 5/8" thick.
- F. Forms for Non-Exposed Finish: Plywood, metal, metal-framed plywood faced, or other acceptable panel materials. Form work materials shall produce a generally smooth, continuous, straight, and level surface. Grain patterns or similar imperfections are acceptable. Lumber shall be dressed on at least two edges and one side.
 1. Plywood shall be at least B-B, Class 1, Exterior Grade. Thickness shall be as required to prevent movement or deformation but shall not be less than 5/8" thick.
- G. Cylindrical Forms: Sonotube Fibre Forms, wax-impregnated strippable forms or ABS or PVC plastic reusable forms.
- H. Form Ties: Provide prefabricated, adjustable length galvanized steel snap-off ties, with brackets, cones, corner locks and other accessories as necessary.
- I. Form Release Agent: Commercial formulation compounds that will not bond with, stain or adversely affect concrete.

2.4 REINFORCEMENT MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60 unless otherwise indicated.

- B. Galvanized Reinforcing Bars: ASTM A 767, Class II with galvanizing before fabrication.
- C. Weldable Reinforcing Bars: ASTM A 706, Grade 60 unless otherwise indicated. Maximum carbon content shall be 0.55 percent.
- D. Epoxy-Coated Reinforcing Bars: ASTM A 775, Grade 60 unless otherwise indicated.
- E. Steel Wire: ASTM A 82, 16 gauge or heavier black annealed wire.
 - 1. Ties for epoxy-coated bars shall be vinyl-coated or epoxy-coated.
 - 2. Ties for zinc-coated bars shall be zinc-coated.
- F. Welded Wire Reinforcement (WWR)
 - 1. Sidewalks: Plain wire, ASTM A1064 as indicated on the Drawings.
 - 2. Concrete Pavement: Plain wire, ASTM A1064 as indicated on the Drawings.
- G. Supports for Reinforcement
 - 1. Supports shall include bolsters, chairs, spacers, and other devices necessary for proper spacing, supporting, and fastening reinforcing bars and wire reinforcement in-place. Conform with CRSI Manual of Standard Practice for corrosion-resistant, plastic-protected wire, epoxy-coated, or stainless-steel supports.
 - 2. For exposed-to-view concrete surfaces and where support legs are in contact with forms, provide supports with plastic protection (CRSI, Class 1) or stainless steel protection (CRSI, Class 2).
- H. Dowel Bars: Plain (smooth) high-chrome steel bar, ASTM A615 Grade 60 with full-length plastic sleeve as a combined unit, dimensions as indicated on the Drawings.
 - 1. Where epoxy-coated dowels are called for: ASTM A1078.
- I. Bar/Dowel Adhesive: Two component (1:1 ratio), 100% solids, high modulus, moisture-insensitive structural epoxy gel designed specifically for bonding bars, dowels, and bolts in concrete.

2.5 JOINT MATERIALS

- A. Preformed Joint Filler Strips
 - 1. Where no joint sealant is called-for: Nonextruding and resilient bituminous type conforming to ASTM D 1751, 1/2 inch thick, one piece for the full depth and width of the joint.
 - 2. Where joint sealant is called-for: Nonextruding and resilient nonbituminous type conforming to ASTM D 1752, Type I (sponge rubber) or Type II (cork), 1/2 inch thick, allowance for sealant at top and extending for the full depth and width of the joint.
- B. Joint Sealant Compound, ASTM C920
 - 1. Self-Leveling (Type SL; Grade "P")

- a. Cold-applied and self-leveling, Type S or Type M elastomeric polymer sealant.
2. Gun-Grade (Non-Sage; Grade “NS”)
 - a. One-component (Type S) high-performance moisture-curing polyurethane sealant specifically formulated for bonding to masonry and concrete.
3. Traffic Bound areas: T sealant.
4. Non-Traffic Bound areas: NT sealant.
5. Color: As approved by Engineer.
6. Backer material: ASTM D5249, closed cell.

2.6 DETECTABLE WARNING PANEL

- A. Surface-mount, UV-stabilized, polymer composite panel as indicated on the Drawings. Fasteners, adhesives, and sealants per manufacturer’s requirements. Panel shall comply with Connecticut Building Code/ADA Guidelines.
 1. Color: As approved by Engineer.
- B. Duralast Detectable Warning Plate with Black Asphaltic Coating, Product Number 00700570 as manufactured by East Jordan Iron Works, 301 Spring Street, East Jordan, MI or approved equal.

2.7 CONCRETE BONDING MATERIALS

- A. Aqueous-phase, film-forming, nonoxidizing, freeze and thaw-resistant compound suitable for brush or spray application conforming to ASTM C 932.
- B. Epoxy-Resin Adhesive Binder: Two-component, penetrating high solids, epoxy-based primer/bond coat, 100% solids, moisture-tolerant, ASTM C-881, Types I, II, and V, Grade-2, Class C and AASHTO M-235.

2.8 CONCRETE CURING MATERIALS

- A. Curing shall be by moist curing (preferred) or by use of curing compound. Sodium Silicate curing compounds shall be used where required by the weather, approved construction schedules and construction that is not adaptable to damp curing.
- B. Curing compound shall be a resin-base, white pigmented compound, ASTM C309, Type 2.
- C. Curing compounds shall contain a fugitive dye or when hot weather conditions dictate, a fugitive heat reflecting pigment.
- D. Moisture-Retaining Cover:
 1. Waterproof paper, ASTM C 171, regular or white.
 2. Polyethylene sheeting, ASTM C 171.

3. Polyethylene-coated burlap consisting of a laminate of burlap and a white opaque polyethylene film permanently bonded to the burlap. Burlap: ASTM C 171, Class 3. Polyethylene film: ASTM C 171.
4. When tested for water retention in accordance with ASTM C 156, weight of water lost 72 hours after application of moisture retaining covering material shall not exceed 0.039 gram per square centimeter of the mortar specimen surface.

E. Water: Potable Quality.

F. Membrane-Forming Curing Compound

1. Liquid type, ASTM C 309, Type 1, clear, Type 2, white, pigmented.

2.9 BOND BREAKER

A. Asphalt felt conforming to ASTM D2626, Type I or 6-mil polyethylene sheeting, ASTM D4397.

2.10 SEALER

A. Consolideck® Saltguard® silane/siloxane water repellent and chloride screen as manufactured by Prosoco, Inc., 3741 Greenway Circle, Lawrence, KS 66046, or approved equal.

2.11 COLORED CONCRETE

A. Integral Colorant

1. Colored, water-reducing admixture containing no calcium chloride with coloring agents that are limeproof and ultra-violet resistant. Admixture shall conform to the requirements of ACI 303.1, ASTM C979 and ASTM C494 and shall be dispensed at the batch plant.
2. Curing and Sealing Compound: ASTM C309. Clear, non-yellowing, solvent-borne, membrane-forming with low-gloss finish.
3. Compound shall be of same manufacturer as colored admixture, for use with integrally colored concrete.

B. Dry Colorants

1. Pigmented Mineral Dry-Shake Color Hardener: ASTM C 979, factory-packaged dry combination of Portland cement, graded quartz aggregate, non-fading finely-ground mineral oxide coloring pigments, and plasticizing admixture.
2. Pigmented-Powder Release Agent: Factory-packaged, nonfading finely-ground, streak free, colored powder that facilitates release of stamps and texture rollers from colored concrete and imparts a secondary accent color.

C. Stains

1. Reactive Chemical Concrete Stain: Reactive, water-based solution of metallic salts which react with calcium hydroxide in cured concrete substrates to produce permanent variegated or translucent color effects. Zero VOC content.

D. Colors

1. Cement: Color shall be white.
2. Sand: Color shall be locally available natural sand.
3. Aggregate concrete producer's standard aggregate complying with specifications.
4. Color of admixture, dry colorant, or stain: As indicated on the Drawings or selected by Engineer.

2.12 STAMPED AND TEXTURED CONCRETE

- A. Furnish tools and stamping equipment as recommended by the stamping system manufacturer and as approved by Engineer. Use stamping equipment and materials from a single manufacturer throughout the entire project.
- B. Stamp Mats: Semi-rigid polyurethane mats with projected texture and ridged underside capable of imprinting texture and joint patterns to plastic concrete.
 1. Pattern: As indicated on the Drawings.
- C. Stencils: Moisture-resistant paper stencils, designed for use on plastic concrete.
 1. Pattern: As indicated on the Drawings.
- D. Texture Rollers: Manually controlled, abrasion-resistant polyurethane rollers capable of imprinting texture on plastic concrete.
 1. Pattern: As indicated on the Drawings.
- E. Accessory Stamp Tools: Aluminum detailing tools capable of imprinting joints and dressing stamped joints of plastic concrete.

PART 3 EXECUTION

3.1 GENERAL

- A. Verify site conditions before proceeding with the work. Field check the accuracy of the Drawings and inspect structures, utilities, and other site features prior to start of work and notify Engineer in writing, of any hazardous conditions and/or discrepancies.
- B. Provide construction techniques in accordance with applicable provisions of ACI 224R, ACI 224.3R, and ACI 302.1R-04.
- C. Engineer shall be notified of concrete placement sufficiently in advance of start of operation to allow their representative to complete preliminary inspection of the Work, including subgrade, forms, and reinforcing steel, if used.
- D. Adjacent work, etc., shall be protected from stain and damage during entire operation. Damaged and stained areas shall be replaced or repaired to equal their original conditions at the contractor's expense. No concrete walks shall be poured after 12 noon unless a guard is visibly stationed nearby to prevent graffiti. Contractor shall be responsible for replacing any graffiti if he fails to provide adequate protection.

- E. Concrete surface shall be protected from traffic or damage until surfaces have hardened sufficiently. If necessary, 1/2-inch thick plywood sheets shall be used to protect exposed surfaces.
- F. Retempering of concrete is not permitted.
- G. Contractor is responsible for the protection and resetting of all existing utility covers/castings to finish grade; as well as, setting all new utility covers/castings to finish grade prior to placement of concrete. The repair of any settlement, or protrusion above finish grade, shall be the responsibility of Contractor at no additional cost to Owner.

3.2 PREPARATION OF SUBGRADE

- A. Compact and bring area to required subgrade elevation in accordance with Section 31 2310 – Earthwork. Provide for final fine grading, and compaction of areas as required to form a firm, uniform, accurate and unyielding subgrade at required elevations and to required lines.
- B. Existing subgrade material, which will not readily compact as required, shall be removed and replaced with satisfactory materials in accordance with Section 31 2310 – Earthwork.
- C. Subgrade of areas to receive concrete shall be recompacted as required to bring the top 8 inches of material, immediately below the base course, to a compaction at optimum moisture content of at least 95 percent (95%) of maximum density, as determined by ASTM D1557. Subgrade compaction shall extend for a distance of at least 1 foot beyond pavement edge.
- D. Materials shall not be stored or stockpiled on subgrade.
- E. Disposal of debris and other material excavated under this section, and material unsuitable for, or in excess of requirements for, completing work of this section shall be disposed of off-site.
- F. Prepared subgrade shall be inspected and approved by Engineer Representative before installation of the gravel base course. Disturbance to subgrade caused by inspection procedures shall be repaired under this Section of the Specification.

3.3 AGGREGATE BASE COURSE

- A. Prepare aggregate base course for concrete in accordance with Section 31 2310 – Earthwork and as shown on the Drawings.
- B. Width of base course shall be greater than or equal to the width of concrete surface, if continuous lateral support is provided during rolling. The width of base course shall extend at least 2 x base thickness beyond the edge of the course above, if it is not so supported.
- C. Aggregate shall be applied in lifts less than or equal to 6 inches thick, compacted measure. Each lift shall be separately compacted to specified density.
 - 1. Material shall be placed adjacent to wall, manhole, catch basin, and other structures only after they have been set to required grade and level.
 - 2. The base shall be wetted and rolled or tamped after the spreading of each lift.
 - 3. Rolling shall begin at the sides and progress to the center of crowned areas, and shall begin on the low side and progress toward the high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.

4. Surface irregularities, which exceed 1/2-inch, as measured by means of a 10-foot long straightedge, shall be replaced and properly re-compacted.
- D. Density: Base course shall be compacted at optimum moisture content to not less than 95 percent of maximum density as determined by ASTM D1557.
- E. Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with gravel. Materials spilled outside pavement lines shall be removed and the area repaired.
- F. Portions of subgrade, or of construction above, which become contaminated, softened, or dislodged by the passing of traffic, or otherwise injured, shall be cleaned, replaced, or otherwise repaired to conform to the requirements of this specification before proceeding with the next operation.

3.4 FORMS

- A. Forms shall be securely staked, braced and held firmly to the required line and grade and shall be sufficiently tight to prevent leakage of mortar. All forms shall be cleaned and oiled or wetted before concrete is placed against them.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Complete and approve formwork. Remove debris and foreign material from interior of forms before start of concrete placing.
- D. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain indicated elevations and contours in finished slab surface and must be strong enough to support vibrating bridge screeds or roller pipe screeds if nature of specified slab finish requires use of such equipment. Align concrete surface to elevation of screed strips by use of strike-off templates or approved compacting-type screeds.
- E. The maximum cross slope for sidewalks shall be 2.0 percent, sloped towards the gutter. Verify formwork prior to concrete placement. Make corrections as required and bring discrepancies to attention of Engineer.

3.5 JOINTS

- A. Locate joints as located on the Drawings, as shown on Engineer-approved joint plan. Conform with applicable sections of ACI 224.3R.
- B. Construction Joints: Effected at the end of a pour, lift, or at the end of a day's concrete placement. This type of joint is a plane surface between two distinct sections of concrete.
 1. Construction Joints shall be 1/2 inch wide and full-depth of slab.
 2. Joint filler: Unless otherwise specified, Construction Joints shall be constructed with joint filler. Joint filler shall extend the full depth of the slab and shall extend the full length of the joint. Use of multiple pieces of joint material of lesser dimensions to make up required depth and width of joint will not be permitted.
 3. Where joints are to receive filler, recess joint filler 1/4-inch below finish surface or as otherwise indicated on the Drawings.

4. Where called-for on the Drawings, install dowels at Construction Joints.
- C. Isolation Joints: Installed at intersections of structures on any type including but not limited to buildings, walks with steps, pre-cast concrete curb, light foundations, walls, pads, slabs at footings, or other structures. Isolation Joints shall not be required where concrete flatwork abuts granite curbing.
 1. Isolation Joints shall be ½ inch wide.
 2. Joint Filler: All Isolation Joints shall be constructed with joint filler. Joint filler shall extend the full depth of the slab and shall extend the full length of the joint. Use of multiple pieces of joint material of lesser dimensions to make up required depth and width of joint will not be permitted.
 3. Where joints are to receive filler, recess joint filler 1/4-inch below finish surface or as otherwise indicated on the Drawings.
- D. Control/Contraction Joints: Installed to form a weakened plane in a concrete member to provide a reduction in member thickness for the purpose of controlling shrinkage stresses to that specific area. Control/Contraction Joints shall be synonymous with “Dummy Joints.”
 1. Control/Contraction Joints shall be tooled or saw-cut.
 - a. Tooled joints: Tool-form joint into the concrete 1 inch in depth, but in no case less than 25 percent of slab depth. Joint width shall be 1/4-inch. Each side of tooled joint shall be dressed to match final overall slab finish. Joint shall be made after concrete is finished and when the surface is stiff enough to support the weight of workmen without damage to the slab, but before the slab has achieved its final set.
 - 1) Where tooled joints are to receive joint sealant, provide 1/2-inch wide tooled joint and install backer rod material to create 1/4-inch recess below finished surface.
 - b. Saw-cut joints: Saw-cut joint into concrete 1 inch in depth, but in no case less than 25 percent of slab depth. Joint width shall be 1/8-inch. Cut joint using rotary saw within 4 to 12 hours after the concrete has been finished.

3.6 STEEL REINFORCEMENT

- A. Install steel reinforcement as shown on the Drawings.
 1. Welded Wire Reinforcement: Where WWR is called-for, install material in the upper 30 to 40 percent (30%–40%) of the overall slab thickness, or at the nearest depth below top of slab as required to achieve a minimum of 2-inches of cover.
- B. Before being placed in position, reinforcing for reinforced concrete shall be thoroughly cleaned of loose mill and rust scale, dirt, ice, and other foreign material, which may reduce the bond between the concrete and reinforcing. Where there is a delay in placing concrete after reinforcement is in place, bars shall be re-inspected and cleaned when necessary.
- C. Any bar showing cracks after bending shall be discarded.
- D. Minimum Cover: 2 inches, except where concrete is cast against and permanently exposed to earth minimum cover shall be 3 inches.

- E. For slab-type construction, welded wire reinforcement and reinforcing bars shall be elevated off the base material by use of supports as specified herein. Adjacent sheets of welded wire reinforcing shall lap 6 inches.
- F. Joints
 - 1. Construction Joints: Reinforcement shall not continue through construction joints. Allow for 2-inches of cover at end of slab. Where called-for on the Drawings, install pins at Construction Joints per detail.
 - 2. Isolation Joints/Expansion Joints: Allow for 2-inches of cover at end of slab.
 - 3. Control/Contraction Joints: Cut at least one-half of reinforcement at joints.
- G. Reinforcing shall be securely wired in the position called for, and shall be maintained in that position until concrete is placed and compacted.

3.7 PLACEMENT

- A. Before placing concrete, forms and the space to be occupied by the concrete shall be thoroughly cleaned, and reinforcing steel and embedded metal shall be free from dirt, oil, mill scale, loose rust, paint, and other material which might tend to reduce bond.
- B. Existing concrete, earth, forms, and other water-permeable material against which new concrete is to be placed and shall be thoroughly damp when concrete is placed. There shall be no free water on the surface.
- C. Concrete shall arrive at the job site in a timely manner so that no additional water will be required to produce the desired slump. When conditions develop that require the addition of water to produce the desired slump, permission of the Engineer must be obtained. The concrete shall be transported from the mixer to its place of deposit by a method that will prevent segregation or loss of material.
- D. Concrete, which has set, or partially set, before placement shall not be employed.
- E. Existing concrete, earth, and other water-permeable material against which new concrete is to be placed shall be thoroughly damp when concrete is placed. There shall be no free water on surface.
- F. Concrete shall be thoroughly spaded and tamped to secure a solid and homogeneous mass, thoroughly worked around reinforcement and into corners of forms.
- G. When joining fresh concrete to concrete which has attained full set, the latter shall be cleaned of foreign matter, and mortar scum and laitance shall be removed by chipping and washing. Clean, roughened base surface shall be saturated with water, but shall have no free water on surface. A coat of 1:1 cement-sand grout, approximately 1/8-inch thick shall be well scrubbed into thoroughly dampened concrete base. New concrete shall be placed immediately, before grout has dried or set.

3.8 STAMPED OR TEXTURED CONCRETE

- A. Construct concrete as recommended by the stamping system manufacturer. Apply pigmented release agent to tools and forms in accordance with the stamping system manufacturer's

specifications. Place concrete and screed to the specified grade. Float the surface and evenly apply dry shake color hardener according to manufacturer's specifications.

- B. Imprint the surface of the plastic concrete with the forms to obtain the specified pattern. The pigmented release agent will serve as the curing agent. Do not clean the surface until adequate curing has been obtained, as recommended by the stamping system manufacturer.
- C. Saw cut all joints one-quarter inch wide and one-inch-deep, following the joint patterns illustrated in the typical sections, or as directed by the Engineer. Seal all joints, including expansion joints and sawed joints, with color-matched joint sealant, as recommended by the stamping system manufacturer. Apply two coats of low-lustre, matte finish clear surface sealer to the finished decorative concrete as recommended by the stamping system manufacturer.
- D. Take steps to avoid the contamination of adjacent surfaces while placing and finishing colored, stamped concrete; clean all surfaces that do get contaminated. Areas that were not properly protected and/or cannot be cleaned to the satisfaction of the Engineer must be removed and replaced. All costs associated with this removal and replacement will be borne by the Contractor.

3.9 FINISHING

- A. Concrete flatwork surfaces shall be screened off and finished true to line and grade, and free of hollows and bumps. Surface shall be dense, smooth, and at exact level and slope required.
 - 1. Finished concrete surface for concrete subbase shall be woodfloated to a slightly rough surface. Surface shall not deviate more than 1/4-inch in 10 feet.
 - 2. Finished concrete surface for concrete pavement, walks, and pads shall be wood-floated and steel troweled to a smooth surface. Surface shall not deviate more than 1/8-inch in 10 feet.
- B. Unless otherwise indicated, horizontal surfaces of concrete surfaces, which will be exposed, shall be given a light broomed finish, with direction of grooves in concrete surface perpendicular to length of concrete band, slab or pad. After concrete has set sufficiently to prevent coarse aggregate from being torn from the surface, but before it has completely set, brooms shall be drawn across it to produce a pattern of small parallel grooves. Broomed surface shall be uniform, with no smooth, unduly rough or porous spots, or other irregularities. Coarse aggregate shall not be dislodged by the brooming operation.
- C. Immediately following finishing operations, arises at edges and both sides of expansion joints shall be rounded to a ¼ inch radius. Control joints to be tooled shall be scored into slab surface with scoring tool. Adjacent edges of control joint shall be same time be finished to a ¼ inch radius.
- D. Where finishing is performed before the end of the curing period, concrete shall not be permitted to dry out, and shall be kept continuously moist from time of placing until end of curing period, or until curing membrane is applied.

3.10 CURING

- A. Cure in accordance with ACI 308R.

- B. Concrete shall be kept continuously damp from time of placement until the end of the specified curing period.
- C. Water shall not be applied to curing concrete within 24 hours after initial placement. Any water shall be applied only to maintain damp conditions. Do not add water during floating and troweling operations.
- D. Between finishing operations, the surface shall be protected from rapid drying by covering with a material specified herein. Surface shall be damp when the covering is placed over it, and shall be kept damp by means of fine-spray of water, applied as often as necessary to prevent drying after the initial 24-hour cure period.
- E. Concrete surfaces shall be cured by completely covering them with curing paper or an application of a curing compound.
 - 1. Concrete cured using waterproof paper shall be completely covered with paper with seams lapped and sealed with tape. Concrete surface shall not be allowed to become moistened between 24 and 36 hours after placing concrete. During curing period surface shall be checked frequently, and sprayed with water as often as necessary to prevent drying, but not earlier than 24 hours after placing concrete.
 - 2. If concrete is cured with a curing compound, the compound shall be applied at a rate of 200 square feet per gallon, in two applications perpendicular to each other.
 - 3. Curing period shall be seven days minimum. Full-strength shall be considered after 28 days.
- F. Only if additional protection is required, the surface should remain uncovered for at least 4 days, after which time new and unwrinkled non-staining reinforced waterproof Kraft curing paper may be used.
- G. Integrally Colored Concrete: Cure using a curing compound specific for integrally colored concrete according to manufacturer's instructions using manufacturer's recommended application techniques. Apply curing and sealing compound at consistent time for each pour to maintain close color consistency.

3.11 COLD WEATHER CONCRETING

- A. Comply with ACI 306R Guide to Cold Weather Concreting.
- B. Materials for concrete shall be heated for concrete, which is mixed, placed or cured when the mean daily temperature is below 40 degrees F or is expected to fall below 40 degrees F within 72 hours. The concrete, after placement, shall be protected by covering, heat, or both.
- C. Details of handling and protecting concrete during freezing weather shall be subject to the approval of Engineer.

3.12 HOT WEATHER CONCRETING

- A. Comply with ACI 305R: Guide to Hot Weather Concreting.
- B. Concrete just placed shall be protected from the direct rays of the sun and the forms and reinforcement just prior to placement shall be sprinkled with cold water. Every effort shall be

made to minimize delays that will result in excessive mixing of the concrete after arrival on the job.

- C. During periods of excessively hot weather (95°F, or above), ingredients in the concrete shall be cooled insofar as possible and cold mixing water shall be used to maintain the temperature of the concrete at permissible levels all in accordance with the provisions of ACI 305R. Any concrete with a temperature below 95°F, when ready for placement, will not be acceptable, and will be rejected.
- D. Temperature records shall be maintained throughout the period of hot weather giving air temperature, general weather conditions (calm, windy, clear, cloudy, etc.) and relative humidity. Records shall include checks on temperature of concrete as delivered and after placing in forms. Data should be correlated with the progress of the Work so that conditions surrounding the construction of any part of the structure can be ascertained.

3.13 PROTECTION

- A. Concrete surface shall be protected from traffic or damage until surfaces have hardened sufficiently. If necessary, ½ inch thick plywood sheets shall be used to protect the exposed surface.

3.14 CLEAN UP

- A. Remove all debris, residuals, and materials at the conclusion of the work. Dispose of all materials in accordance with applicable waste management regulations.

END OF SECTION

SECTION 04 01 20.56

MASONRY RESTORATION AND REPOINTING

PART 1-GENERAL

1.1 SUMMARY OF WORK

- A. Extent of masonry restoration work is as shown on the Drawings and as specified herein.
 - 1. The drawings endeavor to show the extent of masonry restoration work required. The contractor shall review the Drawings, Photographs and make a Pre-bid field visit to verify all work whether shown or not shown on the Drawings.
- B. The work includes, but is not limited to: (Examples)
 - 1. Repairing cracks and voids in stone construction.
 - 2. Patching stone structures and stone sills.
 - 3. Repointing mortar joints.
 - 4. Application of water repellent/light consolidant

1.2 QUALITY ASSURANCE

- A. Restoration Specialist: Work must be performed by a firm having not less than 5 years successful experience in comparable masonry restoration projects and employing personnel skilled in the restoration process and operations indicated.
 - 1. Only skilled journeymen masons who are familiar and experienced with the materials and methods specified and are familiar with the design requirements shall be used for masonry restoration.
 - 2. One skilled journeyman mason, trained and Certified by the specified stone repair system manufacturer, shall be present at all times during masonry restoration and shall personally direct the work.
- B. Field -Construction Mock-ups: Prior to start of general masonry restoration, prepare the following sample panels and sample areas on building where directed by Architect. Obtain Architect's acceptance of visual qualities before proceeding with the work. Retain acceptable panels in undisturbed condition, suitably marked, during restoration as a standard for judging completed work.
 - 1. Coating removal: Demonstrate materials and methods to be used for coating removal for each type of masonry surface and condition with sample panel 4 sq. ft. in area. The removal method or methods shall be tested on an inconspicuous area of the building.
 - 2. Crack Repair: Prepare a sample area for each type of crack repair required for stone. Repair shall demonstrate methods and quality of workmanship expected for crack repair.
 - 3. Patching: Prepare on-building sample of each type of stone and masonry construction to be patched. Patching and mold shall demonstrate methods and quality of workmanship expected of repair work.
 - 4. Repointing: Prepare 2 separate sample areas of approximately 5' high by 5' wide for each type of repointing required, one for demonstrating methods and quality of workmanship expected in removal of mortar from joints and the other for demonstrating quality of materials and workmanship expected in pointing mortar joints. Sample areas shall be located in an inconspicuous yet readily accessible place.
- C. Patching, Repointing and Coating work: The samples of each type of repair work shall be done in an area that will be exposed to the same weathering conditions as the building. Allow samples to

cure at least three days before obtaining acceptance of color, texture and detailing match. Samples shall be viewed from an approved distance.

- D. Source of Materials: Obtain materials for patching, coating, sealing, crack repair and repointing from a single manufacturer source to ensure match quality, color, texture and detailing.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each product specified. Include test data and certifications substantiating that products comply with requirements.
- B. Submit the following items in time to prevent delay of the work and to allow adequate time for review and resubmittals, if needed. Do not order materials or start work before receiving the written approval:
1. Written certificates from the patching materials manufacturer should be submitted stating that all installers of the patching material have successfully completed a training workshop for installation of the patching material, or have met alternative workmanship qualifications acceptable to the manufacturer, or provide written certification from the manufacturer that on-site training services have been contracted for.
 2. Safety Data Sheets (SDS) as appropriate.
 3. Certificates, except where the material is labeled with such certification, by the producers, of the materials, that all materials supplied comply with all the requirements of these specifications and the appropriate standards.
 4. Color-match patch samples fabricated on pieces of appropriate masonry from or on the building using the specified repair mortar as required. A minimum of three color shades shall be provided, representing the range of colors present in the existing stonework.
 5. Written verification that all specified items will be used. Provided purchase orders, shipping tickets, receipts, etc. to prove that the specified materials were ordered and received.
- C. Restoration Program: Submit written program for each phase of restoration process including protection of surrounding material on building and site during operations. Describe in detail material methods and equipment to be used for each phase of restoration work.

D. SUBSTITUTIONS

1. If alternative methods and materials to those indicated are proposed for any phase of restoration work, provide written description, including evidence of at least 10 years' successful use on other, comparable projects, and program of testing to demonstrate effectiveness for use on this project. Provide documentation showing compliance with the requirements for substitutions and the following information:
 - a. Coordination information, including a list of changes needed to other work that will be necessary to accommodate the substitution.
 - b. A comparison of the substitution with the specified products and methods, including performance, durability, and visual effect.
 - c. Product data, including specifications for products and installation procedures.
 - d. Samples, where applicable, or as requested.
 - e. A statement indicating the effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the substitution on contract completion time.
 - f. Cost information, including a proposal of the net change, if any, in the contract sum.
 - g. Certification that the substitution conforms to the contract documents and is appropriate for the applications indicated. Material substitution requests must be accompanied by independent laboratory test reports from a lab designated by the

architect to establish equivalent performance levels and specification compliance. Testing shall be paid for by the submitting party.

- h. The Contractor's waiver of rights to additional payment or time that may become necessary because of the failure of the substitution to perform adequately.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site in manufacturer's original unopened containers and packaging, bearing labels as to type and names of products and manufacturers, color numbers and batch numbers.
- B. Deliver and store restoration material in manufacturer's original, unopened containers with the grade, batch and production data shown on the container or packaging.
- C. Protect restoration materials during storage and construction from wetting by rain, snow or ground water, and from staining or intermixture with earth or other types of materials.
- D. Protect grout, mortar and other materials from deterioration by moisture and temperature. Store in a dry location or in waterproof containers. Keep containers tightly closed and away from open flames. Protect liquid components from freezing. Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage.
- E. Comply with the manufacturer's written specifications and recommendations for mixing, application, and curing of grouts and patching materials.

1.5 PROTECTION / SITE CONDITIONS

- A. Protect persons, motor vehicles, building site and surrounding buildings from injury resulting from masonry restoration work.
- B. Do not perform any masonry patching unless air temperatures are between 50 degrees Fahrenheit (10 deg. C) and 90 degrees Fahrenheit (32 deg. C) and will remain so for at least 48 hours after completion of work.
- C. Prevent masonry patching materials from staining the face of masonry or other surfaces to be left exposed. Immediately remove all patching materials that come in contact with such surfaces.
- D. Cover partially completed work when work is not in progress.
- E. Protect sills, ledges and projections from droppings.

1.6 SEQUENCING / SCHEDULING

- A. Perform masonry restoration work in the following sequence:
 - 1. Repair and/or replace existing roof gutters, flashing, drains and/or leaders as indicated.
 - 2. Remove coatings, stains and foreign material from all stone surfaces.
 - 3. Rake-out existing mortar from joints of masonry indicated to be restored.
 - 4. Repoint existing mortar joints of masonry indicated to be repointed.
 - 5. Wash building exterior as per Section 01 10 07.
 - 6. Patch and repair existing stone structures as indicated.
 - 7. Provide water repellent/consolidant treatment for masonry structures as indicated.

PART 2 - PRODUCTS**2.1 REPOINTING MORTAR MATERIALS**

- A. Repointing mortar shall be a pre-mixed, pre-colored, custom-matched cement-lime based mixture formulated to comply with the requirements of ASTM C-270 Type __ mortar.
 - 1. Products: The following shall be assumed to meet the quality and performance requirements specified:
 - a. "SPEC-JOINT 46", by Edison Coatings, Inc., Plainville, CT, (860)747-2220, or approved equal.
 - b. If proposed equal is submitted, thorough lab testing shall be required to establish equivalent performance levels. An independent testing laboratory shall be utilized as determined by the Architect and paid for by the submitting party.

2.2 CRACK INJECTION MATERIALS

- A. Cementitious crack filler shall be an ultra-fine, superplasticized, polymer- modified injection grout. Cementitious grout shall be suitable for application in wet or dry cracks, shall develop direct tensile bond strength of 200 psi minimum, shall exhibit less than 0.06% drying shrinkage, and shall have a linear coefficient of thermal expansion of 0.000004 to 0.000008 inches/inch per degree Fahrenheit.
 - 1. Products: The following shall be assumed to meet the quality and performance requirements specified:
 - a. PUMP-X 53i, as manufactured by Edison Coatings, Inc., Plainville, CT, Phone (860) 747-2220.

2.3 PATCHING MATERIAL

- A. Patching material shall be a premixed, cementitious material with acrylic latex-modifier, formulated to match the color and texture of the existing stone. Material must be vapor permeable, frost and salt resistant, shall develop direct tensile bond strength of 200 psi minimum, shall exhibit less than 0.06% drying shrinkage, and shall have a linear coefficient of thermal expansion of 0.000005 to 0.000008 inches/inch per degree Fahrenheit. Material shall be compatible with substrate, including but not limited to, porosity, tensile, and compressive strength. Modulus of elasticity shall be 50,000 to 100,000 psi. Non-latex mortars shall be unacceptable. Material shall have a minimum 10-year successful performance history for similar projects.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. "Custom System 45 Type SD RL-1" by Edison Coatings, Inc., Plainville, CT (860) 747-2220 for usage at existing brownstone
 - b. If proposed substitute is submitted, thorough lab testing shall be required to establish equivalent performance levels. An independent testing laboratory shall be utilized as determined by the Architect and paid for by the submitting party.

2.4 REINFORCING MATERIALS

- A. Pins / Threaded rods: Type and size are specified herein and as indicated on the Contract Drawings, if not indicated, as per structural engineer's recommendation. Anchors and dowels shall be fabricated from ANSI Type 302/304 stainless steel.
- B. Mechanical anchors and dowels (for deep repairs and overhanging repairs): Stainless steel threaded rod (ASTM F-593) with a diameter as indicated on Contract Drawings, bent and cut to lengths required to achieve embedments shown on Contract Drawings. Cut end of rod square.

- C. Adhesive: Adhesive shall be a two-component epoxy gel, with minimum 4% elongation, 300 psi direct tensile bond strength, 10,000 psi tensile strength. Product shall be applicable to metals, masonry, concrete and other substrates as required, and shall be appropriate for use at ambient temperatures from zero degrees to 100 degrees Fahrenheit (-18 to 38 degrees Celsius).
1. Products: Subject to compliance with requirements, provide the following:
 - a. FLEXI-WELD 520T, as manufactured by Edison Coatings, Inc., Plainville, CT (860)747-2220.
 - b. If proposed equal is submitted, thorough lab testing shall be required to establish equivalent performance levels. An independent testing laboratory shall be utilized as determined by the Architect and paid for by the submitting party.
- D. Water Repellent/Consolidant: Water repellent/light consolidant shall be a breathable, two-component, proprietary self-crosslinking hybrid system. Product shall be colorless, low viscosity, two component penetrating treatment with minimum 96% moisture vapor transmission per Oklahoma DOT method, maximum 1% water absorption per Ontario MTC method, and which meets the freeze-thaw requirements of Ontario MTC (50 cycles) and the wind-driven rain resistance requirements of US Federal Specification TT-C-555B. Product shall be non-yellowing and UV resistant for a minimum 1500 hours per ASTM G53-84.
1. Products: Subject to compliance with requirements, provide the following:
 - a. SYSTEM 90-II, as manufactured by Edison Coatings, Inc., Plainville, CT (860) 747-2220.

PART 3 - EXECUTION

3.1 CLEANING EXISTING MASONRY AND STONE

A. General:

1. Proceed with cleaning in an orderly manner, work from top to bottom of each staging area and from one end of each elevation to the other.
2. Use only those cleaning methods indicated for each masonry material and location.
3. Perform each cleaning method indicated in a manner which results in uniform coverage of all surfaces, including corners, moldings, interstices and which produces an even effect without streaking or damage to masonry surfaces.
4. Rinse off chemical residue and soil working upwards from bottom to top of each treated area at each stage or scaffold setting.

3.2 MASONRY REPOINTING

A. Sealant Removal & Stone Repointing

1. Carefully remove existing sealants from stone joints using approved methods. Damage to edges of stone units must be avoided. Remove sealant to its full depth, and rake back existing masonry mortar beneath the sealants to provide a minimum of 3/4" depth for repointing, or until sound mortar is reached, whichever is greater.
2. Wet surfaces to ensure that stone is nearly saturated but surface dry when repointed. Completely fill bed, head and collar joints. Maintain joint width to match existing.
3. When mortar is thumbprint hard, tool exposed mortar joints to match joints of original stonework

3.3 LOCATE AND MARK AREA TO BE REPAIRED / RESTORED

- A. Work areas are approximately shown on drawing. Locate areas to be repaired/restored by sounding with a hammer to detect hollow and deteriorated areas.
- B. Mark locations using chalk or crayon.

3.4 WORKMANSHIP OF PATCHING MATERIAL

- A. Patching material workmanship shall comply with all applicable recommendations of material manufacturer's written specifications and requirements and/or as modified in this and following sections.
- B. Mixing of patching material: Mix the patching material in accordance with Manufacturer's printed instructions.
- C. Do not use any additives, such as bonding agents, accelerators, or retarders, in the patching material without prior written approval from the Manufacturer.

3.5 SURFACE PREPARATION: (for all patching work)

- A. Patching and repair work for spalled and deteriorated materials shall be accomplished with the approved Patching material, according to manufacturer's printed instructions and as specified herein.
- B. At areas to receive patches, remove all loose, spalled and deteriorating materials. If required cut away an additional 1/4 to 1/2 inch of the substrate that may be in the process of deteriorating and to ensure the surface to be patched is solid and stable. Saw cut edges of all repair areas to a minimum 1/4" depth. "Sound" remaining substrate with a hammer to verify its integrity.
- C. Remove any soil, mortar, dust and other debris or foreign material from areas to receive patch.
- D. Cut out sections shall be squared off at the edges. Do not overcut corners of the patch; stop short of corner and chip out remainder by hand without damaging surrounding masonry. Do not allow any feathered edges in the patch areas.
- E. Roughen the substrate surface as necessary to achieve the surface roughness required by manufacturer for good bond, but do not damage the substrate surface. Moisten substrate surfaces as per manufacturer's directions.
- F. For very dry or porous surfaces, pre-wet the substrate ahead of time to prevent the substrate from drawing moisture out of the patch too quickly. Re-wet the surface just before applying the patching material.

3.6 PATCHING REPAIR WORK

- A. Prepare and mix Patching material in accordance with manufacturer's directions.
- B. Patching material shall be applied by trowel, casting-in-place or other techniques recommended by approved materials manufacturer for each specific field condition.
- C. Air, surface and product temperature must all be above minimum temperature of 50 deg F (10 deg C) at time of application and must be maintained above minimum until product has dried thoroughly.
- D. Apply patching material in one layer or several layers, according to the depth of the repairs. Comply with manufacturer's instructions when applying multiple layers for thickness of each layer, setting-up time for each layer, surface preparation between layers, etc., to ensure sound adhesion between layers. Final application of repair mortar shall be at the desired surface level and shall be tooled, shaped or carved as required to achieve proper surface profile and texture.

Surfaces shall be tooled to replicate the texture, and detailing of the original surface. Do not sponge float the patch. Keep tools clean by frequent washing in clean water, but remove excess water to avoid introducing water into patch surfaces.

- E. Under hot conditions, as directed by Manufacturer, moisten repaired areas, cover and cure in accordance with manufacturer's directions. Keep patches moist and out of direct sun for at least the first day.
- F. To avoid rapid evaporation, do not patch in direct sunlight. If necessary, shade or cover work with tarpaulin or wet burlap.

3.7 PATCHING FOR DEEP OR OVERHANGING REPAIR

- A. At areas of large, deep and overhanging repairs the installation of mechanical keying or anchoring is required. The decision whether to anchor and how frequently to provide anchors shall be based on structural requirements, the conditions of the substrate, patch dimensions and weight, and the extent to which patch integrity will rely on self adhesion alone. Typical procedures are outlined in this section and shall be modified as required.
- B. Drill 1/4" to 1/2" diameter holes at various angles, spaced 4 to 6 inches apart in staggered rows. Clean holes using compressed, oil-free air.
- C. Insert stainless steel rods into drilled holes. Set depth and projection of rods so that at least 3/4" of patching material is placed over the rods, which are secured into the holes with the specified adhesive.
- D. Prepare and mix patching material in accordance with manufacturer's directions. Comply with all safety precautions, environmental limitations and work time limitations.
- E. Dampen patch area immediately prior to application of patching material and apply bond coat to create a good bond. Using a masonry brush, apply bondcoat to patch area, working into corners, edges and profile. Apply bond coat only to area of patch that can be covered with patch material mix before bond coat dries. Work bond coat into pieces of the substrate and under and around mechanical anchors. Do not apply excess bond coat; do not leave standing in puddles on the substrate. Do not allow bond coat material to run down onto surfaces which will not be repaired.
- F. Apply patching material to deep sections by building up in a series of multiple lifts. Comply with manufacturer's instructions for thickness of each layer, setting-up time for each layer, and surface preparation between layers to ensure sound restoration. Work patching material into all corners of patch area and under and around mechanical anchors; including the existing coated reinforcements.
- G. To re-create original ornamentation, apply an extra-thick patch. Then after the patch is partially cured the patching material shall be carved, using molding profiles and/or straight edges to restore original ornamentation. In all cases, finish patch so that it is as indistinguishable as possible from adjacent surfaces.
- H. Clean any patching material residue from area surrounding the patch by sponging as many times, as necessary with clean water. This should be done before patching material sets.
- I. Moisten, cover and cure repaired areas in accordance with manufacturer's directions.

3.8 CASTING NEW ELEMENTS OR SECTIONS

- A. In designated areas, new elements or sections shall be cast in place using specified patching compound with superplasticized admixture.
- B. Prepare surfaces and install anchors in accordance with Section 3.7, above.
- C. Construct molds made of wood, sheet metal, plastic, rubber molding compound or other suitable material, and fasten mold to repair area as required to secure mold during casting process.
- D. Interior face of mold shall be treated for clean release of patching compounds. This may be achieved by use of polyethylene lining, high-gloss polyurethane coating, or use of approved proprietary form release agent. No form oils, silicones or teflon release agents shall be used.
- E. Prepare mixture of superplasticized patching compound, using slow speed (250-450 rpm) paddle mixer. Mix consistency should be a viscous, plastic mortar. Do not add excessive liquid to produce an excessively thinned mixture.
- F. Pour, pump or pack the mixture into the mold, rodding, vibrating or tapping the mold with a rubber mallet while filling. Add material in shallow increments, vibrating or tapping to remove air bubbles and to allow the material to completely slump into the mold pattern after each addition. Once filling has begun, do not interrupt the process until the mold is completely filled.
- G. Allow mold to remain in place for 24 to 48 hours to assure complete through-set. Carefully strip forms to avoid damaging the "green" casting. Rub, sand or stone surfaces as required to match texture of adjacent surfaces.

3.9 REPAIRING CRACKS AND VOIDS

- A. Prepare cracked area in accordance to manufacturer's written instructions. Typical procedures are outlined in this section and shall be modified according to approved materials manufacturer.
- B. Crack repair for hairline and microscopic cracks:
 - 1. Inject cementitious crack repair material into designated cracks, using syringes, grouting pumps, or other types of injection apparatus suitable for size of crack, distance crack injection material must travel and viscosity of material used. Seal surfaces as required to prevent crack injection material from leaking out and to facilitate pumping. Take caution not to strain the face of adjacent surfaces.
 - 2. Immediately wipe spills off surfaces with clean, wet rag and allow injection material to cure as required.
- C. Crack repair for cracks larger than 1/16" and voids larger than 1/8" mm:
 - 1. Remove loose and spalling materials, cut into crack to a minimum depth of 3/8 inches and a width of 3/16 inch. If embedded reinforcements are rusted then cut material deep enough to expose the rusting reinforcements and remove material around reinforcement to provide a minimum of 3/4 inch clearance for patch material.
 - 2. Clean and coat exposed reinforcements at patch work with an approved rust-preventative agent.
 - 3. Fill enlarged areas of crack repair with patching material, following repair procedures outlined in this section under Part 3, "Patch for typical repair work" and/or Part 3, "Patching for deep or overhanging repair."

- D. Inject cementitious crack repair material into designated voids and cracks, using syringes, grouting pumps, or other types of injection apparatus suitable for size of crack, distance crack repair material must travel and viscosity of material used. Seal surfaces as required to prevent crack injection material from leaking out and to facilitate pumping. Take caution not to strain the face of adjacent surfaces. Immediately wipe spills off surfaces with clean rag and compatible solvent.
- E. Unacceptable patches are defined as those with hairline cracks or showing separation from repair edges, or on which "hollow spots" can be detected by light impact. Remove unsound patches and refill to provide patches free of those defects.
- F. Final Cleaning: No steam cleaning or additional pressure cleaning shall be performed within 28 days of patch installation. No acid or alkali cleaning agents shall be used except as recommended and/or approved by patch manufacturer.

END OF SECTION

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SECTION 05 12 00

STRUCTURAL STEEL

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A Preparation, repair and painting of steel lintels designated to remain. Coordinate brick masonry removals and reinstallation, and flashing work with the appropriate Sections.
- B Fabrication and installation of structural steel fittings

1.2 RELATED SECTIONS

- A Section 04 20 00 – Unit Masonry
- B Section 06 10 00 – Rough Carpentry

1.3 REFERENCES

- A Comply with the following standard material specifications:
 - 1. AISC - Code of Standard Practice - Manual of Steel Construction - Allowable Stress Design (ASD)
 - 2. ASTM A992 - Structural Steel
 - 3. ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
 - 4. ASTM A276, Type 304 – Stainless Steel Structural Shapes and Threaded Round Bar Stock.
 - 5. ASTM A240, Type 304 – Stainless Steel Plate Stock.
 - 6. ASTM A563 - Carbon and Alloy Steel Nuts
 - 7. AWS A2.4 - Symbols for Welding, Brazing, and Nondestructive Examination.
 - 8. AWS D1.1 - Structural Welding Code. Type of Contract:

1.4 SUBMITTALS

- A Submit the following items to the Architect for review:
 - 1. Shop Drawings of all fabrications showing field verified dimensions, locations, and connections to be made in the field.
 - 2. Product literature for standard manufactured products and/or mass-produced items to be used
 - 3. Mill test certificates for all tension rod materials and cast steel items indicating yield stress and ultimate failure stress of supplied materials.

1.5 QUALITY CONTROL

- A Comply with all referenced standards for the products employed.
- B Coordinate times of Architects and Engineer's Special On-Site Inspections.

PART 2 – PRODUCTS**2.1 STRUCTURAL STEEL MATERIALS AND FABRICATIONS**

- A Structural steel shall conform to “Specifications for Structural Steel Buildings” (AISC ASD 1989).
- B Structural steel shapes and plates shall conform with the following:
 - 1. Rolled shapes: ASTM A992, Grade 50
 - 2. Plates, rods and bars: ASTM A572, Grade 50
 - 3. Pipe: ASTM A53, Grade B
 - 4. Cast fittings: Available steel material to be submitted and approved by the Architect. Minimum properties shall meet or exceed those of ASTM A36.
 - 5. Structural tubing (HSS): ASTM A500, Grade B
 - 6. Bolts, nuts, and washers: ASTM A325 bolts, ASTM A563 nuts, Type 304 stainless steel for outdoor applications.
- C Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days.
- D Touch-up primer for galvanized surfaces: SSPC 20 Type I Inorganic or Type II inorganic
- E All structural steel fabrications exposed to weather shall be stainless steel to meet the requirements of ASTM A276, Type 304 or hot dip galvanized in accordance with ASTM A123.
- F All non-stainless, non-galvanized steel fabrications shall be painted with one coat of zinc rich primer equal or equivalent to TNEMC Series 10 shop primer.
- G All connections shall be fully welded with ¼” minimum fillet unless otherwise noted.
- H Cutting torch shall not be used in the field except with specific prior written permission.
- I Fabricate structural steel to proper field measurements before delivering to site.

2.2 RODS, ANCHORS AND ATTACHMENTS TO MASONRY AND CONCRETE CONSTRUCTION

- A Rods and anchors shall meet the requirements listed above for the appropriate interior or exterior application.
 - 1. Pinning Rods shall be threaded over their entire lengths unless otherwise noted.
 - 2. Field-drilled and set anchor bolts for steel installation to concrete construction shall be:
 - 3. Threaded rod set with Hilti HY200 Adhesive to concrete unless otherwise noted.
 - 4. Field-drilled and set anchor bolts for steel installation to masonry construction shall be: galvanized threaded rod set with Hilti HY270 Adhesive and Screen Tubes.
 - 5. Pre-set anchor bolts for attachment to Masonry and Concrete shall be ASTM A307, threaded for their entire lengths.

2.3 WELDING ELECTRODES

- A Welding electrodes for new non-stainless steel shall be AWS E70-XX.
- B Welding electrodes for retrofit welding of existing steel members shall be AWS E60-XX, Low Hydrogen, specifically suited and field verified for compatibility with existing steel.

- C Welding electrodes for stainless steel shall be AWS “Stainless 304” compatible electrode.

2.4 PAINTING OF EXISTING STEEL

- A At existing steel lintels designated to remain paint existing exposed surfaces of steel with RD Coatings RD-Elastometal Primer and coat with RD-Mur Acryl Satin Top Coat, or approved equal. Color to be selected by Owner.
 - 1. 2 coats of primer and one coat of top coat.
- B Paint for existing metal to be approved rust inhibitive primer and top coat such as TNEMEC 10 with color to be selected by Owner.

2.5 FLASHING AND ACCESSORY MATERIALS

- A Lead coated copper drip edge flashing.
- B Self adhesive rubberized asphalt membrane such as Grace Perm A-Barrier or approved equal.

PART 3 – EXECUTION

3.1 INSTALLATION AND ERECTION OF STRUCTURAL STEEL

- A Allow for erection loads, and for sufficient temporary bracing to maintain steel framing in a safe, plumb, and in true alignment until completion of erection and installation of permanent bracing connections.
- B Field-weld structural components only with written approval of Architect or where specifically indicated on the drawings.
- C Field-connect members with threaded fasteners; torque to required resistance per AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts.
- D Do not field-cut or alter structural members without approval of the Architect.
- E After erection, prime welds, abrasions, and surfaces not galvanized, except surfaces to be in contact with concrete.
- F Provide and install Non-Shrink Grout under and behind steel bearing surfaces against masonry and concrete in accordance with the Contract Drawings and where required for uniform, full bearing against rough or canted masonry and concrete surfaces. Trowel grouted surface smooth, splay neatly to 45 degrees.
- G Structural Steel installation shall be done in consideration of median ambient temperatures and their effects on the alignment of the Steel Frame. Final tightening and adjustment of anchors to the existing structure shall not be done under extreme temperature conditions but shall be limited to when the temperature of the steel is between 40 degrees F and 70 degrees F.
- H Install all mechanically-set and adhesive-set drilled anchors in accordance with the respective product manufacturer’s instructions.
- I Coordinate work with the general contractor who shall be responsible for shoring of existing elements that may be supported by or temporarily in the way of the structural steel.

- J Coordinate removal finishes and wood construction as necessary for installation of structural steel, submitting a list of all necessary removals to the Architect/Engineer for review before proceeding with the work.

3.2 CLEANING, INSPECTION AND REPAIR OF EXISTING STRUCTURAL STEEL

- A Coordinate exposure of existing structural steel members and schedule an inspection with the Architect./Engineer
- B Cleaning: Cleaning shall be done in accordance with SSPC-SP-3 , “Power Tool Cleaning”: For Corroded Surfaces” For corroded surfaces steel shall be cleaned using SSPC-SP-3 to the extent that any mill scale, rust or paint remaining is adherent to steel.
- C Architect/Engineer shall determine the nature and extent of repair work which may involve cover plating or replacement and shall issue sketches showing the extent of the work. Refer to Contract Drawings for additional information of repair work at various locations where structural steel repairs are anticipated.
 - 1. All welding to existing members shall be done incrementally to avoid heating and yielding loaded members.
 - 2. Remove all rust from weld locations and adjust welding voltage as needed where sections have thinned.
 - 3. Follow the procedure described in AISC Engineering Journal “Field Welding to Existing Steel Structures”, attached, including testing, and review in field with Architect/Engineer before starting work.
 - 4. Maintain proper support and bracing to all members during work.
- D Following work, clean and repaint members:
 - 1. Remove all rust, dirt and scale from existing steel with scrapers and wire brushes until bare metal is completely exposed.
 - 2. Paint steel surface with two coats of an approved rust inhibitive primer and top coat. Apply first coat to cleaned, dust-free steel within 30 minutes of exposure to the atmosphere. Follow manufacturer’s instructions for application.
 - 3. Surfaces shall be kept dry and of at least 50 degrees F temperature during painting and 24 hour curing period.

3.3 FLASHING INSTALLATION AT LINTELS

- A Following the completion of structural steel repairs and repainting.
- B Install new lintel flashings at all locations.
 - 1. Install lead coated copper drip edge along the bottom shelf of the lintel.
 - 2. Provide self-adhesive membrane flashing to extend from edge of horizontal surface of the lead coated copper flashing, along the vertical leg of the lintel and extend a minimum of one brick masonry course or 2” beyond the top of the lintel. Secure with a termination bar at 8” o.c. or reglet into the back up masonry. Architect/Engineer to review condition and provide recommendation for the specific configuration.
 - 3. At the limits of the openings, provide 2” vertical end dams.
 - 4. Reset existing brick masonry soldier course, providing weeps at 24” o.c. or a minimum of 2 weeps per opening. Add mortar wash at top of the soldier course to shed water.
 - 5. Coordinate with Section 04 20 00 and Section 07 62 00 for flashing and masonry work.

3.4 FIELD QUALITY CONTROL

A Satisfy all applicable requirements of the Connecticut State Building Code.

END OF SECTION

SECTION 05 52 00

METAL RAILINGS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Steel pipe and tube handrails.

1.2 RELATED SECTIONS

- A. Section 06 20 00 – Finish Carpentry: wood handrails and railings.
- B. Section 09 91 00 – Painting: Paint finish.

1.3 REFERENCES

- A. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- B. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- D. ASTM E935 - Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
- E. ASTM E985 - Permanent Metal Railing Systems and Rails for Buildings.
- F. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.

1.4 DESIGN REQUIREMENTS

- A. Railing assembly, wall rails, and attachments to resist lateral force of 300 lbs at any point without damage or permanent set. Test in accordance with ASTM A935.
- B. Fabricate railing assembly, wall rails, and attachments to ASTM E985.

1.5 SUBMITTALS FOR REVIEW

- A. Section 01 33 00 - Submittals: Procedures for submittals.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
- C. Samples: Submit two inch long samples of handrail. Submit two samples, of handrail, channel, wall bracket, escutcheon and end stop.

PART 2 – PRODUCTS

2.1 STEEL RAILING SYSTEM

- A. Steel Tubing: ASTM A500, Grade B.
- B. Rails and Posts: 1½ inch diameter and square steel tubing and pipe; welded joints.
- C. Fittings: Elbows, T-shapes, wall brackets, escutcheons; cast or machined steel.
- D. Mounting: brackets and flanges, with steel brackets for embedding in masonry.
- E. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

- F. Splice Connectors: Steel concealed spigots.
- G. Galvanizing: To ASTM A123, provide minimum 1.25 oz/sq ft galvanized coating.
 - 1. Touch-Up Primer for Galvanized Surfaces: SSPC 20 Type II Organic zinc rich.
- H. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.

2.2 FABRICATION

- A. Fit and shop assemble components in largest practical sizes for delivery to site.
- B. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
- C. Provide anchors, plates and angles required for connecting railings to structure.
- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- F. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
- G. Interior Components: Continuously seal joined pieces by continuous welds.
- H. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- I. Accurately form components to suit stairs and landings, to each other and to building structure.
- J. Accommodate for expansion and contraction of members and building movement without damage to connections or members.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be embedded in masonry with setting templates, to appropriate sections.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects.
- C. Anchor railings to structure with anchors and plates.
- D. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds smooth.
- E. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- F. Assemble with spigots and sleeves to accommodate tight joints and secure installation.

3.4 ERECTION TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per storey, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

3.5 SCHEDULE

- A. Refer to details on drawings.
- B. Color to be determined by Architect.

END OF SECTION

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SECTION 06 10 00

ROUGH CARPENTRY

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A Repair and replacement of deteriorated wood framing members and sheathing.

1.2 RELATED SECTIONS

- A Section 02 44 00 – Temporary Shoring and Protection
- B Section 06 20 00 – Finish Carpentry

1.3 REFERENCES

- A Comply with the following standard material specifications
 - 1. AITC (American Institute of Timber Construction) – Glued Laminated Lumber Manufacturing Standards.
 - 2. ALSC (American Lumber Standards Committee) - Softwood Lumber Standards.
 - 3. ASTM (American Society of Testing and Materials) D245 - Standard Practice for Establishing Structural Grades and Related Allowable Properties for Visually Graded Lumber.
 - 4. AWWA (American Wood Preservers Association) C1 - All Timber Products - Preservative Treatment by Pressure Process.
 - 5. NELMA (Northeast Lumber Manufacturer's Association) - Grading Rules.
 - 6. NFPA (National Forest Products Association).
 - 7. NLGA (National Lumber Grades Authority).
 - 8. NSLB (Northern Softwood Lumber Bureau) - Grading Rules.
 - 9. SPIB (Southern Pine Inspection Bureau).
 - 10. WCLIB (West Coast Lumber Inspection Bureau).
 - 11. WWPA (Western Wood Products Association).
 - 12. Timber Framer's Guild of North America - Recommended Standard Practice.

1.4 SUBMITTALS

- A Submit the following items to the Engineer for review:
 - 1. Product Data sheets for standard hangers and supports.
 - 2. Grading certification for remanufactured and new timber products.

1.5 QUALITY CONTROL

- A Comply with all referenced standards for the products employed.
- B Contractor that performs carpentry work shall be a Timber Framer regularly engaged in repair and replacement of historic timber frame carpentry. Contractor shall demonstrate to the Owner's satisfaction that, within five (5) years, he or she has successfully performed and

completed in a timely manner at the least three (3) projects similar in scope and type to this project.

PART 2 – PRODUCTS

2.1 DIMENSIONAL LUMBER

- A Lumber Grading Rules: NELMA, NFPA, RIS, SPIB, WCLIB or WWP.
- B Rafter Framing: SPF Species, 1 or 2 grade, size as per drawings, 19 percent maximum moisture content.
- C Non-structural Light Framing: SPF Species, 2 grade, size as per drawings, 19 percent maximum moisture content.
- D Studding and Blocking: SPF Species, stud grade, size as per drawings, 19 percent maximum moisture content.
- E Pressure Treated Lumber (P/T) shall be Southern Yellow Pine #1 or #2, pressure preservative treated with a minimum retention of 0.25 pcf of ACQ. Moisture content in post-treated, to-be-installed condition shall not exceed 19%.

2.2 MANUFACTURED WOOD PRODUCTS (ONLY WHERE SPECIFIED)

- A Provide the following manufactured wood products or approved equivalents:
 - 1. Laminated Veneer Lumber (LVL): "Microllam" as manufactured by Trus-Joist Macmillan, or approved Equal. Fb=2600 psi, E=1,900,000 psi, Fct=750 psi, Fcii=2310 psi, Fv=285 psi.
 - 2. Parallel Strand Lumber (PSL) shall be "Parallam" as manufactured by Trus-Joist Macmillan, or approved Equal - Fb=2900 psi, E=2,000,000 psi, Fc⊥=650 psi, FcII=2900 psi, Fv=290 psi.

2.3 MISCELLANEOUS FASTENERS, CONNECTORS AND WOOD PRESERVATIVE

- A Provide standard attachment hardware consisting of nails, bolts, screws and standard fittings as noted on the drawings and as required. Hardware for rough carpentry shall be as follows:
 - 1. Bolts and Nuts: AISI / ASME Standard B18.2.1
 - 2. Lag Screws: AISI / ASME Standard B18.6.1
 - 3. Steel Washer Plates: Same as above or ASTM A36 for custom sizes.
 - 4. Spikes: Galvanized, hardened steel conforming to Federal Specification FF-N-105B.
 - 5. Standard Connectors (where specified or allowed): Items as manufactured by the Simpson Strong-Tie Company of San Leandro, CA, or approved equal.
- B Provide standard framing hangers and accessories that are equal or equivalent to the Simpson products that are referenced on the drawings.
- C Wood Preservative shall be Boracare manufactured by the Nisus Corporation of Rockford, TN or equivalent boric acid solution.

PART 3 – EXECUTION

3.1 REMOVAL AND ARCHIVING OF DESIGNATED AND REJECTED TIMBERS

- A Carefully remove timbers designated or required to be replaced so as not to damage the surrounding construction not scheduled for removal. Provide sufficient shoring and bracing to the structure to preclude the possibility of settlement or collapse of the structure above.
- B Following removal of noted timbers, clean all contiguous timbers for inspection by the Engineer and Exterminator.

3.2 APPLICATION OF WOOD PRESERVATIVE

- A Application of Boric Acid
 - 1. This section applies to all new lumber and board sheathing that has not been pressure treated.
 - 2. Dilute concentrate with warm water at a 1:1 ratio. Application is recommended through use of a dedicated insecticide sprayer and solution must be well mixed to avoid inconsistent coverage and hose clogs.
 - 3. Solution shall be applied within 24 hours after mixing, preferably immediately
 - 4. Follow all manufacturer specifications.

3.3 INSTALLATION OF TIMBER FRAMING AND DUTCHMEN

- A Set structural members in correct positions.
- B Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C Place horizontal members, crown side up.
- D Field drill all holes and recesses for bolts, lag screws and shear plates. Inject all bolt and lead holes with wood preservative before installing hardware.
- E Holes for through bolts and lag screw shanks shall be 1/32" greater in diameter than bolts and shanks.
- F Drill lead holes for the threaded portions of lag screws to avoid splitting wood. Lead holes shall be properly sized for the threaded diameters and species type in accordance with the NFPA National Design Specification.
- G Provide tapered oak shims of at least 1/8" thickness as required for adjustment and to provide solid, firm contact between bearing surfaces where proper fit is not otherwise provided with existing members. Maximum allowable tolerance to be accommodated by shims shall be 3/8" or less.
- H Make all cut lines plumb and true, to within 1/8" of required dimension. Do not leave any splintered wood or checked end grain exposed to weather or soil.

3.4 INSTALLATION OF BOARD SHEATHING

- A Install sheathing boards with minimum of two continuous spans per board between supports, except as otherwise detailed or required by existing conditions being replicated.
- B Fasten board sheathing per the requirements of the Connecticut State Building Code, but not less than three 12d nails per board at all board ends on support crossings.

3.5 CONVENTIONAL (DIMENSIONAL LUMBER) FRAMING REQUIREMENTS

- A Provide standard galvanized metal connectors as noted on drawings.
- B Provide all framing in accordance with proper and standard practice, and all governing codes. Contractor shall be prepared to correct any unsuitable conditions per the direction of the Engineer.
- C Inspect all existing framing and report all unsound conditions to the Engineer before performing other work that would obscure inspection or repair/replacement of damaged items.
- D Wood construction is to conform to part II "design specifications" as published in the "Timber Construction Manual" (AITC) and to "National Design Specification for Wood Construction", latest editions.
- E New lumber for structural use is to be surface dried and have a moisture content of not more than 19 percent.
- F Structural lumber is to be identified by the grade mark of, or certificate of inspection issued by, a grading or inspection bureau or agency recognized as being competent.
- G Structural lumber is to be visually stress-graded lumber in accordance with the provisions of ASTM designation D245-74, "methods for establishing structural grades and related allowable properties for visually graded lumber."
- H Wood is to be handled and covered to prevent damage and moisture absorption from snow or rain.
- I Plywood Roof Sheathing:
 - 1. Plywood sheathing for roof construction shall be 5/8" thick minimum installed with grain of outer plies at right angles to joists and be staggered so that end joists in adjacent panels occur over different joists. Provide at least 1/16" joint space at panel edges.
 - 2. Plywood shall be nailed with 10d common or 8d threaded nails. Nails are to be 6 inches o.c. at all edges and 12" o.c. at interior lines of support.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Finish carpentry items, other than shop prefabricated casework.
- B. Hand attachment accessories.
- C. Refer to schedule at end of this Section.

1.02 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Section 05 52 00 – Metal Railings: metal handrails.

1.03 RELATED SECTIONS

- A. Section 09 91 00 - Painting: Painting and finishing of finish carpentry items.

1.04 REFERENCES

- A. AWI - Quality Standards.
- B. PS 20 - American Softwood Lumber Standard.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire retardant requirements.
- B. Conform to Certification of Compliance with HUD Severe Use Standards.

1.06 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00.
- B. Submit shop drawings indicating materials, component profiles, fastening methods, jointing details, finishes, accessories, to a minimum scale of 1-1/2 inch to one foot.
- B. Submit product data under provisions of Section 01 33 00.
- D. Submit samples under provisions of Section 01 33 00.
- C. Submit one sample 24 x 24 inch in size illustrating wood grain and specified finish.
- F. Submit two samples 12-inch-long of wood trim.
- G. Mock-ups: Build mock-ups to set quality standards for fabrication and installation.
 - 1. Contractor shall provide mock-up of the porch including the following elements for Architect's review & approval. Mock-up may be kept in place if approved.
 - a. Decking
 - b. Railing System
 - c. Posts
 - d. Lattice
 - e. All Miscellaneous trim including but not limited to skirts, trim and facias.
 - f. Coordinate with Concrete Support Piers as per specification 03 30 00.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00.
- B. Store and protect products under provisions of Section 01 60 00.
- C. Store materials in ventilated, interior locations under constant minimum temperatures of 60 degrees F (16 degrees C) and maximum relative humidity of 55 percent.

PART 2 PRODUCTS

2.01 FABRICATORS

- A. Brockway-Smith Company.
- B. Custom Millwork Shop.
- C. Substitutions: Under provisions of Section 01 60 00.

2.02 LUMBER MATERIALS

- A. Softwood Lumber: PS 20; Premium grade in accordance with AWI; maximum moisture content of 6 percent. Pine species, with plain sawn grain, of quality capable of transparent finish.
- B. Hardwood Lumber: FS MM-L-736; Premium grade in accordance with AWI; maximum moisture content of 6 percent. Birch or oak species, with plain sawn grain, of quality capable of transparent finish.
- C. MDO Plywood: Grade C-D: Graded in accordance with AWI Custom: veneer core; paper face; exterior glue.

2.03 ACCESSORIES

- A. Nails: Size and type to suit application, plain and coated finish.
- B. Bolts, Nuts, Washers, Blind Fasteners, Lags, and Screws: Size and type to suit application; plain and galvanized finish.
- D. Lumber for Shimming, Blocking, Softwood lumber of Southern yellow pine species.
- D. Primer: Alkyd primer sealer type.
- E. Wood Filler: Oil base, tinted to match surface finish color.

2.04 FABRICATION

- A. Fabricate to AWI Premium standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and openings are ready to receive work and field measurements are as shown on the drawings.
- B. Verify mechanical, electrical, and building items affecting work of this Section are placed

and ready to receive this work.

- C. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

- A. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.
- B. Before installation, back prime paint all unexposed surfaces.

3.03 INSTALLATION

- A. Install work in accordance with AWI Premium quality standard.
- B. Set and secure materials and components in place, plumb and level.
- C. Install components and trim with nails and screws at 8 inch on center.
- D. Install hardware in accordance with manufacturer's instructions.

3.04 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch (1.5 mm).
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.7 mm).

3.05 SITE TREATMENT OF WOOD MATERIALS

- A. Brush apply one coat of primer on hidden surfaces of exterior located finish carpentry items.
- B. Apply preservative treatment in accordance with manufacturer's instructions.
- C. Treat site-sawn ends. Allow preservative to cure prior to erecting materials.
- D. Verify that materials requiring paint finish do not exceed 6 percent moisture content before applying treatment.

3.06 PREPARATION FOR SITE FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
- B. Site Finishing: Refer to Section 09 91 00.

3.07 PROTECTION

- A. Protect finished installation under provisions of Section 01500.

3.08 SCHEDULE

- A. Stair and Ramp Railings and lattice.

END OF SECTION

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SECTION 06 82 00

COMPOSITE TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Exterior synthetic (poly-ash) trim.

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 – Rough Carpentry
- B. Section 09 91 00 – Painting: Painting exterior synthetic trim

1.3 REFERENCE STANDARDS

- A. ASTM C 1185 – Standard Test Methods for Sampling and Testing Non-Asbestos Fiber-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards.
- B. ASTM D 570 – Standard Test Method for Water Absorption of Plastics.
- C. ASTM D 1761 – Standard Test Methods for Mechanical Fasteners in Wood.
- D. ASTM D 6341 – Standard Test Method for Determination of the Linear Coefficient of Thermal Expansion of Plastic Lumber and Plastic Lumber Shapes Between -30 and 140°F (-34.4 and 60°C).
- E. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- F. AWP A E1 – Standard Method for Laboratory Evaluation to Determine Resistance to Subterranean Termites.
- G. AWP A E10 – Standard Method of Testing Wood Preservatives by Laboratory Soil-Block Cultures.

1.4 SUBMITTALS

- A. Comply with Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's product data, including installation instructions.
- C. Samples: Submit manufacturer's sample of exterior synthetic trim, minimum 1 inch by 4 inches by 8 inches long.
- D. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.
- E. Warranty Documentation: Submit manufacturer's standard warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling Requirements:
 - 1. Store and handle materials in accordance with manufacturer's instructions.
 - 2. Keep materials in protective covering until installation.
 - 3. Store materials in clean, dry area.
 - 4. Store exterior synthetic trim on flat, level surface.
 - 5. Keep exterior synthetic trim covered and free of dirt and debris.
 - 6. Protect materials and finish during storage, handling, and installation to prevent damage.

1.6 WARRANTY

- A. Warranty Period for Exterior Synthetic Trim: 20-year limited warranty.
 - 1. No decay due to rot.
 - 2. No excess swelling from moisture.
 - 3. Resist termite damage.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Boral Composites Inc., 200 Mansell Court East, Suite 305, Roswell, Georgia 30076. TollFree 888-926-7259. www.BoralTruExterior.com. info@TruExterior.com.

2.2 EXTERIOR SYNTHETIC TRIM

- A. Exterior Synthetic (Poly-ash) Trim: Boral TruExterior[®] Trim.
- B. Composition:
 - 1. Post-Industrial Recycled Content: Minimum 70 percent, by weight.
 - 2. Post-Consumer Recycled Content: Minimum 2 percent, by weight
 - 3. Pigments and dyes.
- C. Physical Properties:
 - 1. Density, ASTM C 1185: 40 to 50 pcf.
 - 2. Water Absorption, ASTM D 570: Less than 1.5 percent.
 - 3. Fungi Rot, AWWA E10:
 - a. White Rot: Negligible loss.
 - b. Brown Rot: Negligible loss.
 - 4. Termite Resistance, AWWA E1: Greater than 9.0, with 10 being impervious.
- D. Mechanical Properties:
 - 1. Flexural Strength, ASTM C 1185: Greater than 1,600 psi.
 - 2. Nail Withdrawal, ASTM D 1761: Greater than 40 lbf/in.
- E. Thermal Properties:
 - 1. Coefficient of Linear Expansion, ASTM D 6341, Typical: 1.40E-05

- in/in/degree F, tested at minus 30 to 140 degrees F.
- 2. Flame Spread, ASTM E 84: Between 25 and 29
- 3. Smoke Developed, ASTM E 84: Less than 450.

F. Trim Sizes:

1.

Nominal Size	Actual Size
1 by 4	3/4" by 3-1/2"
1 by 6	3/4" by 5-1/2"
1 by 8	3/4" by 7-1/4"
1 by 10	3/4" by 9-1/4"
1 by 12	3/4" by 11-1/4"
5/4 by 4	1" by 3-1/2"
5/4 by 6	1" by 5-1/2"
5/4 by 8	1" by 7-1/4"
5/4 by 10	1" by 9-1/4"
5/4 by 12	1" by 11-1/4"
5/8 by 6 Beadboard	5/8" by 5 1/4"

- 2. Manufacturing Tolerances:
 - a. Width: Plus or minus 1/16 inch.
 - b. Thickness: Plus or minus 1/16 inch.
 - c. Length: Plus 2 inches, minus 0 inch.
 - d. Edge Cut: Plus or minus 2 degrees.
- 3. Exposed Texture: Smooth.

2.3 FINISHES

A. Primer:

- 1. Acrylic based.
- 2. Low VOC.
- 3. Factory applied on all sides.

2.4 FASTENERS

A. Type: Nails.

- 1. Size: As indicated on the Drawings.
- 2. Finish: Galvanized

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive exterior synthetic trim.
- B. Notify Architect of conditions that would adversely affect installation or subsequent use.
- C. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

- A. Install exterior synthetic trim in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Do not install exterior synthetic trim in structural or load-bearing applications.
- C. Install exterior synthetic trim plumb, level, and square.
- D. Install exterior synthetic trim with flush, tight joints.
- E. Install Fasteners:
 - 1. Maximum of 24 inches on center.
 - 2. Within 2 inches of end of boards.
- F. Fill nail and screw holes with acrylic caulk, wood filler, or auto body filler.
- G. Repair minor damages to exterior synthetic trim in accordance with manufacturer's instructions and as approved by Architect.
- H. Remove and replace damaged exterior synthetic trim that cannot be successfully repaired as determined by Architect.
- I. Painting:
 - 1. Apply top coat to exterior synthetic trim over factory-applied primer.
 - a. Within 150 days of installing trim.
 - b. As specified in Section 09 91 00.

3.3 PROTECTION

- A. Protect installed exterior synthetic trim to ensure that, except for normal weathering, trim will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 07 26 00

UNDER-SLAB VAPOR BARRIER

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Vapor barrier and installation accessories for installation under concrete slabs.

1.2 RELATED WORK

- A. Section 03 30 00 Cast-in-Place Concrete

1.3 REFERENCES

- A. International
 1. ASTM E1745-17: Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
 2. ASTM E1643-18a: Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- B. Technical Reference – American Concrete Institute (ACI):
 1. ACI 302.2R-06: Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
 2. ACI 302.1R-15: Guide to Concrete Floor and Slab Construction.

1.4 SUBMITTALS

- A. Submit manufacturer's installation instructions under provisions of Section 01 33 00 and the following Quality control/assurance:
 1. Summary of test results per paragraph 9.3 of ASTM E1745.
 2. Manufacturer's samples and literature.
 3. Manufacturer's installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
 4. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.
 5. Contact vapor barrier manufacturer to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.
 6. Vapor barrier manufacturer must warrant in writing (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for, at least, the Life of the Building.
 7. Manufacturer verify in writing 20 years in the industry with no reported product failures.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Vapor barrier shall have all the following qualities:
 1. Maintain permeance of less than 0.01 Perms [grains/(ft² · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
 2. Other performance criteria:
 - a. Strength: ASTM E1745 Class A.
 - b. Thickness: 15 mils minimum

3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1
 4. Warranty: (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for, at least, the Life of the Building.
- A. Vapor barrier products:
1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com
 2. Approved Alternate: Vaporguard by Reef Industries, 713-507-4250 www.reefindustries.com
 3. Approved Alternate: VaporFlex 15mil by Layfield, 800-277-8298 www.layfieldgroup.com

2.2 ACCESSORIES

- A. Seams:
1. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
- B. Sealing Penetrations of Vapor barrier:
1. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 2. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
- C. Perimeter/terminated edge seal:
1. Stego Crete Claw (textured tape) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 2. Stego Term Bar by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 3. StegoTack Tape (double-sided sealant tape) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 4. One-sided seaming tape is not a recommended method of sealing at the terminated edge.
- D. Penetration Prevention:
1. Beast Foot by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 2. Beast Form Stake by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com
- E. Vapor Barrier-Safe Hand Screed System
1. Beast Screed by Stego Industries, LLC, (877) 464-7834 www.stegoindustries.com.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Ensure that subsoil is approved by Architect, Structural Engineer, or Geotechnical Engineer.
1. Level and compact base material.
- B. Contact vapor barrier manufacturer to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.

3.2 INSTALLATION

- A. Install vapor barrier in accordance ASTM E1643.
1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.

2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, water stops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
 - a. Seal vapor barrier to the entire slab perimeter using manufacturer's textured tape with a surface that creates a mechanical seal to freshly-placed concrete, per manufacturer's instructions.
3. Overlap joints 6 inches and seal with manufacturer's seam tape.
4. Apply seam tape/textured tape/double-sided tape to a clean and dry vapor barrier.
5. Seal all penetrations (including pipes) per manufacturer's instructions.
6. Avoid the use of stakes driven through vapor barrier by utilizing vapor barrier-safe, peel-and-stick screed and forming penetration prevention systems. Ensure peel-and-stick adhesive base is fully adhered to the vapor barrier.
7. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.

END OF SECTION

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SECTION 07 92 00

JOINT SEALERS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Preparing sealant substrate surfaces.
- B. Sealant and backing
- C. Acoustical Sealant

1.2 RELATED SECTIONS

- A. Section 03 30 00 - Concrete: Sealants used in conjunction with concrete.
- B. Section 04 22 00 – Concrete Wall Unit Masonry: Sealants used in conjunction with concrete block masonry.
- C. Section 04 21 13.13 - Veneer Masonry System: Sealants used in conjunction with brick masonry.

1.3 REFERENCES

- A. ANSI/ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- B. ANSI/ASTM D1565 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).
- C. ASTM C790 - Use of Latex Sealing Compounds.
- D. ASTM C804 - Use of Solvent-Release Type Sealants.
- E. ASTM C834 - Latex Sealing Compounds.
- F. FS TT-C-00598 - Calking Compound, Oil and Resin Base Type.
- G. FS TT-S-001657 - Sealing Compound, Single Component, Butyl Rubber Based, solvent Release Type.
- H. FS TT-S-00227 - Sealing Compound: Elastomeric Type, Multi-Component.
- I. FS TT-S-00230 - Sealing Compound: Elastomeric Type, Single Component.
- J. FS TT-S-001543 - Sealing Compound, Silicone Rubber Base.
- K. SWI (Sealing and Waterproofers Institute) - Sealant and Caulking Guide Specification.

1.4 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Submit product data indicating sealant chemical characteristics, performance criteria, limitations and color availability.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples 1/4 x 4 inches in size illustrating colors selected.
- E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- F. Submit manufacturer's certificate under provisions of Section 01 40 00 that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.

- B. Applicator: Company specializing in applying the work of this Section with minimum three years documented experience, approved by sealant manufacturer.
- C. Conform to Sealant and Waterproofers Institute requirements for materials and installation.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install solvent curing sealants in enclosed building spaces.
- B. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate work under provisions of Section 01 31 00.
- B. Coordinate the work of this Section with all Sections referencing this Section.

1.8 WARRANTY

- A. Provide five-year warranty under provisions of Section 01 77 00.
- B. Warranty: Include coverage of installed sealants and accessories which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 – PRODUCTS

2.1 SEALANTS

- A. Acrylic Emulsion Latex: ASTM C834-76, single component; as selected; AC-20 manufactured by Pecora.
- B. Butyl Sealant: FS TT-S-001657, black color; BC-158 manufactured by Pecora.
- C. Polysulphide Sealant: FS TT-S-230C, Type II - non-sag, Class A; as selected; Synthacalk GC-9 manufactured by Pecora.
- D. Polyurethane Sealant: FS TT-S-230C, Type I - self-levelling, Class A; as selected; manufactured by Pecora.
- E. Silicone Sealant: FS TT-S-01543B, Class A, low modulus type; as selected; #864 manufactured by Pecora.
- F. Acoustical, Fire-rated Sealant: USG Sheetrock Brand Acoustical Sealant by USG
- G. Air Sealant, non-skinning butyl: Butyl BA-98 by Pecora.

2.2 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: ANSI/ASTM D1056 and D1565; Denverfoam or Greenrod oversized 30 to 50 percent larger than joint width; as recommended by Pecora.

- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work and field measurements are as shown on Drawings and recommended by the manufacturer.
- B. Beginning of installation means installer accepts existing surfaces.

3.2 PREPARATION

- A. Clean and prime joints in accordance with manufacturer's instructions.
- B. Remove loose materials and foreign matter, which might impair adhesion of sealant.
- C. Verify that joint backing and release tapes are compatible with sealant.
- D. Perform preparation in accordance with ASTM C804 for solvent release and C790 for latex base sealants.
- E. Protect elements surrounding the work of this Section from damage or disfiguration.

3.3 INSTALLATION

- A. Install sealant in accordance with manufacturer's instructions.
- B. Measure joint dimensions and size materials to achieve required width/depth ratios.
- C. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.
- D. Install bond breaker where joint backing is not used.
- E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- G. Tool joints channel shaped.

3.4 CLEANING AND REPAIRING

- A. Clean work under provisions of Section 01 77 00.
- B. Clean adjacent soiled surfaces.
- C. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.5 PROTECTION OF FINISHED WORK

- A. Protect finished installation under provisions of Section 01 50 00.
- B. Protect sealants until cured.

3.6 SCHEDULE

<u>Location</u>		<u>Type</u>	<u>Color</u>
A.	Concrete Sidewalks	D.	Limestone
B.	Brick	E.	Color to match new mortar
C.	Concrete Block	E.	Gray
D.	Dampproofing	C.	Black
E.	Vapor & air barriers	A.	White or clear
F.	Roofing	B.	Black
G.	Flashing & sheet metal	B.	Clear

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Glass for Windows.

1.02 RELATED WORK

- A. Section 06 20 00 – Finish Carpentry

1.03 REFERENCES

- A. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.
- B. ASTM C669 - Glazing Compounds for Back Bedding and Face Glazing of Metal Sash.
- C. ASTM C804 Use of Solvent Release Type Sealants.
- D. ASTM C864 - Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- E. ASTM C920 -Elastomeric Joint Sealants.
- F. ASTM C1036 - Flat Glass.
- G. ASTM C1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
- H. ASTM C1172 - Laminated Architectural Safety Glass.
- I. ASTM E84- Surface Burning Characteristics of Building Materials.
- J. ASTM E283 - Test Method For Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.
- K. ASTM E330 Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- L. ASTM E546 - Test Method For Frost Point of Sealed Insulating Glass Units.
- M. ASTM E576 - Test Method For Dew/Frost Point of Sealed Insulating Glass Units in Vertical Position.
- N. ASTM E773 - Test Method for Seal Durability of Sealed Insulating Glass Units.
- O. ASTM E774 - Sealed Insulating Glass Units.
- P. FGMA Glazing Manual.
- Q. FGMA Sealant Manual.
- R. Laminators Safety Glass Association - Standards Manual.
- S. SIGMA - Sealed Insulated Glass Manufacturers Association.
- T. CPSC 16 CFR Part 1201 for Category II materials.

1.04 PERFORMANCE REQUIREMENTS

- A. Provide glass and glazing materials for continuity of building enclosure, vapor retarder, and air barrier:
 - 1. In conjunction with materials described in Section 07 92 00.
 - 2. To utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapor retarder seal.
 - 3. To maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.
- B. Size glass to withstand dead loads and positive and negative live loads acting normal to plane of glass as measured in accordance with ASTM E330 & ASTM E283.
- C. Limit glass deflection to 1/200 or flexure limit of glass with full recovery of glazing

materials, whichever is less.

1.05 QUALITY ASSURANCE

- A. Conform to Flat Glass Marketing Association (FGMA) Glazing Manual for glazing installation methods.

1.06 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver products to site under provisions of Section 01 60 00.
- B. Store and protect products under provisions of Section 01 60 00.

PART 2 PRODUCTS**2.01 ACCEPTABLE GLASS MANUFACTURERS**

- A. Pittsburg Plate Glass.
- B. Saint-Gobain
- C. Pilkington/ Libbey-Owens-Ford
- D. Substitutions: Under provisions of Section 01 60 00.

2.02 GLASS MATERIALS

- A. Insulated Tempered Glass Units at Exterior Window Openings: Double pane units with aluminum double edge seal; both panes of clear glass with Low 'E'; argon gas-filled inter pane space purged with dry hermetic air; total thickness of 5/8 inch.

2.05 ACCEPTABLE GLAZING COMPOUND MANUFACTURERS

- A. Dow Chemical.
- B. Substitutions: Under provisions of Section 01 60 00.

2.06 GLAZING COMPOUNDS

- A. Silicone Sealant: Single component, capable of water immersion without loss of properties; non-bleeding; non-staining; cured Shore A hardness of 15-25; dark brown color.
- B. Verify glazing sealant is compatible with glazing accessories as supplied by door and window manufacturer. Notify Architect if non-silicone compatible accessories are supplied and require a field applied glazing sealant.

2.07 GLAZING ACCESSORIES

- A. Supply glazing accessories in accordance with window and door manufacturer's standard shop glazing procedures and as shown on the drawings.
- B. Supply field installed glazing accessories in accordance with window and door manufacturer's recommendations.

PART 3 EXECUTION**3.01 INSPECTION**

- A. Verify wall surfaces are clean, free of obstructions, and ready for work of this Section.
- B. Verify sashes are clean, free of obstructions, and ready for work of this Section.
- C. Beginning of installation means acceptance of substrate.

3.02 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses.

3.03 EXTERIOR DRY METHOD (PREFORMED GLAZING)

- A. Cut glazing tape or spline to length; install on glass pane. Seal corners by butting tape and dabbing with butyl sealant.
- B. Place setting blocks at 1/4 points.
- C. Rest glass on setting blocks and push against fixed stop with sufficient pressure to attain full contact at perimeter of pane.
- D. Install removable stops without displacement of glazing spline. Exert pressure for full continuous contact.
- E. Trim protruding tape edge.

3.04 EXTERIOR COMBINATION METHOD (TAPE AND SEALANT)

- A. Cut glazing tape to length and set against permanent stops, 3/16 inch (5 mm) below sightline. Seal corners by butting tape and dabbing with butyl sealant.
- B. Apply heel bed of butyl sealant along exterior void ensuring full contact with pane.
- C. Place setting blocks at 1/4 points.
- D. Rest glass on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane.
- E. Install removable stops, spacer strips inserted between glass, and applied stops at 24 inch (600 mm) intervals, 1/4 inch (6 mm) below sightline. Place glazing tape on glass with tape 1/4 inch (6 mm) below sightline.
- F. Fill gap between pane and applied stop with sealant to depth equal to bite of frame on pane, but not more than 3/8 inch (9 mm) below sightline.
- G. Apply cap bead of sealant along exterior void, to uniform line, flush with sightline. Tool or wipe sealant surface with solvent for smooth appearance.

3.05 EXTERIOR WET METHOD (SEALANT AND SEALANT)

- A. Place setting blocks at 1/4 points and install glass pane.

- B. Install removable stops with pane centered in space by inserting spacer shims both sides at 24 inch (600 mm) intervals, 1/4 inch (6 mm) below sightline.
- C. Fill gap between pane and stops with type sealant to depth equal to bite of frame on pane, but not more than 3/8 inch (9 mm) below sightline.
- D. Apply sealant to uniform line, flush with sightline. Tool or wipe sealant surface with solvent for smooth appearance.

3.06 INTERIOR DRY METHOD (TAPE AND TAPE)

- A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sightline.
- B. Place setting blocks at 1/4 points.
- C. Rest glass on setting blocks and push against tape for full contact at perimeter of pane.
- D. Place glazing tape on free perimeter of pane in same manner described above.
- E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- F. Knife trim protruding tape.

3.07 INTERIOR COMBINATION METHOD (TAPE AND SEALANT)

- A. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch (1.6 mm) above sightline.
- B. Place setting blocks at 1/4 points.
- C. Rest glass on setting blocks and push against tape to ensure full contact at perimeter of pane.
- D. Install removable stops, spacer shims inserted between glass, and applied stops at 24-inch (600 mm) intervals, 1/4 inch (6 mm) below sightline.
- E. Fill gap between pane and applied stop with sealant to depth equal to bite of frame on pane to uniform and level line.
- F. Trim protruding tape edge.

3.08 INTERIOR WET METHOD (COMPOUND AND COMPOUND)

- A. Install glass resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch (600 mm) centers, kept 1/4 inch (6 mm) below sightline.
- B. Locate and secure glass pane using glaziers' clips.
- C. Fill gaps between pane and stops with glazing compound until flush with sightline. Tool surface to straight line.

3.09 SCHEDULE

- A. Window Glazing: Low E, Clear, Insulated, Tempered Glass

3.10 CLEANING

- A. After installation, mark pane with an "X" by using plastic tape or removable paste.
- B. Remove glazing materials from finish surfaces.
- C. Remove labels after work is completed.

END OF SECTION

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SECTION 09 91 00

PAINTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Exterior painting, including surface preparation.

1.2 RELATED SECTIONS

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 05 12 00 – Structural Steel
- C. Section 05 52 00 – Metal Railings
- D. Section 06 20 00 – Finish Carpentry

1.3 REFERENCES

- A. Green Seal Standard GS-11; May 20, 1993.
- B. US Green Building Council, (USGBC) - Green Seal standards for LEED paint credits.
- C. Occupational Safety and Health Act (OSHA) - Safety Standards.
- D. American National Standards Institute (ANSI) - Performance Standards.
- E. Paint Decorating Contractors of America (PDCA) - Application Standard.
- F. National Paint and Coatings Association (NPCA) - Gloss Standard.
- G. American Society for Testing Materials (ASTM) - Testing Methods.
- H. Master Paint Institute (MPI #) - Established paint categories and standards.
- I. Ozone Transmission Commission (OTC) - Established levels of Volatile Organic Compounds.
- J. SCAQMD 1168 - South Coast Air Quality Management District Rule #1168; October 3, 2003.
- K. SSPC (PM1) - Steel Structures Painting Manual, Vol. 1, Good Painting Practice; Society for Protective Coatings; 1993, Third Edition.
- L. SSPC (PM2) - Steel Structures Painting Manual, Vol. 2, Systems and Specifications; Society for Protective Coatings; 1995, Seventh Edition.
- M. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

1.4 DEFINITIONS

- A. Commercial as used in this Section refers to a product well suited for a commercial application.
- B. DFT as used in this Section refers to the Dry Film Thickness of the coating.
- C. Enamel refers to any acrylic or alkyd (oil) base paint which dries leaving an eggshell, pearl, satin, semi-gloss or high gloss enamel finish.
- D. DTM as used in this Section refers to paint that is applied Direct To Metal.
- E. OTC as used in this Section refers to the Ozone Transmission Commission. OTC has established the following VOC levels for the Northeastern United States. Products shall meet the following OTC limits for VOC's.
 - 1. Interior flat paints: 50 grams per liter or less, per gallon.
 - 2. Interior enamels: 150 grams per liter or less, per gallon.
 - 3. Interior stains: 250 grams per liter or less, per gallon.

4. Interior primers: 200 grams per liter or less, per gallon.
 5. Rust preventive coatings: 400 grams per liter or less, per gallon.
 6. Dry fog coatings: 400 grams per liter or less, per gallon.
 7. Floor coatings: 250 grams per liter or less, per gallon.
- F. Premium as used in this Section refers to the best quality product "top of the line".
- G. VOC as used in this Section refers to Volatile Organic Compounds found in primers, paints, sealers and stains. The level of VOCs appears after each product listed in the Schedule in grams per liter (g/L).
- H. Paints are available in a wide range of sheens or glosses, as measured by a gloss meter from a 60 and/or 85 degree angle from vertical, as a percentage of the amount of light that is reflected. The following terms are used to describe the gloss of our products. The list below is provided for general guidance; refer to the technical data sheet for the actual gloss/sheen level for each product.
1. Flat - Less than 5 Percent.
 2. Eggshell - 5 - 20 Percent.
 3. Satin - 20 - 35 Percent.
 4. Semi-Gloss - 30 - 65 Percent.
 5. Gloss - Over 65 Percent.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 – Submittals
- B. Product Data: Provide a complete list of all products to be used, with the following information for each:
1. Manufacturer's name, product name and/or catalog number, and general product category.
 2. Cross-reference to specified paint system(s) that the product is to be used in; include description of each system.
- C. Samples: Submit three paper samples, 5 inches by 7 inches (127mm x 178mm) in size, illustrating selected colors for each color and system selected with specified coats cascaded.
- D. Manufacturer's Instructions: Indicate special surface preparation procedures.
- E. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten years experience.
- B. Installer Qualifications: All products listed in this section are to be applied by a Painting Contractor with a minimum of five years demonstrated experience in surface preparation and field application of the same type and scope as specified.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Mock-up areas designated by Architect.

2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Approved mock-up areas will serve as the standard for remaining Work.
4. Refinish mock-up area as required to produce acceptable Work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
- C. Disposal:
 1. Never pour leftover coating down any sink or drain. Use up material on the job or seal can and store safely for future use.
 2. Do not incinerate closed containers.
 3. For specific disposal or recycle guidelines, contact the local waste management agency or district. Recycle whenever possible.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.9 WARRANTY

- A. Inspection of all surfaces to be coated must be done by the manufacturer's representative to insure proper preparation prior to application. All thinners, fillers, primers and finish coatings shall be from the same manufacturer to support a product warranty. Products other than those submitted shall be accompanied by a letter stating its fitness for use and compatibility.
- B. At project closeout, provide to the Owner or owner's representative an executed copy of the Manufacturer's standard form outlining the terms and conditions of and any exclusions to their Limited Warranty against Manufacturing Defect.

1.10 EXTRA MATERIALS

- A. At project closeout, supply the Owner or owner's representative one gallon of each product for touch-up purposes. Cans shall be clearly marked with color name, number and type of paint.
- B. At project closeout, provide the color mixture name and code to the Owner or owner's representative for accurate future color matching.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Benjamin Moore & Co., which is located at: 101 Paragon Dr; Montvale, NJ 07645; Toll Free Tel: 855-724-6802 ; Email:[request info \(info@benjaminmoore.com\)](mailto:requestinfo@benjaminmoore.com); Web:[www.benjaminmoore.com/en-us/for-architects-and-designers|www.benjaminmoore.ca](http://www.benjaminmoore.com/en-us/for-architects-and-designers/www.benjaminmoore.ca)
- B. United States Gypsum Company, which is located at: 550 West Adams Street, Chicago IL

60661; Toll Free Tel: 800.874.4968; Web: www.usg.com

- C. Substitutions:
 - 1. Sherwin Williams, which is located at: 101 Prospect Ave, Cleveland, OH 44115; Toll Free Tel: 800.474.3794; Web: www.sherwin-williams.com
 - 2. Pittsburgh Paints Industries, Inc., which is located at: One PPG Place, Pittsburgh, PA 15272; Toll Free Tel: 800.441.9695 ; Web: www.ppgpittsburghpaints.com
- D. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 MATERIALS - GENERAL

- A. Volatile Organic Compound (VOC) Content:
 - 1. Provide coatings that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D-National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- B. Compatibility: Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.3 MIXING AND TINTING

- A. Except where specifically noted in this section, all paint shall be ready-mixed and pre-tinted. Agitate all paint prior to and during application to ensure uniform color, gloss, and consistency.
- B. Thinner addition shall not exceed manufacturer's printed recommendations. Do not use kerosene or other organic solvents to thin water-based paints.
- C. Where paint is to be sprayed, thin according to manufacturer's current guidelines.

2.4 EXTERIOR PAINT SYSTEMS

- A. MASONRY: New and reclaimed brick.
 - 1. Clear Water Repellant Sealant:
 - a. 3 Coats:
 - 1) DRYLOK Siloxane 7.
- B. METAL: Aluminum, Galvanized.
 - 1. Latex Systems:
 - a. Gloss Finish:
 - 1) 1st Coat: Benjamin Moore Ultra Spec EXT Gloss Finish N449 (46 g/L) MPI # 11.
 - 2) 2nd Coat: Benjamin Moore Ultra Spec EXT Gloss Finish N449 (46 g/L) MPI # 11.
 - b. Gloss Finish- Early Moisture Resistant Finish
 - 1) 1st Coat: Benjamin Moore Ultra Spec D.T.M. Acrylic Gloss Enamel HP28 (45 g/L), MPI # 114, X-Green 114.

- 2) 2nd Coat: Benjamin Moore Ultra Spec D.T.M. Acrylic Gloss Enamel HP28 (45 g/L), MPI # 114, X-Green 114, 154.
- c. Semi-Gloss Finish:
 - 1) 1st Coat: Benjamin Moore Ultra Spec HP Acrylic DTM Semi-Gloss Enamel HP29 (45 g/L), MPI # 141.
 - 2) 2nd Coat: Benjamin Moore Ultra Spec HP Acrylic DTM Semi-Gloss Enamel HP29 (45 g/L), MPI # 141.
- C. METAL: Misc. Iron, Ornamental Iron, Structural Iron and Steel, Ferrous Metal.
 - 1. Latex Systems:
 - a. Gloss Finish
 - 1) 1st Coat: Corotech Acrylic Metal Primer V110 (199 g/L).
 - 2) 2nd Coat: Benjamin Moore Ultra Spec EXT Gloss Finish N449 (46 g/L) MPI # 11.
 - 3) 3rd Coat: Benjamin Moore Ultra Spec EXT Gloss Finish N449 (46 g/L) MPI # 11.
 - b. Semi-Gloss Finish
 - 1) 1st Coat: Corotech Acrylic Metal Primer V110 (199 g/L).
 - 2) 2nd Coat: Benjamin Moore Ultra Spec HP D.T.M. Acrylic Semi-Gloss Enamel, HP29 (45 g/L), MPI # 141.
 - 3) 3rd Coat: Benjamin Moore Ultra Spec HP D.T.M. Acrylic Semi-Gloss Enamel, HP29 (45 g/L), MPI # 141.
- D. WOOD: treads, ramps, guards, balusters, newels.
 - 1. Waterproof sealer: SEAL-ONCE Marine Grade Premium Clear Wood Sealer by UC Coatings.
 - a. Apply 3 Coats.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The Contractor shall review the product manufacturer's special instructions for surface preparation, application, temperature, re-coat times, and product limitations.
- B. The Contractor shall review product health and safety precautions listed by the manufacturer.
- C. The Contractor shall be responsible for enforcing on site health and safety requirements associated with the Work.
- D. Do not begin installation until substrates have been properly prepared.
- E. Ensure that surfaces to receive paint are dry immediately prior to application.
- F. Ensure that moisture-retaining substrates to receive paint have moisture content within tolerances allowed by coating manufacturer. Where exceeding the following values, promptly notify Architect and obtain direction before beginning work.
 - 1. Concrete and Masonry: 3-5 percent. Allow new concrete to cure a minimum of 28 days.
 - 2. Exterior Wood: 17 percent.
 - 3. Interior Wood: 15 percent.
 - 4. Interior Finish Detail Woodwork, Including Trim, and Casework: 10 percent.

5. Plaster and Gypsum: 15 percent.
 6. Concrete Slab-On-Grade: Perform calcium chloride test over 24 hour period or other acceptable test to manufacturer. Verify acceptable moisture transmission and pH levels.
- G. Examine surfaces to receive coatings for surface imperfections and contaminants that could impair performance or appearance of coatings, including but not limited to, loose primer, rust, scale, oil, grease, mildew, algae, or fungus, stains or marks, cracks, indentations, or abrasions.
- H. Correct conditions that could impair performance or appearance of coatings in accordance with specified surface preparation procedures before proceeding with coating application.

3.2 PREPARATION - GENERAL

- A. Clean surfaces thoroughly prior to coating application.
- B. Do not start work until surfaces to be finished are in proper condition to produce finished surfaces of uniform, satisfactory appearance.
- C. Stains and Marks: Remove completely, if possible, using materials and methods recommended by coating manufacturer; cover stains and marks which cannot be completely removed with isolating primer or sealer recommended by coating manufacturer to prevent bleed-through.
- D. Remove Mildew, Algae, and Fungus using materials and methods recommended by coating manufacturer.
- E. Remove dust and loose particulate matter from surfaces to receive coatings immediately prior to coating application.
- F. Remove or protect adjacent hardware, electrical equipment plates, mechanical grilles and louvers, lighting fixture trim, and other items not indicated to receive coatings.
- G. Move or protect equipment and fixtures adjacent to surfaces indicated to receive coatings to allow application of coatings.
- H. Protect adjacent surfaces not indicated to receive coatings.
- I. Prepare surfaces in accordance with manufacturer's instructions for specified coatings and indicated materials, using only methods and materials recommended by coating manufacturer.

3.3 SURFACE PREPARATION

- A. Existing Coatings:
1. Remove surface irregularities by scraping or sanding to produce uniform substrate for coating application; apply one coat primer of type recommended by coating manufacturer for maximum coating adhesion.
 2. If presence of lead in existing coatings is suspected, cease surface preparation and notify Architect immediately.

- B. Masonry Surfaces - Restored: Remove loose particles, sand, efflorescence, laitance, cleaning compounds and other substances that could impair coating performance or appearance.
- C. Metals - Aluminum, Mill-Finish: Clean and etch surfaces with a phosphoric acid-water solution or water based industrial cleaner. Flush with clean water and allow to dry, before applying primer coat.
- D. Metals - Copper: Clean surfaces with pressurized steam, pressurized water, or solvent washing.
- E. Metals - Ferrous, Unprimed: Remove rust or scale, if present, by wire brush cleaning, power tool cleaning, or sandblast cleaning; remove grease, oil, and other contaminants which could impair coating performance or appearance by solvent cleaning, with phosphoric-acid solution cleaning of welds, bolts and nuts; spot-prime repaired welds with specified primer.
- F. Metals - Ferrous, Shop-Primed: Remove loose primer and rust, if present, by scraping and sanding, feathering edges of cleaned areas to produce uniform flat surface; solvent-clean surfaces and spot-prime bare metal with specified primer, feathering edges to produce uniform flat surface.
- G. Metals - Galvanized Steel (not passivated): Clean with a water-based industrial strength cleaner, apply an adhesion promoter followed by a clean water rinse. Alternately, wipe down surfaces using clean, lint-free cloths saturated with xylene or lacquer thinner; followed by wiping the surface dry using clean, lint-free cloths.
- H. Metals - Galvanized Steel, Passivated: Clean with water-based industrial strength cleaner. After the surface has been prepared, apply recommended primer to a small area. Allow primer to cure for 7 days, and test adhesion using the "cross-hatch adhesion tape test" method in accordance with ASTM D 3359. If the adhesion of the primer is positive, proceed with a recommended coating system for galvanized metal.
- I. Metals - Stainless Steel: Clean surfaces with pressurized steam, pressurized water, or water-based industrial cleaner.
- J. Wood:
 - 1. Seal knots, pitch streaks, and sap areas with sealer recommended by coating manufacturer; fill nail recesses and cracks with filler recommended by coating manufacturer; sand surfaces smooth.
 - 2. Remove mill marks and ink stamped grade marks.
 - 3. Apply sealant as per manufacturer's instructions.

3.4 APPLICATION - GENERAL

- A. Application of primers, paints, stains or coatings, by the Contractor, will serve as acceptance that surfaces were properly prepared in accordance with the manufacturer's recommendation.
- B. Apply each coat to uniform coating thickness in accordance with manufacturer's instructions, not exceeding manufacturer's specified maximum spread rate for indicated surface; thins, brush marks, roller marks, orange-peel, or other application imperfections are not permitted.
- C. Allow manufacturer's specified drying time, and ensure correct coating adhesion, for each coat before applying next coat.

- D. Inspect each coat before applying next coat; touch-up surface imperfections with coating material, feathering, and sanding if required; touch-up areas to achieve flat, uniform surface without surface defects visible from 5 feet (1.5 m).
- E. Remove dust and other foreign materials from substrate immediately prior to applying each coat.
- F. Where paint application abuts other materials or other coating color, terminate coating with a clean sharp termination line without coating overlap.
- G. Where color changes occur between adjoining spaces, through framed openings that are of same color as adjoining surfaces, change color at outside stop corner nearest to face of closed door.
- H. Re-prepare and re-coat unsatisfactory finishes; refinish entire area to corners or other natural terminations.

3.5 CLEANING

- A. Clean excess coating materials, and coating materials deposited on surfaces not indicated to receive coatings, as construction activities of this section progress; do not allow to dry.
- B. Re-install hardware, electrical equipment plates, mechanical grilles and louvers, lighting fixture trim, and other items that have been removed to protect from contact with coatings.
- C. Reconnect equipment adjacent to surfaces indicated to receive coatings.
- D. Relocate to original position equipment and fixtures that have been moved to allow application of coatings.
- E. Remove protective materials.

3.6 PROTECTION AND REPAIR

- A. Protect completed coating applications from damage by subsequent construction activities.
- B. Repair to Architect's acceptance coatings damaged by subsequent construction activities. Where repairs cannot be made to Architect's acceptance, re-apply finish coating to nearest adjacent change of surface plane, in both horizontal and vertical directions.

3.7 SCHEDULE - COLORS

- A. Exterior
 - 1. New and reclaimed brick: Clear
 - 2. Stair and ramp treads, risers, landings guardrail, balusters and newels: Clear
- B. Interior
 - 1. NA

END OF SECTION

SECTION 10 14 26

POST AND PANEL SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-illuminated post and panel signs.

1.2 COORDINATION

- A. Furnish templates and tolerance information for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.3 SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: For post and panel/pylon signage.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

- C. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify locations of embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Deterioration of finishes beyond normal weathering.
- b. Deterioration of embedded graphic image.
- c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- B. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.2 POST AND PANEL/PYLON SIGNS

- A. Post and Panel Sign: Sign of single-panel configuration; with smooth, uniform surfaces and support assembly; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Laminated, Aluminum-Sheet Sign Panels: Aluminum sheet laminated to both sides of acrylic core sheet with painted edges.
 - a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
 - b. Surface-Applied Graphics: Applied vinyl film.
 - 2. Posts: Galvanized Steel Pipe.
 - a. Shape: Round.
 - b. Size: 2-3/8" OD Pipe (Sch 40).
 - c. Installation Method: Direct burial with concrete footing.
 - d. Finish and Color: Black
 - e. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. (366 g /sq. m) zinc.
 - 1) Polymer coating over metallic coating.
 - 3. Text and Typeface: typeface as indicated by manufacturer's designation and variable content as scheduled.

2.3 MATERIALS

- A. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Copper Sheet: ASTM B 152/B 152M.
- D. Steel Materials:
 - 1. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating, either commercial or forming steel.
 - 2. Bolts for Steel Framing: ASTM A 307 or ASTM A 325 (ASTM A 325M) as necessary for design loads and connection details.
 - 3. For steel exposed to view on completion, provide materials having flat, smooth surfaces without blemishes. Do not use materials whose surfaces exhibit pitting, seam marks, roller marks, rolled trade names, or roughness.
- E. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated and suitable for exterior applications.
- F. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. For exterior exposure, furnish stainless-steel or hot-dip galvanized devices unless otherwise indicated.
 - 3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 - b. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant, Allen-head or one-way-head slots unless otherwise indicated.
 - 4. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- C. Anchoring Materials:

1. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for exterior applications.
2. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
3. Water-Resistant Product: At exterior locations, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 1. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in locations concealed from view after final assembly.
 2. Mill joints to tight, hairline fit. Form joints exposed to weather to resist water penetration and retention.
 3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed joints of flux, and dress exposed and contact surfaces.
 4. Conceal fasteners and anchors unless indicated to be exposed; locate exposed fasteners where they will be inconspicuous.
 5. Internally brace signs for stability and for securing fasteners.
- B. Sign Message Panels: Construct sign-panel surfaces to be smooth and to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.
 1. Coordinate dimensions and attachment methods to produce message panels with closely fitting joints. Align edges and surfaces with one another in the relationship indicated.
 2. Increase panel thickness or reinforce with concealed stiffeners or backing materials as needed to produce surfaces without distortion, buckles, warp, or other surface deformations.
 3. Continuously weld joints and seams unless other methods are indicated; grind, fill, and dress welds to produce smooth, flush, exposed surfaces with welds invisible after final finishing.
- C. Post Fabrication: Fabricate posts designed to withstand wind pressure indicated for Project location and of lengths required for installation method indicated for each sign.
 1. Aluminum Posts: 2-3/8" OD Pipe (Sch 40), coated, extruded-aluminum tubing unless otherwise indicated, with brackets or slots to engage sign panels. Include post caps,

fillers, spacers, junction boxes, access panels, reinforcement where required for loading conditions, and related accessories required for complete installation.

2. Direct Burial: Fabricate posts 36 inches (910 mm) longer than height of sign to permit direct burial and embedment in concrete foundations or concrete-filled postholes.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.
- B. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

2.8 METALLIC-COATED STEEL FINISHES

- A. Surface Preparation: Clean surfaces of oil and other contaminants. Use cleaning methods that do not leave residue. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A 780/A 780M.
- B. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils (0.05 mm).

2.9 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, and prepare for coating according to coating manufacturer's written instructions.
 1. For Baked-Enamel or Powder-Coat Finish: After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.
- B. Factory Prime Finish: After surface preparation and pretreatment, apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer.
- C. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils (0.05 mm).

PART 3 EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs.
- C. Verify that anchor inserts are correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using installation methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to accessibility standard.
 - 3. Before installation, verify that sign components are clean and free of materials or debris that would impair installation.
 - 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.3 INSTALLING POSTS

- A. Vertical Tolerance: Set posts plumb within a tolerance of 1/16 inch in 3 feet.
- B. Direct-Burial Method and Concrete Footing:
 - 1. Excavation: Excavate posthole to dimensions indicated. Reconstruct subgrade that is not firm, undisturbed, or compacted soil, or that is damaged by freezing temperatures, frost, rain, accumulated water, or construction activities by excavating an additional 12 inches (300 mm), backfilling with satisfactory soil or well-graded aggregate, and compacting to original subgrade elevation.
 - 2. Setting in Earth: Set post in position, support to prevent movement.
 - 3. Setting in Cast-in-Place Concrete: Set post in position, support to prevent movement, and place concrete for concrete foundation as indicated.
 - 4. Setting in Preformed Hole in Concrete Foundation: Form or core drill holes in concrete foundation not less than 3/4 inch larger than outside dimension of post for installing posts in concrete. Set post in position, shim to prevent movement, and fill annular space between post and hole with nonshrink, nonmetallic grout, mixed and placed to comply with manufacturer's written instructions.

- a. Leave anchorage joint exposed with 1/8-inch anchoring material sloped away from post.

3.4 FINISH AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 12 93 00

SITE FURNISHINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Park Benches
 - 2. Waste Receptacles
- B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.2 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR).
 - 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. ASTM International (ASTM).
 - 1. ASTM A90 – Standard Test Method for Weight (Mass) of Coating on Iron or Steel Articles with Zinc or Zinc Alloy.
 - 2. ASTM A153 – Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
 - 3. ASTM B211 – Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire.
 - 4. ASTM C94 – Standard Specification for Ready-Mixed Concrete.
 - 5. ASTM D2967 – Standard Test Method for Corner Coverage of Powder Coating.
 - 6. ASTM D3451 – Standard Guide for Testing Coating Powders and Powder Coatings.
 - 7. ASTM D4217 – Standard Test Method for Gel Time of Thermosetting Coating Powder.
 - 8. ASTM A123 – Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
 - 9. ASTM A428 – Standard Test Method for Weight (Mass) of Coating on Aluminum-Coated Iron or Steel Articles.

1.3 SUBMITTALS

- A. Shop drawings for all equipment furnished under this Section. Shop drawings shall indicate the configuration, dimensions, layout, and spacing of major and minor equipment components such as posts, supports, rails, brackets, fasteners, foundations, anchorage, and a schedule of such equipment components. Show in large-scale details any unique fabrication, assembly, and/or installation requirements.
- B. Material certificates or other data indicating compliance with these Specifications for finish type, color, size, style, posts, fittings, hardware, and accessories.
- C. Copies of manufacturer-provided installation instructions, operation instructions, and maintenance material for all equipment furnished under this Section.
- D. Manufacturer's warranties and associated warranty registration data in Owner's name. Submit two (2) copies of each warranty to Engineer in the manufacturer's/supplier's standard form or if there is no standard form available, in a form specified by Engineer.

1.4 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage

- 1. Transportation carrier shall use appropriate methods to ensure materials are properly packaged, stacked, and restrained during transport. Utilize protective packaging as required.
- 2. Protect materials during storage against moisture, soiling, staining, and physical damage.
- 3. Any product or associated component showing manufacturing flaws upon receipt at the Project Site shall be referred to Engineer for determination as to whether it shall be repaired, rejected, or used.
- 4. Protect railing materials during storage to avoid damage from moisture, abrasion, and other construction activities.

B. Handling

- 1. Handle railing materials to prevent abrasion, chipping, marring, soiling and other damage.
- 2. Damaged equipment shall not be installed. Contractor shall bear responsibility for damage to equipment until final acceptance by Owner. Any installed equipment exhibiting damage shall be replaced or repaired to the satisfaction of Engineer, and Contractor shall assume all costs related thereto.

1.6 WARRANTY

- A. Provide manufacturer's standard warranty, as applicable, for all products furnished under this Section. Warranty shall be registered in Owner's name.

- B. Bind warranties in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8½-by-11-inch paper.
- C. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
- D. Identify each binder on the front and spine with the typed or printed title “WARRANTIES,” Project title or name, and name of Contractor.
- E. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 PRODUCTS

2.1 PARK BENCH

- A. CityView Backed Bench, Model No. CV1-1010-Custom, as manufactured by SiteScapes, P.O. Box 22326, Lincoln, NE 68542 (Web: www.sitescapesonline.com) or approved equal.
 - 1. Color: Brandy

2.2 WASTE RECEPTACLE

- A. Stainless steel, electrostatically powder-coated, stainless steel, waster receptacle as manufactured by Victor Stanley Co., model #SD-42 or approved equal.
 - 1. Material: All fabricated metal components are to be steel shotblasted, etched, phosphatized, preheated and electrostatically powder-coated with TGIC polyester powder coatings.
 - 2. Liner: High-density plastic.
 - 3. Leveling: Rubber-tipped leveling feet on the base.
 - 4. Lid: Rain Bonnet
 - 5. Lockable
 - 6. Anchor bolts – galvanized steel (2 per receptacle).
 - 7. Color: Black.
 - 8. Quantity – six (6) required.

2.3 CONCRETE

- A. Ready-Mix, ASTM C94; or pre-packaged concrete mix, ASTM C387. Minimum 28-day compressive strength of 3,500 psi.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions, unless more stringent requirements are indicated. Complete field assembly of site and street furnishings, where required.
- B. Unless otherwise indicated, install site and street furnishings after landscaping and paving have been completed.
- C. Install items per manufacturer's recommendations and at locations approved by Owner.

3.3 PROTECTION AND CLEAN UP

- A. After completing installation, inspect components. Remove spots, dirt, and debris.
- B. Protect until acceptance of project. Repair any damaged finishes to match original finish or replace component.

END OF SECTION

SECTION 31 23 10

EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Preparation and grading subgrades for slabs-on-grade, walks, pavements, and landscaping.
 - 2. Excavating and backfilling for structures.
 - 3. Excavation and backfilling for underground utilities and associated appurtenances.
 - 4. Excavation, backfill and compaction for the demolition/removal of subsurface utilities and improvements.
 - 5. Earth retention systems.
- B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.2 GENERAL

- A. Contractor is advised that lines and grades, as shown on the Drawings, are subject to change. Although it is intended to adhere to what is shown on Drawings, Engineer reserves the right to make changes in lines and grades of utilities or other subsurface construction when such changes may be necessary or advantageous.
- B. In open trenching on public roadways, Contractor shall be governed by the conditions, restrictions and regulations made by the local or state authority as applicable. All such regulations shall be in addition to those set down in the Specifications.

1.3 EXCAVATION CLASSIFICATIONS

- A. Excavation - Excavation shall be unclassified and no consideration will be given to the nature of the materials. Excavation shall comprise and include the satisfactory removal and disposal of all materials encountered regardless of the nature of the materials and shall be understood to include but not limited to earth, fill, boulders, foundations, pavements, curbs, piping, cobbles, stones, footings, bricks, concrete, previously abandoned drainage structures and utility structures abandoned and not removed by the utility and debris.
- B. Common Excavation - Excavation of all materials that can be excavated, moved, loaded, transported, and unloaded using heavy equipment or that can be excavated and dumped into place or loaded onto hauling equipment by excavation equipment (shovel, bucket, backhoe, dragline, or clam shell) or moved with dozer-type equipment, appropriate to the material type, character, and nature of the materials. The presence of isolated boulders or rock fragments larger than 1 cubic yard is not in itself sufficient cause to change the classification of the surrounding material. All Common Excavation shall be included in the Base Bid.

- C. Rock Excavation - Rock Excavation as defined herein. The excavation and removal of isolated boulders or rock fragments larger than 1 cubic yard encountered in materials otherwise conforming to the definition of Common Excavation shall be classified as rock excavation. The presence of isolated boulders or rock fragments larger than 1 cubic yard is not in itself sufficient cause to change the classification of the surrounding material.

1.4 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. State of Connecticut Department of Transportation (ConnDOT)
 - 1. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 819, 2024 and any supplements.
- C. Code of Federal Regulations (CFR)
 - 1. 29 CFR 1926, Safety and Health Regulations for Construction
- D. American Concrete Institute (ACI)
 - 1. ACI 229R-99 - Controlled Low-Strength Materials (CLSM).
- E. American Association of State Highway and Transportation Officials (AASHTO)
 - 1. AASHTO Method T 90 - Determining the Plastic Limit and Plasticity Index of Soils.
 - 2. AASHTO T104 - Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.
 - 3. AASHTO Method T146 - Standard Method of Test for Wet Preparation of Disturbed Soil Samples for Test.
- F. ASTM International (ASTM).
 - 1. ASTM D422 - Standard Test Method for Particle-Size Analysis of Soils.
 - 2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 - 3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³(2,700 kN-m/m³)).
 - 4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - 5. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

7. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.5 DEFINITIONS

- A. Backfill: Soil material or flowable concrete used to fill an excavation.
- B. Bedding Course: Layer placed over the excavated sub-grade in a trench before laying pipe.
- C. Benching: A method of limiting cave-in potential by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.
- D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Clearing: Clearing shall consist in the felling, cutting up, and satisfactory disposal of trees and other vegetation designated for removal in accordance with these specifications.
- F. Drainage Course: Layer supporting basement grade used to minimize capillary flow of pore water.
- G. Earth Retention Systems: Any structural system, such as sheeting and bracing or cofferdams, designed to retain in-situ soils in place and prevent the collapse of the sides of an excavation in order to protect employees and adjacent structures.
- H. Excavation: Any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.
 - 1. Additional Excavation: Excavation beyond required dimensions or below subgrade elevations that is requested and/or directed by Engineer. Additional Excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.
 - 3. Unauthorized Excavation: Excavation below the elevations specified on the plans, beyond the limits indicated on the plans, or where no dimensions are indicated, beyond depths, elevations, and dimensions reasonably necessary for construction of the work without the request and/or direction of the Engineer. Unauthorized excavation, as well as any remedial work directed by Engineer, or if applicable Geotechnical Engineer, shall be without additional compensation.
- I. Fill: Soil materials used to raise existing grades.
- J. Finished Grade: The proposed final elevations shown on the Drawings or called for in the Specifications.
- K. Geotechnical Engineer: A qualified and licensed entity designated for the project as the authority on the assessment, design, and oversight of soil and/or rock conditions and construction affected by such conditions.

- L. Geotechnical Testing Agency: An independent testing agency employed by Owner, or by Contractor is called-for, and qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- M. Grubbing: Grubbing shall consist of the removal of roots 1 ½ inch and larger, organic matter and debris, and stumps having a diameter of three inches or larger, to a depth of at least 18 inches below the surface and or subgrade; whichever is lower, and the disposal thereof.
- N. Protective System: A method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include earth retention systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.
- O. Regular Excavation: Removal and disposal of any and all material above subgrade elevation, except solid rock and undercut excavation, located within the limits of construction.
- P. Rock: Solid ledges, bedded deposits, unstratified masses and conglomerations of material so firmly cemented as to possess the characteristics of solid rock which cannot be removed without systematic drilling or hoe ramming. All boulders containing a volume of more than one (1) cubic yard shall be considered rock.
- Q. Rock Excavation: Removal and satisfactory disposal of Rock, which, in the opinion of Engineer, cannot be excavated except by drilling, wedging, jack hammering or hoe ramming or the excavation of boulders or rock fragments containing a volume of more than one (1) cubic yard. The presence of isolated boulders or rock fragments larger than 1 cubic yard is not in itself sufficient cause to change the classification of the surrounding material.
- R. Licensed Professional Engineer: A person who is licensed as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.
- S. Satisfactory Materials: Earth material that meets the classification, use, and/or gradation requirements herein that does not contain limestone, shale, clay, ash, slag, friable material, organic or vegetative materials, topsoil, wood, trash, broken concrete, masonry rubble, trash, refuse, or frozen materials.
- T. Shield System: A structure that is designed to withstand the forces imposed on it by a cave-in and thereby protects employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either pre-manufactured or job-built in accordance with 29 CFR 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."
- U. Sloping: A method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.
- V. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

- W. Sub-grade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below drainage fill.
- X. Surplus Material: Excavated acceptable material that cannot be utilized elsewhere on the site as backfill or embankment fill, or as otherwise directed by the Engineer.
- Y. Temporary Dewatering System: A system to lower and control water to maintain stable, undisturbed subgrades at the lowest excavation levels. Dewatering shall be provided for all pipelines, structures and for all other miscellaneous excavations.
- Z. Testing Laboratory: A qualified entity engaged to perform specific laboratory tests.
- AA. Testing Agency: A qualified entity engaged to collect samples, perform specific in-field tests, and/or inspections. The Testing Laboratory may provide the services of the Testing Agency.
- BB. Trench: A narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet.
- CC. Unacceptable Material: Soil material that contains organic silt, peat, vegetation, wood or roots, stones or rock fragments over six (6) inches in diameter or exceeding 40 percent by weight of the backfill material, porous biodegradable matter, loose or soft fill, construction debris, or refuse, or material which cannot be compacted to the specified or indicated density.

1.6 SUBMITTALS

- A. Testing Laboratory - Submit name and qualifications of commercial testing laboratory for Engineer's approval. Submit applicable documentation of credentials, licenses, etc.
- B. Testing Agency - Submit name and qualifications of third-party in-field quality control Testing Agency for Engineer's approval. Submit applicable documentation of credentials, licenses, etc.
- C. Site Characterization of Off-Site Borrow Sources: The following information shall be submitted to Engineer for review at least two weeks prior to use of an off-site borrow source:
 - 1. Location and name of the borrow source site.
 - 2. Owner and contact information for the borrow source site.
 - 3. Present and past usage of the source site and materials.
 - 4. Any previously existing report(s) associated with an assessment of the source site as relates to the presence of oils, hazardous materials, or other organic and non-organic constituents which may be considered contaminants.
 - 5. Location within the site from which the material will be obtained.
- D. Chemical Testing Data: For each type/classification of earth material proposed and each source of earth material proposed: Submit a letter signed by an authorized representative of material supplier stating that such proposed material is free of oils, hazardous materials, or other organic and non-organic constituents which may be considered contaminants.
- E. Material Testing Data: Provide results for all proposed bedding, fill, aggregates, and backfill. Submit complete laboratory reports.

1. Gradation analysis.
 2. Soil classification and Moisture-Dry Density Curve.
 3. Loss on Abrasion.
 4. Soundness.
- F. Samples: 50-pound sample of each type of off-site bedding, fill, aggregates, and backfill that are proposed for use at the Project Site in an air-tight container for the testing laboratory, a minimum of two weeks prior to delivery of such material to the site. Use of these proposed materials by Contractor prior to testing and approval or rejection shall be at Contractor's risk.
- G. Product Data
1. Plastic warning tape.
 2. Separation fabric, filter fabric, geogrids, or similar geotextiles.
- H. Field Testing Results
1. Compaction test results keyed to date and specific location of testing. Provide Engineer with copies of testing reports within 24 hours of field test.

1.7 SAFETY

- A. Contractor shall conduct all excavation activities in conformance with applicable regulations, including those relating to warning signs, excavation safety, sheeting, shoring, and stabilization.
- B. Contractor shall provide and maintain barricades, signs, lights, etc., required for the protection of personnel, materials and property. Temporary barricades, etc. shall conform all applicable codes and regulations, and shall be lighted at night with lanterns, flares and reflectorized paint as required for safety. Adapt barricades, signs, lights, etc. to evolving site conditions throughout the progress of the work.
- C. Provide other safety devices as required, including adaptation of such safety devices to changing site conditions, to prevent unauthorized entry to construction areas and open excavations. Provide warning signs and other temporary construction safety devices necessary for proper completion of the work in compliance with applicable safety regulations.
- D. Contractor shall properly design and furnish all labor, materials, equipment, and tools necessary to construct permanent or temporary excavation support systems, including, but not necessarily limited to, sheet piling, trench shields, trench boxes, timber trench shoring, pneumatic/hydraulic shoring, steel sheeting or sheeting using other materials, sloping, and benching.
- E. Any time an excavation is to remain open, at a minimum, provide full enclosure with safety barriers and fencing, warning signs, and additional safety control measures as appropriate for the condition.

1.8 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required

for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.

B. Utility Mark-out

1. Prior to commencing work, comply with utility mark-out requirements of the Call-Before-You-Dig System (1-800-922-4455).
2. Verify the location of all subsurface utilities marked through the Call-Before-You-Dig System.
3. Not all subsurface facilities or structures will be identified through the Call-Before-You-Dig System. Confirm the location of other subsurface utilities and other subsurface facilities or structures prior to commencing work. Field-mark utilities as required.

C. Codes and Standards: Perform the work of this Section in accordance with all applicable codes, standards, and the requirements of authorities having jurisdiction.

D. Engineer reserves the right to perform all in-field testing specified in this Section and reserves the right to determine the suitability of all materials to be used for fills and reject any fill not meeting the specifications.

E. Field Density testing and subgrade observation shall be performed by the designated entity

F. Weather Limitations:

1. Material excavated when frozen or when air temperature is less than 32 degrees Fahrenheit (32 F) shall not be used as fill or backfill until material completely thaws.
2. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

1.9 TESTING

A. All sampling and testing shall be the responsibility of Contractor via Testing Agency and Testing Laboratory as applicable. Contractor shall retain and pay for the services of such Testing Agency/Testing Laboratory to perform all pre-construction testing and field testing in accordance with applicable standards.

B. The Owner will retain a testing entity to perform sampling and testing of the work under this Section during construction. The testing entity's presence does not constitute supervision or direction of Contractor's work. Neither the presence of the testing entity nor any observations and testing performed by him, nor any notice or failure to give notice shall excuse Contractor from conformance with these Specifications or from defects discovered in his work. Contractor shall remain responsible for all pre-construction sapling and testing.

C. Borrow and Fill: Contractor shall provide testing as defined below.

1. Gradation analysis for each type of borrow and on-site fill materials by ASTM D422.
2. Soil classification (ASTM D2487) and Moisture-Dry Density Curve (Proctor Test-Modified) by ASTM D1557 for all proposed fill and backfill materials at the frequency specified below:

- a. For suitable soil materials removed during Trench Excavation, perform one test for every 1,000 cubic yards of similar soil type. Similarity of soil types will be as determined by the Engineer.
 - b. For borrow materials, perform tests from each proposed source, at a rate of one test for every 1,000 cubic yards of soil type. Similarity of soil types will be as determined by the Engineer.
3. Loss on Abrasion: Where called-for, AASHTO Method T 96.
 4. Soundness: Where called-for, AASHTO Method T 104.
- D. Compaction Testing: [Contractor shall conduct] [Owner will conduct] compaction testing (i.e. ASTM D2922 and ASTM D3017 or ASTM D1556) at the frequency indicated below.
1. Trench: 1 test per lift, every 1,000 square feet or 200 feet of trench.
 2. Embankment: 1 test per lift, every 1,000 square feet.
 3. Additional compaction testing may be required when there is evidence of a change in the quality of moisture control or the effectiveness of compaction.
 4. If all compaction test results within the initial 25% of the total anticipated number of tests indicate compacted field densities equal to or greater than 95% of maximum dry density at optimum moisture content, Engineer may reduce frequency of compaction testing. In no case will the frequency be reduced to less than one test for every 500 cubic yards of material backfilled.
 5. Contractor is cautioned that compaction testing by nuclear methods may not be effective where trenches are so narrow that trench walls impact the attenuation of the gamma radiation or where oversize particles (i.e. large cobbles or coarse gravels) are present. In these cases, other field density testing methods may be required.
 6. If testing indicates that compacted subgrade, backfill, or fill are below specified density, additional compaction and/or replacement of material shall be provided at no expense to Owner.
- E. Chemical Testing: Prior to delivery of any earth material to the Project Site, Contractor shall conduct chemical testing to demonstrate that such material is free of oils, hazardous materials, or other organic and non-organic constituents which may be considered contaminants.

1.10 EXCAVATED MATERIAL

A. Placement

1. Excavated material shall be so placed as not to interfere with travel or movement on existing streets, driveways, sidewalks or other areas designated to remain undisturbed. Excavated material shall not be deposited on private property without the written consent of the property owner(s) and approval of Engineer.
2. No excavated material shall be stored on top of installed pipe or other construction. Contractor shall consider surcharge loads when stockpiling excavated material adjacent to trenches, and take any measure required to prevent cave-in, including but not limited to, trench support systems and/or stockpiling excavated material remote from trench.

- B. Suitable excavated material may be used for Common Fill or Backfill on other parts of the Work, if specifically approved by Engineer.
- C. Material excavated from private property shall belong to the property Owner, or his representative, and shall be disposed of by the Contractor, as required by said Owner or his representative. If the Contractor fails to promptly remove such surplus material, Engineer may have the same done and charge the cost thereof as money paid to the Contractor.
- D. Contractor shall be responsible for the proper disposal of all unsuitable excavated materials. Engineer shall determine what is suitable or unsuitable material where questions arise. Generally, unsuitable material shall include, but not be limited to, pavement (bituminous and concrete), large boulders, pipe, conduit and metal.
- E. Contractor shall submit to Engineer, for approval, the location(s) to be utilized during the Contract period for waste material disposal. This approval must occur before any export of waste material from the project site. Any change in the disposal site during construction shall be submitted for approval.

1.11 SHEETING, SHORING AND BRACING

- A. Provide earth retention systems as required by federal, state and local regulations. Shoring and bracing of trenches and other excavations shall be in accordance with the latest OSHA Standards and Interpretations, and to all other applicable codes, rules and regulations of federal, state and local authorities.

1.12 DRAINAGE

- A. At all times during construction, Contractor shall temporarily provide, place and maintain ample means and devices with which to remove promptly, and dispose of properly, all water entering trenches and other excavations, or water that may flow along or across the site of the Work, and keep said excavations dry until the structures, pipes, and appurtenances to be built therein have been completed to such extent that they will not be damaged. At the conclusion of the work, Contractor shall remove such temporary means and devices.
- B. All groundwater which may be found in the trenches and foundation excavations, and any water which may get into them from any cause whatsoever, shall be pumped or bailed out, so that the trench shall be dry during pipe laying and backfilling and during the placement of concrete.
- C. All water pumped or drained from the Work shall be managed in accordance with applicable discharge permits, without undue interference with other work or damage to pavements, other surfaces, or property.

1.13 COORDINATION

- A. Prior to commencing earthwork operations, meet with representatives of governing authorities, Engineer, testing entity, and other pertinent entities.
 - 1. Review earthwork procedures and responsibilities including Contractor's schedule of operations, scheduling observation and testing procedures and requirements.
 - 2. Notify participants at least three (3) working days prior to convening conference. Record discussions and agreements and furnish copies to each participant.

3. Contractor shall at all times so conduct his work as to insure the least possible inconvenience to the general public and the residents in the vicinity of the work. Fire hydrants on or adjacent to the work shall be kept accessible to firefighting equipment at all times. Temporary provisions shall be made by Contractor to ensure the proper functioning of all gutters, sewer inlets, drainage ditches, and irrigation ditches, which shall not be obstructed except as approved by Engineer.
- B. Benchmark/Monument Protection: Protect and maintain benchmarks, monuments or other established reference points and property corners. If disturbed or destroyed, replace at no cost to Owner.
- C. Provide five (5) days advance notice to Engineer and testing entity for any proposed earthwork operation requiring observation and/or testing.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

- A. All materials used in the work of this Section shall be Satisfactory Material, and any material that does not meet this classification shall be considered an Unsatisfactory Material and shall not be used.
- B. Unsatisfactory Soils: Soil materials not meeting the requirements for Satisfactory Soils.
 1. Unsatisfactory soils also include satisfactory soils not maintained within two (2) percent of optimum moisture content at time of compaction.

2.2 COMMON FILL/ORDINARY BORROW

- A. Earth materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GP-GC, SW, SP, and SM that are free of clay.
- B. Common Fill material is subject to the approval of Engineer and may be either material removed from excavations or borrow from off site. It shall have physical properties such that it can be readily spread and after it has been placed and properly compacted, it will form a dense, stable fill.
- C. Common Fill shall be graded as follows:

Gradation of Common Fill

Sieve	Percent Passing by Weight
6"	100
3.5 "	50-100
3/4"	50-90
No. 4	25-55
No. 200	0-20

1. Less than twenty (20) percent of material by weight passing the No. 4 sieve shall pass the No. 200 sieve.
2. Common Fill shall not be used at locations where use of select fill is indicated.

2.3 COMMON FILL/ORDINARY BORROW

- A. Satisfactory Material that is well-graded meeting ASTM D 2487 classification group GW, GP, GM, SW, SP, and SM. No particle shall exceed 6-inches in size and no greater than 10% by weight of the material shall pass the No. 100 sieve and no greater than 5% by weight of the material shall pass the No. 200 sieve.
- B. Common Fill is subject to the approval of Engineer and may be either material removed from on-site excavations or borrow pits or imported from off-site, approved sources. It shall have physical properties such that it can be readily spread and after it has been placed and properly compacted, it will form a dense, stable fill.

2.4 BANK RUN GRAVEL

- A. Granular material, well graded from fine to coarse, obtained from approved natural deposits and unprocessed, except for the removal of unacceptable material and stones larger than the maximum size permitted.
- B. Bank Run Gravel shall be graded as follows:

Gradation of Bank Run Gravel (ConnDOT Grading "C")

Sieve	Percent Passing by Weight
1 ½"	100
¾"	45-80
¼"	25-60
No. 10	15-45
No. 40	5-25
No. 100	0-10
No. 200	0-5

2.5 GRANULAR FILL

- A. Broken or crushed stone, gravel, or a mixture thereof.
- B. Broken or crushed stone
 - 1. The product resulting from the artificial crushing of rocks, boulders or large cobblestones, substantially all faces of which have resulted from the crushing operation. Broken or crushed stone shall consist of sound, tough, durable stone, reasonably free from soft, thin, elongated, laminated, friable, micaceous or disintegrated pieces.
- C. Bank or crushed gravel
 - 1. Sound, tough, durable particles of crushed or uncrushed gravel, free from soft, thin, elongated or laminated pieces and vegetable or other deleterious substances. Crushed gravel shall be the manufactured product resulting from the deliberate mechanical crushing of gravel with at least 50% of the gravel retained on the No. 4 sieve having at least one fractured face.

- D. Granular Fill shall be graded as follows:

Gradation of Granular Fill (ConnDOT Grading "A")

Sieve	Percent Passing by Weight
3 1/2"	100
1 1/2"	55-100
1/4"	25-60
No. 10	15-45
No. 40	5-25
No. 100	0-10
No. 200	0-5

- E. Reclaimed material shall not be considered acceptable for use as granular fill.

2.6 SCREENED GRAVEL AND CRUSHED STONE

- A. Screened gravel, well graded in size from 3/8 inch to 3/4 inch. The gravel shall consist of clean, hard, and durable particles or fragments. Crushed rock of suitable size and grading may be used instead of screened gravel.
- B. Screened Gravel shall be graded as follows:

Gradation of Screened Gravel (ConnDOT Gradation No. 6)

Sieve	Percent Passing by Weight
1"	100
3/4"	90-100
1/2"	20-55
3/8"	0-15
No. 4	0-5

2.7 SUBBASE

- A. Bank or Crushed Gravel

1. Sound, tough, durable particles of crushed or uncrushed gravel, free from soft, thin, elongated or laminated pieces. It shall be hard and durable enough to resist weathering, traffic abrasion and crushing.
2. Bank or crushed gravel for subbase shall be graded as follows:

Gradation of Bank or Crushed Gravel Subbase (ConnDOT Gradation "B")

Sieve	Percent Passing by Weight
5"	100
3 1/2"	90-100
1 1/2"	55-95
1/4"	25-60

Sieve	Percent Passing by Weight
No. 10	15-45
No. 40	5-25
No. 100	0-10
No. 200	0-5

B. Crusher-Run Stone

1. Sound, tough, durable broken stone. It shall be reasonably free from soft, thin, elongated, laminated, friable, micaceous or disintegrated pieces.
2. Loss on Abrasion: The crusher-run stone shall show a loss on abrasion of not more than fifty percent using AASHTO Method T 96.
3. Crusher-run stone shall for subbase shall be graded as follows:

Gradation of Crusher Run Stone Subbase (ConnDOT Gradation "A")

Sieve	Percent Passing by Weight
3 1/2"	100
1 1/2"	55-100
1/4"	25-60
No. 10	15-45
No. 40	5-25
No. 100	0-10
No. 200	0-5

2.8 PROCESSED AGGREGATE BASE

- A. Coarse aggregates and fine aggregates shall be combined and mixed by approved methods so that the resulting material shall conform to the following gradation:

Gradation of Processed Aggregate Base

Sieve	Percent Passing by Weight
2 1/2"	100
2"	95-100
3/4"	50-75
1/4"	25-45
No. 40	5-20
No. 100	2-12

- B. Coarse Aggregate: Either gravel, broken stone or a combination thereof. When tested by means of the Los Angeles Machine, using AASHTO Method T 96, the coarse aggregate shall not have a loss of more than 50%.
1. If gravel is used for the coarse aggregate, it shall consist of sound, tough, durable particles of crushed or uncrushed gravel or a mixture thereof, free from soft, thin, elongated or laminated pieces, lumps of clay, loam and vegetable or other deleterious substances.
 2. If broken stone is used for the coarse aggregate, it shall consist of sound, tough, durable fragments of rock of uniform quality throughout. It shall be free from soft disintegrated pieces, mud, dirt, organic or other injurious material.
 3. Soundness for Gravel and Broken Stone: When tested by magnesium sulfate solution for soundness using AASHTO Method T 104, the coarse aggregate shall show a loss of not more than 15% at the end of 5 cycles.
- C. Fine Aggregate: Natural sand, stone sand, screenings or any combination thereof. The fine aggregate shall be limited to material 95% of which passes a No. 4 (4.75-mm) sieve having square openings and not more than 8% of which passes a No. 200 (75- μ m) sieve. The material shall be free from clay, loam and deleterious materials.
1. Plasticity: When natural sand is used, the fine aggregate shall conform to the following:
 - a. When the fraction of the dry sample passing the No. 100 mesh sieve is 4% or less by weight (mass), no plastic limit test will be made.
 - b. When the fraction of the dry sample passing the No. 100 mesh sieve is greater than 4% and not greater than 8% by weight (mass), that fraction shall not have sufficient plasticity to permit the performing of the plastic limit test using AASHTO Method T 90.
 - c. When the fraction of the dry sample passing the No. 100 mesh sieve is greater than 8% by weight (mass), the sample will be washed; and the additional material passing the No. 100 mesh sieve shall be determined by AASHTO Method T 146, except that the No. 100 mesh sieve will be substituted for the No. 40 mesh sieve where the latter is specified in AASHTO Method T 146. The combined materials that passed the No. 100 mesh sieve shall not have sufficient plasticity to permit the performing of the plastic limit test using AASHTO Method T 90.
 2. Plasticity: When screenings or any combination of screenings and natural sand or any combination of stone sand and natural sand are used, the following requirements shall apply:
 - a. When the fraction of the dry sample passing the No. 100 mesh sieve is 6% or less by weight (mass), no plastic limit test will be made.
 - b. When the fraction of the dry sample passing the No. 100 mesh sieve is greater than 6% and not greater than 10% by mass, that fraction shall not have sufficient plasticity to permit the performing of the plastic limit test, using AASHTO Method T 90.
 - c. When the fraction of the dry sample passing the No. 100 mesh sieve is greater than 10% by weight (mass), the sample shall be washed; and additional material

passing the No. 100 mesh sieve shall be determined by AASHTO Method T 146, except that the No. 100 mesh sieve shall be substituted for the No. 40 mesh sieve where the latter is specified in AASHTO Method T 146. The combined materials that have passed the No. 100 mesh sieve shall not have sufficient plasticity to permit the performing of the plastic limit test using AASHTO Method T 90.

2.9 BEDDING

A. Slabs on grade

1. Granular Fill unless otherwise indicated.

B. [Utilities- Refer to applicable utility Specifications.]

C. [Utilities]

1. [Unless otherwise indicated, bedding shall consist of screened gravel, maximum size 3/4 inches and minimum size 3/8 inches.]
2. [Unless otherwise indicated, naturally or artificially graded mixture of natural or crushed gravel, crushed stone and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.]
3. [Thermoplastic Pipe: Unless otherwise indicated, ASTM D2321, bedding, haunching, and initial backfill material shall be placed in six-inch lifts and be Class IA, IB, or II embedment material unless otherwise approved by Engineer.]
4. [When clay, wet, soft or silty soil conditions prevail, 3/4-inch crushed stone shall be used for bedding of pipe.]

2.10 SAND

- A. Sand shall consist of clean, hard, durable, uncoated particles of quartz or other rock. It shall not contain more than 3% of material finer than a #200 sieve.
- B. Organic Impurities: Fine aggregate subjected to the colorimetric test shall not produce a color darker than Gardner Color Standard No. 11, using AASHTO T 21. If the fine aggregate fails to meet this requirement, the provisions of AASHTO M 6, Section 5.2, will govern.
- C. Sand shall be uniformly graded as follows:

Gradation of Sand

Sieve	Percent Passing by Weight
3/8"	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10

- D. The above gradation represents the extreme limits which shall determine suitability for use from all sources of supply. The gradation from any one source shall be reasonably uniform and not subject to the extreme percentages of gradation specified above. For the purpose of determining the degree of uniformity, a fineness modulus determination will be made upon representative samples from any source. Fine aggregate from any one source having a variation in fineness modulus greater than 0.20 either way from the fineness modulus of the representative sample will be rejected.

2.11 FLOWABLE CONCRETE FILL/BACKFILL (FLOWFILL)

- A. Cementitious material, ACI 229R, comprised of cement, aggregates, fly ash, water, and admixtures, capable of being poured or pumped, self-leveling, self-curing to specified strengths.
- B. Excavatable flowfill: Concrete strength shall be liquid enough to flow, be self-leveling and excavatable by hand methods. Unless otherwise specified, excavatable flowfill shall have a minimum 28 day compressive strength of 30 psi, and shall not exceed 100 psi.
- C. Non-excavatable flowable: Concrete strength shall be liquid enough to flow and be self-leveling and excavatable by machine equipment. Unless otherwise specified, non-excavatable flowfill shall have a minimum 28-day compressive strength of 125 psi, and shall not exceed 200 psi.

2.12 DETECTABLE WARNING TAPE

- A. Acid and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 - 1. Red: Electric power lines, electric power conduits and other electric power facilities.
 - 2. Yellow: Gas, oil petroleum products, steam, compressed air, compressed gas and all other hazardous materials.
 - 3. Blue: Water.
 - 4. Orange: Communication lines or cables, including but not limited to telephone, fire signals, cable television, and electronic controls.
 - 5. Green: Storm drainage and sanitary sewer systems, including force mains and other non-hazardous materials.
 - 6. Brown: Chilled Water and Other.

PART 3 EXECUTION

3.1 PREPARATION

- A. Notify "Call-Before-You-Dig" to request a utility mark-out for the Project Site prior to any earth disturbance. Provide written confirmation to Engineer that such mark-out has been completed.
- B. Verify site conditions before proceeding with demolition work. Field check the accuracy of the Drawings and inspect structures, utilities, and other site features prior to start of work and notify Engineer in writing, of any discrepancies or hazardous conditions.

- C. Take precautions for preventing injuries to persons or damage to property in or about the work. Protect structures, utilities, sidewalks, pavements and other improvements from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.
- D. Protect sub-grades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- E. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- F. When excavations are to be made in paved surfaces, the pavement shall be removed so as to provide a clean uniform edge with a minimum disturbance of remaining pavement. Saw cutting the pavement to provide a clean, uniform edge shall unless otherwise indicated.
- G. If pavement is removed in large pieces, it shall not be mixed with other excavated material, but shall be disposed of away from the site of the Work before the remainder of the excavation is made.

3.2 CLEARING AND GRUBBING

- A. Clear, grub, remove, and dispose of all vegetation and debris within the limits of construction, as designated on the plans or as required by Engineer. Contractor shall remove only those trees and shrubs absolutely necessary to allow for the construction. The work shall also include the preservation from injury or defacement of all vegetation or object designated to remain.
- B. **Refer to Section 31 1100 – Clearing and Grubbing.**

3.3 PROTECTION OF EXISTING FEATURES

A. General

- 1. Protect all existing improvements from damage unless those improvements are specifically designated for permanent removal, relocation, or temporary removal and replacement.
- 2. As excavation approaches underground structures, digging by machinery shall be discontinued and the excavation shall be done by means of hand tools.
- 3. Pavements: On paved surfaces to remain, do not use or operate tractors, bulldozers, or other power operated equipment, the treads or wheels of which are so shaped as to cut or otherwise damage such surfaces. All surfaces, which have been damaged by Contractor's operations, shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of operations. Suitable materials and methods shall be used for such restoration.

B. Utilities

- 1. Existing utilities remaining in service, including those remaining in service until after relocation, and relocated utilities shall be protected from damage. Before excavating near any existing utilities, notify the utility owner, coordinate protective work and comply with the utility owners' requirements. Coordinate with respective utility owners/operators as required.

2. Safeguard and protect from damage or movement any existing services, utilities, and utility structures uncovered or encountered which are to remain in service.
 3. All utility services shall be supported by suitable means so that the services shall not fail when tamping and settling occurs.
 4. Where known utilities are encountered, notify Engineer and document location and type of utility before proceeding with work in such area.
 5. When uncharted or incorrectly charted piping or utilities are encountered during excavation, stop work and notify Engineer immediately. Cooperate with the utility owners in maintaining their utilities in operation prior to resuming work.
- C. Retaining Structures: Provide bracing, shoring, sheeting, sheet piling, underpinning or other retaining structures necessary to guard against any movement or settlement of existing or new construction, utility systems, paving, or other improvements. Assume responsibility for the strength and adequacy of retaining structures, and for the safety and support of construction, utilities or paving, and for any movement, settlement or damage thereto. Retain the services of a licensed engineer as required to design bracing, shoring, sheeting, sheet piling, underpinning or other retaining structures.
- D. Replacement and Relocation
1. In case of damage, Contractor shall notify the appropriate party so that proper steps may be taken to repair any and all damage done. When the Owner does not wish to make the repairs themselves, all damage shall be repaired by Contractor, or, if not promptly done by him, Engineer may have the repairs made at the expense of Contractor.
 2. If certain existing structures are encountered that in the opinion of Engineer require temporary or permanent relocation or removal, Engineer may order in writing that Contractor undertake all or part of such work or to assist the Owner in performing such work. For such occurrences, Contractor shall be compensated as applicable, as extra work.
 3. In removing existing structures, Contractor shall use care to avoid damage to the material, and Engineer shall include for payment only those new materials, which, in his judgment, are necessary to replace those unavoidably damaged.
 4. The structures to which the provisions of the preceding two paragraphs shall apply include structures which (1) are not indicated on the Drawings or otherwise provided for, (2) encroach upon or are encountered near and substantially parallel to the edge of the excavation, and (3) in the opinion of Engineer will impede progress to such an extent that satisfactory construction cannot proceed until they have been changed in location, removed (to be later restored), or replaced. (See Item 3.19, "Sub Surface Obstructions" also).

3.4 DEWATERING

- A. Comply with all applicable permit requirements.
- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrade and from flooding Project site and surrounding area.

- C. Protect sub-grades from softening, undermining, washout and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - 2. Install de-watering system to keep subgrades dry and convey ground water away from excavations.

3.5 EXCAVATION

- A. Dust Control: During the progress of the Work, Contractor shall conduct his operations and maintain the area of his activities in order to minimize the creation and dispersion of dust. Refer to Section 01 5714- Temporary Dust Control.
- B. Excavate to the exact elevations shown on the plans, or as directed by Engineer. Where no dimensions are indicated, make excavations in such manner, and to such depths, elevations, and dimensions, that will give suitable room for construction of the work indicated on the Drawings. As applicable for utility installations, comply with trench limits shown on the Drawings.
- C. Furnish and place all sheeting, bracing, and supports, and render the bottom of the excavation firm and dry, and in all respects, acceptable for construction of the work.
- D. If Contractor excavates below the elevations specified on the plans, beyond the limits indicated on the plans, or where no dimensions are indicated, beyond depths, elevations, and dimensions reasonably necessary for construction of the work, Contractor shall bring the excavation back to the proper elevation and/or dimension by backfilling with Suitable Material that is approved by Engineer in accordance with the backfilling provisions specified herein. Engineer, or if applicable Geotechnical Engineer, shall have sole authority in determining the specific composition of such Suitable Material.
 - 1. Any increase in cost resulting from Unauthorized Excavation, including but not necessarily limited to backfilling, haul-off, increasing the size of footings or foundations, testing, schedule impact, or administrative impact shall be at Contractor's sole expense.
- E. If utilities are to be laid in new embankments, or other new fill areas which are more than 12 inches deep below the invert of the pipe, the fill material shall be placed and properly compacted to final grade or to a height of at least 3 feet above the top elevation of the pipe, whichever is the lesser, before laying pipe. Particular care shall be taken to ensure maximum consolidation of material under the pipe location. The pipe trench shall then be excavated as though in undisturbed material.

3.6 TRENCH EXCAVATION

- A. In general, trenches shall be excavated to such depth as will provide a cover depth as indicated on the Drawings from finished grade to the top of the pipe barrel. Deeper trenches shall be provided where necessary on account of the conformation of the ground and to permit the alignment of the pipe without undue deflection of joints.
- B. Trenches shall be excavated by hand or machinery to the width and depth indicated on the Drawings and specified herein. Depth shall account for thickness of the pipe and thickness of

bedding. All loose materials shall be removed from the bottom of the trench so that the bottom of the trench will be in an undisturbed condition.

- C. If in the opinion of Engineer, the material at or below the depth to which excavation for structures and pipes would normally be carried is unsuitable for foundation, it shall be removed to such widths and depths as directed and replaced with suitable material.
- D. Trench widths shall be 3 feet greater than the nominal inside diameter of pipe for such diameters of 36 inches or less. For diameters greater than 36 inches, the width shall be 4 feet greater than nominal inside diameter. Trench excavation for manholes, catch basins, drop inlets, etc. shall be two (2) feet outside the neat lines of the foundations. These limits may be adjusted for field conditions at the direction of Engineer.
- E. Bedding for pipe and utility structures will be as detailed on the Drawings.

3.7 APPROVAL OF SUBGRADE

- A. Notify Engineer, and Geotechnical Engineer if applicable, when excavations have reached required subgrade elevation.
- B. If Engineer and, if applicable, Geotechnical Engineer determines that Unacceptable Material is present, continue excavation of such Unacceptable Material and replace with approved Satisfactory Materials as directed. The replacement of Unacceptable Material with Satisfactory Materials will be paid for as a change in the work according to applicable provisions of the contract.
- C. Protect subgrade from disturbance at all times. Reconstruct sub-grades damaged by freezing temperatures, frost, rain, accumulated water or construction activities, as directed by Engineer. Excavation and replacement with structural fill of any disturbed or softened materials resulting from inadequate preparation, inadequate dewatering, or inadequate protection, shall be at Contractor's sole expense.

3.8 TUNNELING

- A. In general, excavation shall be made in open cut from the surface and Contractor shall not be allowed to do any tunneling without obtaining permission from Engineer, and then only according to methods approved by him, and at no additional cost to the Owner. This permission will only be given where a line is to be laid to a point behind the curb, across a paved street, or where, in the opinion of the Engineer, it is necessary to tunnel short sections on account of proximity of adjacent walls, utilities, structures, to avoid important roots of trees or large masses of roots, or to ensure against root damage endangering the life of trees near the pipeline location. Such excavations then can be made in alternate sections of open cut and tunnel, the length of the tunnel sections to be specified by Engineer. These tunnel sections shall be cut underneath to a wedge with its edge horizontally across the pipe, and backfilled tightly by ramming and tamping from each end.

3.9 FILL AND BACKFILL

- A. Fill: Contractor shall remove loam and topsoil, loose vegetable matter, stumps, large roots, etc., from areas upon which embankments will be built or material will be placed as fill to adjust subgrade prior to final grading. The subgrade shall be prepared by forking, furrowing, or plowing such that the first layer of the new material placed thereon, will be well bonded to it.

- B. Backfill: Common Fill material may be used as backfill when indicated on the Drawings or when authorized by Engineer (or as applicable Geotechnical Engineer) if Contractor can achieve required minimum dry density after compaction. Backfilling shall be done as promptly as is consistent with non-injury to pipe or structures, but no backfilling shall be done before Engineer (or as applicable Geotechnical Engineer) gives permission.
- C. Frozen material shall not be placed in any fill or backfill, nor shall any fill or backfill be placed upon frozen material. Previously frozen material shall be removed, or shall be otherwise treated as required, before new fill or backfill is placed.
- D. After the subgrade has been prepared, fill material shall be placed thereon and built up in successive layers not exceeding twelve (12) inches before compaction until it has reached the required elevation.
 - 1. When gravel fill or other material is used for foundation of structures, it shall be spread in layers of uniform thickness not exceeding six (6) inches before compaction.
- E. Upon completion of filling and backfilling, all surplus material shall be removed and surfaces to remain which are affected in any way by the work restored to the condition in which they were before ground was broken. All surplus materials shall become the property of Contractor. If Contractor fails to promptly remove such surplus materials, Engineer may have the same done and charge all associated costs to Contractor, including deduction from payments due.

3.10 BACKFILLING UTILITIES

- A. As soon as practical after utility has been placed into bedding and joints properly made, backfilling shall begin, and shall continue without delay.
- B. Placement of bedding over pipe prior to placement of backfill shall be as indicated on the Drawings. Hand-place bedding at the sides of the pipe and to the limits indicated on the Drawings over the pipe. Bedding placed over pipe shall be in 6-inch layers, leveled along the length and width of the trench and thoroughly compacted with approved tampers.
- C. Install warning tape as indicated on the Drawings unless otherwise specified by the utility owner/operator.

3.11 BACKFILLING AT STRUCTURES

- A. No backfill shall be deposited against concrete until the concrete has obtained sufficient strength to withstand the earth pressure placed upon it and in no case less than seven days, nor before carrying out and satisfactorily completing the tests for watertight structures specified elsewhere.
- B. Prior to placing backfill, subgrade shall be thoroughly compacted. Soft or loose material evident during compaction shall be removed and replaced with Granular Fill.
- C. Fill placed around arches, rigid frames, box culverts and piers shall be deposited on both sides of the structure to approximately the same elevation at the same time. Each layer of backfill shall be spread to a thickness not exceeding 6 inches deep after compaction and shall be thoroughly compacted by the use of power rollers or other motorized vehicular equipment, by tamping with mechanical rammers or vibrators, or by pneumatic tampers. Any equipment not principally manufactured for compaction purposes or which is not in proper working order in all respects shall not be used within the area described above.

- D. Bring backfill to sub-grade elevations. Slope backfill at exterior of building to drain water away from building.

3.12 COMPACTION

- A. Each layer of fill or backfill material shall be compacted by the use of compaction equipment consisting of rollers, compactors or a combination thereof. Earth-moving and other equipment not specifically manufactured for compaction purposes will not be considered as compaction equipment. At such points as cannot be reached by mobile mechanical equipment, or where such equipment is not permitted, the materials shall be thoroughly compacted by the use of suitable power- driven tampers.
- B. Previously placed or new materials shall be moistened by sprinkling, if required, to ensure proper bond and compaction. No compacting shall be done when the material is too wet, from either rain or application of water, to compact it properly. At such times the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compaction, or such other precautions shall be taken as may be necessary to obtain proper compaction.
- C. Special attention shall be given to compaction in places close to walls where motorized vehicular compaction equipment cannot reach. Within 3 feet of the back face of walls and within a greater distance at angle points of walls, each layer of backfill shall be compacted by mechanical rammers, vibrators or pneumatic tampers.
- D. Each layer of fill or backfill shall be compacted at optimum moisture content. No subsequent layer shall be placed until the specified compaction is obtained for the previous layer.
- E. Compaction Density: Compaction density shall be expressed as a percentage of maximum dry density at optimum moisture content according to ASTM D 1557 Method C. Density indicated is minimum required.
 - 1. Under structures, building slabs, and steps: 95 %
 - 2. At building foundations: 95 %
 - 3. Utilities, below pipe centerline: 95%
 - 4. Utilities below unpaved surface, above pipe centerline: 92%
 - 5. Utilities below paved surface, above pipe centerline: 95%
 - 6. Embankments: 92%
 - 7. Landscaped areas: 90 %.
 - 8. Natural grass athletic fields and similar recreational fields: 93%

3.13 SUBSURFACE OBSTRUCTIONS

- A. As a general rule, sub-surface obstructions encountered along the route of the pipeline shall be considered as follows:
 - 1. Crossing Obstruction: All pipes, conduits, wires, etc. of whatever nature whose centerline lies at an angle of 20 degrees or greater to the centerline of the pipe being installed shall

be considered as crossing obstructions and shall be protected, or repaired or replaced if damaged, or relocated, all at no additional cost to the Owner.

2. Interfering Obstructions: All pipes, conduits, wires, etc. of whatever nature whose centerline lies at an angle of less than 20 degrees, but more than 5 degrees to the centerline of the pipe being installed, shall be considered as interfering obstructions. Costs for supporting such obstructions in place during installation of the new pipe shall be paid for by the Owner. Costs for supporting interfering obstructions shall not be construed to include any costs for excavation. Repairing or replacing damaged interfering obstructions, or relocation shall be accomplished at no additional cost to the Owner.
3. Parallel Obstructions: All pipes, conduits, wires, etc. of whatever nature whose centerline lies at an angle of 5 degrees or less, or is truly parallel and less than 0.5 feet offset from outside the normal trench limits, as specified in Subarticle 3.5 B. of this Section, of the pipe being installed, shall be considered parallel obstructions. Costs for supporting such obstructions in place during installation of the new pipe, including excavation, may be paid for by the Owner, or Owner may elect to pay for the cost of replacing such obstructions. Should Owner first elect to pay the cost of supporting the obstruction and then elect to pay the cost of replacing the obstruction, approved costs for supporting the obstruction, including excavation, incurred prior to electing replacement costs shall also be paid. After Owner elects to pay replacement costs, only replacement costs will be paid for all additional work in the vicinity of the parallel obstruction.
4. Angle measurement between centerline of obstructing pipe, conduit, wire, etc. and centerline of the pipe being installed shall be taken from between the horizontal projection of the centerlines at ground surface. Parallel offset distance between centerline of obstructing pipe, conduit, wire, etc. and the outside of normal trench limits of the pipe being installed shall be taken from between the horizontal projection of the centerlines and outside trench limit at ground surface.

END OF SECTION

SECTION 32 12 16

BITUMINOUS CONCRETE PAVEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Bituminous concrete paving for streets, driveways, and parking areas.
2. Installation of bituminous concrete overlays over existing pavement, including surface preparation, truing and leveling pavement, tack coating and all other associated items and operations necessary and required to complete the installation.

1.2 REFERENCES

- A.** Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B.** Code of Federal Regulations (CFR).
1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C.** State of Connecticut Department of Transportation (ConnDOT).
1. Standard Specifications for Roads, Bridges and Incidental Construction, Form 817, 2016 and any supplements.
 2. Standard Specifications for Roads, Bridges and Incidental Construction, Form 817, 2016, Supplemental Section 4.06 – Bituminous Concrete (Revised 3/17/14).
 3. Standard Specifications for Roads, Bridges and Incidental Construction, Form 817, 2016, Supplemental Section M.04 – Bituminous Concrete (Revised 1/28/15).
- D.** American Association of State Highway and Transportation Officials (AASHTO).
1. AASHTO M-17 - Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
 2. AASHTO M 82, Cutback Asphalt (Medium-Curing Type) .
 3. AASHTO M-208 - Standard Method of Test for Unconfined Compressive Strength of Cohesive Soil-ASTM Designation D 2166.
 4. AASHTO M-320 - Standard Specification for Performance-Graded Asphalt Binder.
 5. AASHTO R-26 - Standard Recommended Practice for Certifying Suppliers of Performance-Graded Asphalt Binders.
 6. AASHTO R-29 - Standard Practice for Grading or Verifying the Performance Grade of an Asphalt Binder.

7. AASHTO T-27 - Sieve Analysis of Fine and Course Aggregates.
 8. AASHTO T-84 - Specific Gravity and Absorption of Fine Aggregates.
 9. AASHTO T-85 - Specific Gravity and Absorption of Coarse Aggregates.
 10. AASHTO T-96 - Standard Method of Test for Resistance to Degradation of small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 11. AASHTO T 104 Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.
 12. AASHTO T-209 - Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
 13. AASHTO T-245 - Standard Method of Test for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
- E. American Society for Testing and Materials (ASTM)
1. ASTM D1188 - Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.
 2. ASTM D2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.

1.3 SPECIFICATIONS

- A. All work performed under this Section shall conform to the Standard Specifications for Roads, Bridges and Incidental Construction, Form 817, 2016, Supplemental Section 4.06 – Bituminous Concrete (Revised 3/17/14). This Specification is hereby incorporated into this Section by reference.

1.4 TESTING

- A. Owner will retain a testing entity to perform observation and testing of the work under this Section. The testing entity's presence does not constitute supervision or direction of Contractor's work. Neither the presence of the testing entity nor any observations and testing performed by him, nor any notice or failure to give notice shall excuse Contractor from conformance with these Specifications or from defects discovered in his work.
- B. Each week, Contractor shall advise the University Representative of anticipated testing requirements during the following week, based on anticipated construction activities. The Contractor shall also notify the University Representative and testing laboratory 24 hours before the expected time of testing.

PART 2 PRODUCTS

2.1 GENERAL

- A. All work performed under this Section shall conform to the Standard Specifications for Roads, Bridges and Incidental Construction, Form 817, 2016, Supplemental Section M.04 – Bituminous Concrete (Revised 1/28/15). This Specification is attached hereto and is hereby incorporated into this Section.

PART 3 EXECUTION

3.1 GENERAL

- A. Contractor shall install all pavements as specified in the location and to the grades as shown on the Drawings and/or approved by Engineer. Materials, methods of construction, and type and thickness of pavement courses shall be as shown on the Details of the Drawings and as specified herein.
- B. Owner and its representatives shall have access to all parts of the Work under construction at all times.

3.2 SPECIFICATIONS

- A. Execute the work of this Section in accordance with the Standard Specifications for Roads, Bridges and Incidental Construction, Form 817, 2016, Supplemental Section 4.06 – Bituminous Concrete (Revised 3/17/14). This Specification is attached hereto and is hereby incorporated into this Section.

END OF SECTION

SECTION 32 16 23

CURBING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Granite curb.
 - 2. Precast concrete curb.
 - 3. Cast-in-place concrete curb.
 - 4. Bituminous concrete lip curb.
- B. Work shall also include all associated items and operations necessary and required to complete the installations, including, but not limited to, surface preparation, finishing and cleanup.
- C. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.
- D. Contractor is responsible for all health and safety.

1.2 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. United States Code of Federal Regulations (CFR)
 - 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. State of Connecticut Department of Transportation (ConnDOT)
 - 1. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 819, 2024 and any supplements.
- D. ASTM International (ASTM).
 - 1. ASTM C33 – Standard Specification for Concrete Aggregates.
 - 2. ASTM C94 – Standard Specification for Ready-Mixed Concrete.
 - 3. ASTM C150 – Standard Specification for Portland Cement.
 - 4. ASTM D235 – Standard Specification for Mineral Spirits (Petroleum Spirits).
 - 5. ASTM C207 – Standard Specification for Hydrated Lime for Masonry Purposes
 - 6. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.

7. ASTM C309 – Standard Specification for Liquid Membrane - Forming Compounds for Curbing Concrete.
 8. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.
 9. ASTM C989 – Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
 10. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 11. ASTM D1752 – Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
 12. American Concrete Institute (ACI)
 13. ACI 304 – Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- E. American Association of State Highway and Transportation Officials (AASHTO)
1. AASHTO M 6 – Standard Specification for Fine Aggregate for Portland Cement Concrete.
 2. AASHTO M 85 – Standard Specification for Portland Cement (Chemical and Physical).
 3. AASHTO M 133 – Standard Specification for Preservatives and Pressure Treatment Processes for Timber.
 4. AASHTO M 213 – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
 5. AASHTO M 233 – Standard Specification for Boiled Linseed Oil Mixture for Treatment of Portland Cement Concrete.
 6. AASHTO M 240 – Standard Specification for Blended Hydraulic Cement.
 7. AASHTO T11 – Standard Method of Test for Materials Finer Than 75-um (No. 200) Sieve in Mineral Aggregates by Washing.
 8. AASHTO T21 – Standard Method of Test for Organic Impurities in Fine Aggregate for Concrete.

1.3 SUBMITTALS

- A. Submit Shop Drawings, manufacturer's literature, material certificates or other data indicating compliance with these Specifications.
- B. Precast Curbing: Submit for approval, data indicating size, shape and dimensions, finish and setting method.
- C. Stone Curbing: Submit for approval, the name of the quarry and the type of curb which the Contractor proposes to use. Samples of curbing shall be submitted for approval only when requested by the Engineer. Such submission shall be made sufficiently in advance of ordering so that the Engineer may have an opportunity to judge the granite, both as to quality and appearance.

- D. Precast Curbing: Submit representative test specimens of the cured concrete used in precast units showing a compressive strength of 4,000 pounds prior to shipping any units.
- E. Submit testing data for concrete as required by Section 03 3200 – Site Cast-in-Place Concrete.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Granite and precast concrete curb units shall be delivered to the job adequately protected from damage during transit.
- B. Curbing shall be protected against staining, chipping, and other damage. Cracked, badly chipped, or stained units will be rejected and shall not be employed in the Work.

PART 2 PRODUCTS

2.1 GRANITE CURBING

- A. Stone for this work shall be hard and durable granite, fundamentally light grey in color, of general uniform texture, of smooth splitting appearance, free from seams or imperfections that would impair its structural reliability and containing only such color variations as in the opinion of Engineer would reasonably be characteristic of the material source.
- B. No granite from any other quarry as indicated in Contractor's submittal shall be used unless it has been properly approved.
- C. Finish and surface dimensions for granite curbing shall conform to the following:
 - 1. The curbstone shall have a top surface free from wind; it shall be pointed, peen-hammered or sawed to an approximately true plane, and shall have no projections or depressions greater than $\frac{1}{8}$ inch. The front and back arris lines shall be pitched straight and true.
 - 2. On the back surface of the curbstone there shall be no projection for 3 inches down from the top which would fall outside of a plane having a batter of 4 inches in 12 inches from the back arris line. The front face shall be at right angles to the plane of the top and shall be smooth quarry-split, free from drill holes in the exposed face.
 - 3. There shall be no projections greater than $\frac{3}{4}$ inch, or depressions greater than $\frac{1}{2}$ inch, measured from the vertical plane of the face through the top arris line for a distance of 8 inches down from the top. For the remaining distance, there shall be no projections or depressions greater than 1 inch measured in the same manner. The arris lines at the ends shall be pitched with no variation from the plane of the face greater than $\frac{1}{8}$ inch.
 - 4. The ends of all stones shall be square with the planes of the top and face and so finished that, when the stones are placed end to end as closely as possible, no space more than $\frac{1}{2}$ inch shall show in the joint for the full width of the top or down on the face for 8 inches.
 - 5. On curbstones having a length of 6 feet or more, the remainder of the end may break back not over 9 inches; whereas, on shorter curbstones, they shall not break back more than 6 inches.
 - 6. If sawed, the curbstones shall be thoroughly cleaned of any iron rust or iron particles. For straight curbing, 80% of the stones shall be furnished in lengths of not less than 6 feet,

and the remaining 20% in lengths of not less than 4 feet, interspersed at random, to allow for closures.

7. Curbstones to be set on a radius of 100 feet or less shall be cut to the curve required, and their ends shall be cut on radial lines.

8. Requirements for length of individual stones in curved curbing vary with radii of curves.

2.2 BLUESTONE CURBING

- A. Stone for this work shall be of a good grade, free from structural defects, and shall be approved by Engineer.
- B. Stone shall conform to the requirements contained herein for stone granite curbing, except that the top surface and the top 8 inches of the front face shall be “fine-pointed” in conformity with the following:
 - 1. Projections on fine-pointed finished surfaces shall not exceed ½ inch.

2.3 PRECAST CONCRETE CURB

- A. Concrete for precast concrete curbing shall have a minimum compressive strength of 4,000 psi at 28 days, and shall contain 5 to 7 percent entrained air.
- B. Precast concrete curb shall be treated with a protective coating of Linseed Anti-Spalling Compound. Boiled linseed oil mixture shall conform to AASHTO M 233 and shall be composed of 50 percent (50 %) double boiled linseed oil and 50 percent (50%) petroleum spirits, ASTM D235, by volume.
- C. Finish and Color: Precast curb units shall be rub-finished in the following manner:
 - 1. After the concrete has properly hardened, the exposed surfaces shall be rubbed with a No. 16 carborundum stone or an abrasive of approved equal in a manner to fully remove cement enamel finish and expose a durable sand grain finish satisfactory to Engineer. No cement shall be used in the rubbing process.
 - 2. The finish of these units shall be uniform and shall conform to those of adjacent work in their final position.
- D. Precast concrete curb sections shall be furnished with sockets in each end to receive dowels to maintain the horizontal and vertical alignment of the curb. The dowel socket shall be 1¼ inch by 2½ inches.
- E. Dowels: Steel, ½ inch by 4 inch with minimum yield strength of 36,000 psi. Dowels shall be supplied by the curb manufacturer.

2.4 CAST-IN-PLACE CONCRETE CURB

- A. Concrete and reinforcement for cast-in-place concrete curbs shall be as specified in Section 03 3200 – Site-Cast-in-Place Concrete.

2.5 BITUMINOUS CONCRETE LIP CURBING

- A. Bituminous concrete for curbing shall be as specified in Section 32 1216 – Bituminous Pavement.

2.6 CEMENT MORTAR

- A. Mortar shall be composed of one part Portland Cement, ASTM C150, and two parts, by volume, of surface dry fine aggregate. Hydrated lime, ASTM C207, in an amount not to exceed 4 pounds of lime to each bag of Portland Cement, may be added at the option of Engineer. Cement and hydrated lime shall conform to the following requirements:
1. Portland cement: Types I, II or IS.
 - a. Cement having a temperature exceeding 160°F (71°C) at the time of delivery to the mixer shall not be used in the concrete.
 - b. Types I, II, and III portland cement shall conform to the requirements of AASHTO M 85.
 - c. Type IS, Portland blast-furnace slag cement and Type IP, portland-pozzolan cement shall conform to the requirements of AASHTO M 240. The use of other approved cementitious material as a partial replacement for Type IS or Type IP cement will not be permitted.
 - d. Type I and Type III portland cement shall be used only when required or expressly permitted by Contract or Engineer.
 2. Hydrated lime: ASTM C6.
 3. Fine aggregate: Fine aggregate shall be sand consisting of clean, hard, durable, uncoated particles of quartz or other rock, free from lumps of clay, soft or flaky material, loam, organic or other injurious material. In no case shall sand containing lumps of frozen material be used.
 - a. Fine aggregate shall contain not more than 3% of material finer than a No. 200 (75 µm) sieve, using AASHTO T 11.
 - b. Organic Impurities: Fine aggregate subjected to the colorimetric test shall not produce a color darker than Gardner Color Standard No. 11, using AASHTO T 21. If the fine aggregate fails to meet this requirement, the provisions of AASHTO M 6, Section 5.2, will govern.
 - c. Gradation: For laying stone or precast units, fine aggregate shall be uniformly graded from coarse to fine and shall meet the following gradation requirements:

Aggregate Gradation (Cement Mortar for Laying Stone or Precast Units)

Sieve	Percent Passing
$\frac{3}{8}$ "	100
No. 4	95–100
No. 8	80–100
No. 16	50–85
No. 30	25–60
No. 50	10–30

Sieve	Percent Passing
No. 100	2–10

- d. Gradation: For pointing stone or precast units, fine aggregate shall be uniformly graded from coarse to fine and shall meet the following gradation requirements:

Aggregate Gradation (Cement Mortar for Pointing Stone or Precast Units)

Sieve	Percent Passing
No. 8	100
No. 50	10–40
No. 100	0–10

4. Water: Potable quality.

2.7 JOINT FILLER

- A. Preformed expansion joint filler or wood joint filler as indicated on the plans.
- B. Preformed expansion joint filler shall be the bituminous cellular type and shall conform to the requirements of AASHTO M213.
- C. Boards for wood joint filler shall be planed on two sides and shall be either redwood, cypress or white pine. Redwood and cypress boards shall be of sound heartwood. White pine boards shall be of sound sapwood.
 1. Occasional small, sound knots and medium surface checks will be permitted provided the board is free of any defects that will impair its usefulness for the purpose intended. The joint filler may be composed of more than one length of board in the length of the joint, but no board of a length less than 6 feet may be used; and the separate boards shall be held securely to form a straight joint. Boards composed of pieces that are jointed and glued shall be considered as one board.
 2. Dimensions shall be as specified or shown on the plans; and tolerances of plus $\frac{1}{16}$ -inch thickness, plus $\frac{1}{8}$ -inch depth and plus $\frac{1}{4}$ -inch length will be permitted.
 3. All wood joint filler boards shall be given a preservative treatment by brushing with a creosote oil conforming to AASHTO M133. After treatment, the boards shall be stacked in piles, each layer separated from the next by spacers at least $\frac{1}{4}$ inch thick; and the boards shall not be used until 24 hours after treatment.

2.8 TRANSITION SECTIONS

- A. Horizontal transition sections shall be provided at all locations where curb sections change (i.e., vertical to sloped). Vertical transition sections shall also be provided for precast curb sections at handicapped ramps to create a smooth transition with a doveled joint. Vertical transition sections for stone curb shall be made as shown on the Drawings.

PART 3 EXECUTION

3.1 GENERAL

- A. Trenching, excavation, backfilling, and compaction shall be completed in accordance with Section 31 2310 – Earthwork, except as modified within this Section.
- B. Cement Mortar Bedding, if required, shall be placed as indicated in details in accordance with Section 03 3200 – Site Cast-In-Place Concrete.

3.2 GRANITE CURB

- A. Excavation shall be made in accordance with details on the plans and shall extend 6 inches below and behind finished curb section.
 - 1. Screened gravel base shall be compacted to a firm, even surface.
- B. Curbing shall be set on edge and settled into place with a heavy wooden hand-rammer, to the line and grade required, straight and true for the full depth.
 - 1. Joints of the stone curbing or curbing shall be filled with mortar for the full depth of the curbing, and neatly pointed on the top and front exposed portions. After pointing, the curbstone or curbing shall be satisfactory cleaned of all excess mortar that have been forced out of the joints.
 - 2. Ends of the stone curbing at driveways and intersections shall be cut at a bevel or rounded, as directed by Engineer.
 - 3. Handicap ramps shall be placed in the curb line by lowering the curb as shown on the drawings. The depressed sections of curbing shall be mitered as required.
- C. Immediately after curb is set and jointed, the trench shall be backfilled with approved material; the first layer to be 4 inches in depth, thoroughly rammed; the other layers to be not more than 6 inches in depth and thoroughly rammed until the trench is filled.
- D. Curbing excavation and installation procedures at existing roadway shall be as specified above with the following additions:
 - 1. Prior to excavation for existing stone curb removal, the pavement surface shall be cut a maximum of two (2) feet from the face of curb with appropriate pavement cutting equipment. Pavement patching shall conform to Asphalt Paving: Section 321216.
 - 2. Existing curb shall be cut, carefully excavated, and removed in such a manner to protect the existing pavement to remain.
 - 3. New stone curb shall be set to match top of existing stone curb at abutting sections and, if required, transitioned to a typical section shown on drawings within the first section of curb.
 - 4. Where new curb is to be installed at existing paved areas, curb shall be set as specified except that cement concrete shall be placed along the front face of the curb as shown on the details in the Drawings.

3.3 PRECAST CONCRETE CURB

- A. Precast units delivered to the site shall be inspected for damage, unloaded and placed along excavated trench or other designated location with the minimum amount of handling.

1. Materials shall be handled in such a manner as to insure delivery to trench in a sound and undamaged condition.
 2. All individual pieces of curbed curbing shall be marked to correspond to the radius and location where curbing is to be set.
- B. Excavation shall be made in accordance with details on the plans and shall extend 6 inches below and behind finished curb sections.
1. Screened gravel base shall be compacted to a firm, even surface.
- C. Installation of precast concrete curb shall be completed within the prepared trench such that each section is doweled to the next continuously and conforming to the line, grade, and cross-section shown on the plans, unless otherwise directed by Engineer. Installation shall be completed in such a manner as to prevent damage to the precast units.
- D. After the curb is set, trench shall be backfilled immediately with approved material. The first layer to be 4 inches in depth, thoroughly rammed, the other layers to be not more than 6 inches in depth and thoroughly rammed until the trench is filled. Care is to be taken not to affect the line or grade of the curb during this procedure.
- E. All curb joints shall be filled with caulking compound (color-cement mortar grey). One joint every 50 feet shall be left clean of caulk to allow for expansion.

3.4 CAST-IN-PLACE CONCRETE CURB

- A. General Requirements: Concrete curb shall be constructed of concrete and shall be cast-in-place on the prepared subbase in accordance with the dimensions and details line and grade shown on the Drawings. Curbing shall be constructed using conventional forms and in segments separated by construction joints and expansion joints as specified herein. This item shall consist of concrete curbing constructed or as ordered and in conformity with these specifications.
- B. Forms: Forms shall be metal or acceptable planed and matched lumber, straight and free from warp or other irregularities that will adversely affect the installation. Forms shall conform to the curb cross-section shown on the Drawings and shall be carefully set to line and grade and thoroughly braced and secured in place so that there will be no displacement during placement of the concrete. All forms shall be thoroughly cleaned prior to reuse.
- C. Placing of Concrete: Prior to placement of the concrete, the subgrade shall be moistened and the contact surfaces of the forms shall be given a light coating of oil that will not discolor the concrete. Concrete shall then be placed in the form as near to its final position as practicable, struck off with a template, spaded to prevent "rock-pockets" or "honey combing" adjacent to the forms and finished to a smooth even surface. The concrete may be compacted by mechanical vibrators if approved by Engineer. Placing by slip form methods shall be approved by Engineer.
- D. Expansion Joints: Vertical expansion joints shall be located approximately every seventy-five (75) feet and shall be so arranged that they shall match expansion joints in any adjacent concrete pavements and sidewalks. Unless directed otherwise, expansion joints shall also be installed at the PC and PT of all radius curb. Expansion joints shall be constructed vertical, plumb, and at right angles to the face of the curb.
1. Prior to concreting, all exposed surfaces of the wood filler shall be given a light brush coating of form oil.

2. They shall be one-half ($\frac{1}{2}$) inch in width and formed with premolded bituminous joint filler cut to conform to the cross-section of the curb/curb gutter.
- E. Construction Joints: Vertical construction joints shall be located approximately every fifteen (15) feet being equally spaced between expansion joints. The length of these curb/curb gutter segments may be varied slightly for closures but in no case shall they be less than eight (8) feet. Construction joints shall be vertical, plumb and at right angles to the face of the curb and shall be formed by approved method that will provide complete separation of the curb segments during the placing of the concrete. If curb is formed by slip form methods, the joints shall be sawed as soon as practicable after the concrete has set to preclude raveling during the sawing and before any shrinkage cracking occurs in the concrete.
- F. Finishing: Forms shall be left in place for twenty-four (24) hours or until the concrete has sufficiently hardened as determined by Engineer so that they can be removed without injury to the curb. Upon removal of the forms, the exposed faces of the curb/curb gutter shall be immediately rubbed to a uniform surface. Rubbing shall be performed by experienced and competent concrete finishers. No plastering will be permitted.

3.5 BITUMINOUS CONCRETE LIP CURB

A. General Requirements

1. Bituminous curbing shall be constructed by the use of an approved self-propelled extruding curb machine equipped with a material hopper, distributing screw and curb forming device capable of placing the bituminous mixture to the required lines, grades and proper curb cross-section. Prior to the placement of any curb, Contractor shall submit a detail of the cross-section of the curb mold that he proposes to use to Engineer for approval.

B. Surface Preparation

1. When curbing is to be placed on existing bituminous pavements, concrete pavements or newly laid bituminous pavements which have been in place more than twenty-four (24) hours, the surface on which the curb is to be placed shall be swept and cleaned, thoroughly dried, and immediately prior to placement of the curb, the surface to be occupied by the curb shall be given an application of tack coat material.
2. Prevent spread of tack coat material beyond the area to be occupied by the curb.
3. Recently placed bituminous concrete pavement, which have been placed less than twenty-four (24) hours prior to placement of the curb need only be thoroughly swept and cleaned.

C. Placing and Compaction

1. The hot bituminous mixture shall be placed in the hopper of the curb paver without segregation and extruded through the mold form to provide the proper compaction and surface texture.
2. The curb paver shall be properly supported and weighted during operation along the edge of the pavement and shall be guided along string or chalk lines to maintain the proper alignment and level of the completed curb.

3. Any portions of the completed curb, which are not satisfactorily compacted, or show signs of sagging, cracking, or distortion, or do not conform to the required lines, grades or cross-section for any reason, and which cannot be satisfactorily repaired during construction, shall be removed and replaced at no additional cost to the Owner.

D. Joints

1. Bituminous curb construction shall be a continuous operation in one direction only, to eliminate joints. Excessive joints will be cause for rejection of entire length of installation.
2. When the placing of the curb is discontinued for a length of time that permits the mixture to become chilled, the curb shall be cut in a true vertical plane and the exposed end painted with a thin uniform coat of hot asphalt cement just prior to placing the fresh curb mixture against the previously constructed curb to insure a continuous bond. Joints that are not smooth and uniform, exhibit distortion, or are patched will be rejected.

END OF SECTION

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Temporary or permanent painted pavement markings, including but not limited to center lines, lane lines and shoulder lines, stop bars, crosswalks, parking stalls, lane arrows, legends, markings within gore areas, and painting of paved islands or medians.
 - 2. Temporary plastic pavement marking tape.
 - 3. Black line mask pavement marking tape.
 - 4. Maintaining access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs, and warning lights as required.
- B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.2 SUBMITTALS

- A. Submit material specifications and shop drawings for all materials furnished under this Section.
- B. Submit material certificates signed by the material producer and Contractor, certifying that materials comply with these Specifications.

1.3 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. State of Connecticut Department of Transportation (ConnDOT)
 - 1. Standard Specifications for Roads, Bridges and Incidental Construction, Form 819, 2024 and any supplements.
- C. Code of Federal Regulations (CFR)
 - 1. 29 CFR 1926, Safety and Health Regulations for Construction
- D. ASTM International (ASTM)
 - 1. ASTM C501 - Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.

2. ASTM D211 - Standard Specification for Chrome Yellow and Chrome Orange Pigments.
 3. ASTM D476 - Standard Classification for Dry Pigmentary Titanium Dioxide Products.
 4. ASTM D562 - Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer.
 5. ASTM D605 - Standard Specification for Magnesium Silicate Pigment (Talc).
 6. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
 7. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.
 8. ASTM D711 - Standard Test Method for No-Pick-Up Time of Traffic Paint.
 9. ASTM D869 - Standard Test Method for Evaluating Degree of Settling of Paint.
 10. ASTM D1475 - Standard Test Method for Density of Liquid Coatings, Inks, and Related Products.
 11. ASTM D1763 - Standard Specification for Epoxy Resins.
 12. ASTM D2240 - Standard Test Method for Rubber Property- Durometer Hardness.
 13. ASTM D2486 - Standard Test Methods for Scrub Resistance of Wall Paints.
 14. ASTM D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
 15. ASTM D4505 - Standard Specification for Preformed Retroreflective Pavement Marking Tape for Extended Service Life.
 16. ASTM E303 - Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester.
 17. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials.
- E. American Association of State Highway and Transportation Officials (AASHTO)
1. AASHTO M 247 - Standard Specification for Glass Beads Used in Traffic Paints.
- F. American Concrete Institute
1. ACI 503R - Use of Epoxy Compounds with Concrete.
- G. United States General Services Administration, Federal Specifications.
1. Federal Specification TT-P-1952D - Paint, Traffic and Air Field Marking, Water Emulsion Base.
- H. United States General Services Administration, Federal Standards.
1. Federal Standard No. 595 - Colors Used in Government Procurement.

1.4 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- B. Contractor shall furnish one technical expert, who shall be fully knowledgeable about all equipment operations and application techniques, to oversee the work of this Section.

PART 2 PRODUCTS

2.1 WATERBORNE PAVEMENT MARKING PAINT

A. General

- 1. White and yellow fast-drying waterborne pavement marking paint, low VOC, ready-mixed, one component, 100 percent acrylic, Federal Specification TT-P-1952D.
- 2. Paint shall be capable of being applied with paint striping equipment at ambient temperatures.
- 3. Weight per gallon shall not be less than 12.5 pounds/gallon when tested in accordance with ASTM D 1475.
- 4. Colors: ASTM D211 and per Federal Standard No. 595.

B. Manufacture

- 1. Paint shall be formulated and manufactured from first-grade raw materials and shall be free from defects and imperfections that might adversely affect the serviceability of the finished product. The materials shall not exhibit settling or jellying after storage in the sealed containers as received that will affect the performance of the products. The paint shall provide the proper anchorage, refraction and reflection for the finished glass spheres when applied as specified.

C. Composition

- 1. Composition of the paint shall be at the discretion of the manufacturer, provided that the finished product meets the requirements of any applicable Federal, State or Local regulations for products of this type and the requirements as follows:
 - a. Paint shall not contain more than 0.06% lead.
 - b. Total nonvolatile shall not be less than 70% by weight (mass).
 - c. Pigment shall be 45-55% by weight (mass).
 - d. Resin solids shall be composed of 100% acrylic emulsion polymer.
 - e. Volatile organic compounds shall not exceed 150 grams/liter, excluding water.
 - f. Closed-cup flash point shall not be less than 100°F (38°C), and weight per gallon shall not be less than 12.5 pounds/gallon when tested in accordance with ASTM D 1475.

D. Viscosity

1. Consistency of the paint shall not be less than 80, nor more than 90 Kreh units when tested in accordance with ASTM D562. The paint shall have good spraying characteristics when the material is heated to application temperature of 130°F to 145°F.

E. Flexibility

1. Paint shall not show cracking or flaking when subjected to the TT-P-1952D flexibility test in which the panels used shall be tin plates that are 3 inches x 5 inches in area and 35 - 31 U.S. Gauge in thickness. The tin panels shall be lightly buffed with steel wool and thoroughly cleaned with solvent before being used for tests.

F. Dry Opacity

1. Both white and yellow paints shall have a minimum contrast ratio of 0.96. Contrast ratio shall be determined by applying a wet film thickness of 0.005 inches (127 microns) to a standard hiding power chart. After drying, the black and white reflectance values shall be determined using a suitable reflectometer and the contrast ratio determined.

G. Bleeding

1. Paints shall have a minimum bleeding ratio of 0.97 when tested in accordance with FS TT-P-1952D.

H. Abrasion Resistance

1. No less than 210 liters of sand shall be required to remove paint film when tested in accordance with TT-P-1952D.

I. Color

1. Yellow: FS 595, No. 13538, latest issue.
2. White: No darker or yellower than FS 595, No. 17778, latest issue, when the material is placed in a type EH weatherometer for a period of 500 hours and weathered according to ASTM G153.
3. Color determination shall be made without beads, after a minimum of 24 hours. If not a visual match, the diffuse day color of the paint shall conform to the CIE Chromaticity coordinate limits as follows:

Paint CIE Chromaticity Coordinate Limits

	x	Y	x	y	x	y	x	y	Brightness
White	0.305	0.295	0.360	0.360	0.388	0.377	0.280	0.310	84.0 Min
Yellow	0.485	0.455	0.506	0.452	0.484	0.428	0.477	0.438	50.0 Min

4. Paint shall not discolor in sunlight and shall maintain colorfastness throughout its life, approximately two years.

J. Glass Bead Adhesion

1. Paint with glass beads conforming to M.07.30, applied at the rate of 6.0 pounds/gallon of paint, shall require not less than 150 liters of sand to remove paint film and glass beads.

K. Scrub Resistance

1. Paint shall pass 300 cycles minimum when tested in accordance with ASTM D2486.

L. Drying time

1. Reflectorized line shall dry to no pick up in 15 minutes or less as tested by ASTM D711 when applied at the ratio provided for specified glass spheres to paint (the paint at 15+ 1 mil (381 millimeters + 25 millimeters) wet film thickness equivalent to 100-115 square foot/gallon and the glass spheres at the equivalent rate of 6.0 pounds/gallon.

2.2 HOT-APPLIED WATERBORNE PAVEMENT MARKING PAINT

A. General

1. White and yellow fast-drying waterborne pavement marking paint, low VOC, ready-mixed, one component, 100 percent acrylic, Federal Specification TT-P-1952D.
2. Paint shall be capable of being applied with paint striping equipment at an application temperature of 130°F to 145°F.
3. Color: ASTM D211 and per Federal Standard No. 595.
4. Glass Beads: AASHTO M 247, Type 1.

B. Manufacture

1. Paint shall be formulated and manufactured from first-grade raw materials and shall be free from defects and imperfections that might adversely affect the serviceability of the finished product. The materials shall not exhibit settling or jellying after storage in the sealed containers as received that will affect the performance of the products. The paint shall provide the proper anchorage, refraction and reflection for the finished glass spheres when applied as specified.

C. Composition

1. Composition of the paint shall be at the discretion of the manufacturer, provided that the finished product meets the requirements of any applicable Federal, State or Local regulations for products of this type and the requirements as follows:
 - a. Paint shall not contain more than 0.06% lead.
 - b. Total nonvolatile shall not be less than 76% by weight (mass).
 - c. Pigment shall be 58-63% by weight (mass).
 - d. Resin solids shall be composed of 100% acrylic emulsion polymer.
 - e. Volatile organic compounds shall not exceed 150 grams/liter, excluding water.

f. Closed-cup flash point shall not be less than 100°F, and weight per gallon shall not be less than 12.5 pounds/gallon when tested in accordance with ASTM D 1475.

D. Viscosity

1. Consistency of the paint shall not be less than 80, nor more than 90 Kreb units when tested in accordance with ASTM D562. The paint shall have good spraying characteristics when the material is heated to application temperature of 130°F to 145°F.

E. Flexibility

1. Paint shall not show cracking or flaking when subjected to the TT-P-1952D flexibility test in which the panels used shall be tin plates that are 3 inches x 5 inches (76 millimeters x 127 millimeters) in area and 35 - 31 U.S. Gauge in thickness. The tin panels shall be lightly buffed with steel wool and thoroughly cleaned with solvent before being used for tests.

F. Dry Opacity

1. Both white and yellow paints shall have a minimum contrast ratio of 0.96. Contrast ratio shall be determined by applying a wet film thickness of 0.005 inches (127 microns) to a standard hiding power chart. After drying, the black and white reflectance values shall be determined using a suitable reflectometer and the contrast ratio determined.

G. Bleeding

1. Paints shall have a minimum bleeding ratio of 0.97 when tested in accordance with FS TT-P- 1952D.

H. Abrasion Resistance

1. No less than 210 liters of sand shall be required to remove paint film when tested in accordance with TT-P-1952D.

I. Color

1. Yellow: FS 595, No. 13538, latest issue.
2. White: No darker or yellower than FS 595, No. 17778, latest issue, when the material is placed in a type EH weatherometer for a period of 500 hours and weathered according to ASTM G153.
3. If not a visual match, the diffuse day color of the paint shall conform to the CIE Chromaticity coordinate limits as follows:

Paint CIE Chromaticity Coordinate Limits

	x	Y	x	y	x	y	x	y	Brightness
White	0.305	0.295	0.360	0.360	0.388	0.377	0.280	0.310	84.0 Min

	x	Y	x	y	x	y	x	y	Brightness
Yellow	0.485	0.455	0.506	0.452	0.484	0.428	0.477	0.438	50.0 Min

4. Paint shall not discolor in sunlight and shall maintain colorfastness throughout its life, approximately two years. Color determination shall be made without beads, after a minimum of 24 hours.

J. Glass Bead Adhesion

1. Paint with glass beads shall require not less than 150 liters of sand to remove paint film and glass beads.

K. Scrub Resistance

1. Paint shall pass 300 cycles minimum when tested in accordance with ASTM D2486.

L. Drying time

1. Reflectorized line shall dry to no pick up in 120 seconds or less when applied at the ratio provided for specified glass spheres to paint (the paint at 15+ 1 mil (381 millimeters + 25 millimeters) wet film thickness equivalent to 100-115 square foot/gallon (2.45-2.82 square meters/liter) and the glass spheres at the equivalent rate of 6.0 pounds/gallon (0.72 kilograms/liter). The paint shall be applied with equipment so as to have the paint at a temperature of 130°F to 145°F (54°C to 63°C) at the spray gun.

2.3 EPOXY RESIN PAVEMENT MARKINGS

A. Epoxy Resin Material: The material shall be composed of epoxy resins and pigments only.

B. Composition:

1. White (percent by weight): 20% +/- 2% Titanium Dioxide, ASTM D476 Type 3 and 80% +/- 2% Epoxy Resins.
2. Yellow (percent by weight): 25% +/- 2% Chrome Yellow, ASTM D211 Type 3 and 75% +/- 2% Epoxy Resins.
3. Epoxy Resins: ASTM D1763.

C. Color

1. Yellow: FS 595, No. 13538, latest issue.
2. White: No darker or yellower than FS 595, No. 17778, latest issue, when the material is placed in a type EH weatherometer for a period of 500 hours and weathered according to ASTM G153.

D. Adhesion Capabilities

1. When the adhesion of the material to portland cement concrete (test concrete shall have a minimum of 300 psi tensile strength) is tested according to ACI 503R testing procedure,

the failure of the system must take place in the concrete. The concrete shall be 90 °F when the material is applied, after which the material shall be allowed to cure for 72 hours at 73 +/- 3.5 °F.

E. Abrasion Resistance

1. When the abrasion resistance of the material is tested according to ASTM C 501 with a CS-17 wheel under a load of 1000 grams for 1000 cycles, the wear index shall be no greater than 82. (The wear index is the weight (mass) in milligrams that is abraded from the sample under the test conditions).

F. Hardness

1. The Type D durometer hardness of the material shall be not less than 75 nor more than 90 when tested according to ASTM D2240 after the material has cured for 72 hours at 73 +/- 3.5 °F.

G. Tensile Strength

1. Tensile strength of the material, when tested according to ASTM D 638, shall not be less than 6,000 psi after 72 hours cure at 73 +/- 3.5 °F.

H. Compressive Strength

1. Compressive strength of the material, when tested according to ASTM D 695, shall not be less than 12,000 psi after 72 hours cure at 73 +/- 3.5 °F.

I. Shelf Life

1. Individual components shall not require mixing prior to use when stored for a period of 12 months.

2.4 GLASS BEADS

- A. Beads shall be transparent, clean, colorless glass, smooth and spherically shaped, free of milkiness, pits, or excessive air bubbles.

B. Quality Assurance Control

1. Beads shall be segregated into maximum lots of 2,500 pounds (1125 kilograms) and lot numbers shall be stamped onto each lot. Each lot shall be tested for gradation, rounds and embedment coating.

- C. Gradation - The glass spheres shall meet the following gradation requirements:

Glass sphere gradation (ConnDOT Grading "A")

Sieve Size	% Passing
20 (850 um)	100

Sieve Size	% Passing
30 (600 um)	80-95
50 (300 um)	9-42
80 (180 um)	0-10

Glass sphere gradation (ConnDOT Grading “B”)

Sieve Size	% Retained
10 (2.0 mm)	0
12 (1.7 mm)	0-5
14 (1.4 mm)	5-20
16 (1.18 mm)	40-80
18 (1.0 mm)	10-40
20 (850 um)	0-5
Pan	0-2

D. Roundness: Glass beads shall have a minimum of 80% rounds per screen for two highest sieve quantities and no more than 3% angular particles per screen for Grading “B”. The remaining sieve fractions shall typically be no less than 75% rounds.

E. Refractive Index: Glass beads shall have a refractive index of 1.50 to 1.52.

2.5 TEMPORARY PLASTIC PAVEMENT MARKING TAPE

- A. Materials for this work shall be commercially available pavement marking tape, ASTM D4505.
- B. Tape shall be pre-coated with a pressure sensitive adhesive and shall be capable of being adhered to existing markings, on bituminous concrete pavement or portland cement concrete in

accordance with the manufacturer's instructions without the use of heat, solvents or other additional adhesives, and shall be immediately ready for traffic use after application.

1. Tape shall be reflective with the use of glass beads throughout the pigments.
 2. Tape shall be durable, flexible, formable and following application shall remain in contact with the pavement surface.
- C. Adhesion: Tape shall adhere to the pavement and existing pavement markings under climatic and traffic conditions normally encountered in the construction work zone. The tape shall be reinforced by a nonmetallic medium and pre-coated with a pressure sensitive adhesive.
- D. Removability: Tape shall be removable after its intended use, intact or in large pieces, manually, at temperatures above 40°F without the use of heat, solvents, grinding or sand or water blasting. The black line mask pavement marking tape shall be totally removed from existing markings that are adequately adhered to the pavement surface, without damage to the underlying markings.
- E. Tape shall be readily visible during daylight and when viewed with vehicular headlights at night.

2.6 PREFORMED BLACK LINE MASK PAVEMENT MARKING TAPE

A. General

1. Tape shall consist of a matte black, non-reflective tape in widths or sizes sufficiently large to mask the existing markings which are to be temporarily covered.
 2. Patterned masking tape shall be pre-coated with a pressure sensitive adhesive and shall be capable of being adhered to existing markings, on bituminous concrete pavement or portland cement concrete in accordance with the manufacturer's instructions without the use of heat, solvents or other additional adhesives, and shall be immediately ready for traffic use after application.
- B. Composition: The non-reflective, patterned black line mask pavement marking tape shall not contain metallic foil and shall consist of a mixture of high quality polymeric materials, pigments and inorganic fillers distributed throughout its base cross-sectional area, with a matte black non-reflective top layer. The patterned surface shall have a minimum of 20% of the surface area raised and coated with non-skid particles. The channels between the raised areas shall be substantially free of particles. The film shall be pre-coated with a pressure sensitive adhesive. A non-metallic medium shall be incorporated to facilitate removal.
- C. Skid Resistance: The surface of the patterned, nonreflective black line mask pavement marking tape shall provide an initial average skid resistance value of 60 BPN when tested in accordance with ASTM E 303.
- D. Thickness
1. Patterned material, without adhesive, shall have a minimum thickness of 0.065 inch at the thickest portion of the patterned cross-section and a minimum thickness of 0.02 inch at the thinnest portion of the cross-section.
- E. Adhesion: Tape shall adhere to the pavement and existing pavement markings under climatic and traffic conditions normally encountered in the construction work zone.

- F. Removability: Tape shall be removable after its intended use, intact or in large pieces, manually, at temperatures above 40°F without the use of heat, solvents, grinding or sand or water blasting. The black line mask pavement marking tape shall be totally removed from existing markings that are adequately adhered to the pavement surface, without damage to the underlying markings.

2.7 BLACK EPOXY RESIN PAVEMENT MARKINGS

- A. Epoxy Resin Material: Material shall be composed of epoxy resins and pigments only.
1. Carbon Black: ASTM D476.
- B. Composition: Black Epoxy Resin shall conform to the following:

Composition of Black Epoxy Resin

Component	Percent by Mass
Carbon Black	7 +/- 2
Talc	14 +/- 2
Epoxy Resins	79 +/- 4

1. Carbon Black: ASTM D476 Type 3.
 2. Talc: ASTM D605.
 3. Epoxy Resins: ASTM D1763.
- C. Black Aggregate: Angular with no dry dispensement pigment, urethane coated.
1. Moisture resistant aggregate shall meet the following gradation requirements:

Gradation of Black Moisture Resistant Aggregate

Sieve Size	Percent Retained
No. 20 (850 um)	23-38
No. 50 (300 um)	58-74
No. 270 (53 um)	1-6
Pan	0-5

- D. Adhesion: Black epoxy resin pavement marking material shall be formulated so as to adhere to the pavement and existing pavement markings under climatic and traffic conditions normally encountered in the construction work zone.
- E. Abrasion Resistance: When the abrasion resistance of the material is tested according to ASTM D 4060 with a CS-17 wheel under a load of 1,000 grams for 1,000 cycles, the wear index shall be no greater than 82.
- F. Hardness: The Type D durometer hardness of the material shall not be less than 75 nor more than 90 when tested according to ASTM D 2240 after the material has cured for 72 hours at $73.5 \pm 3.5^{\circ}\text{F}$.
- G. Compressive Strength: The compressive strength of the material, when tested according to ASTM D 695, shall not be less than 12,000 psi after 72 hours cured at $73.5 \pm 3.5^{\circ}\text{F}$.

PART 3 EXECUTION

3.1 GENERAL

- A. Pavement markings shall be applied in accordance with the details shown on the plans and the control points established by the Contractor and approved by the Engineer.
- B. No paint shall be applied to new bituminous pavement until the top course has cured at least one week minimum.
- C. Pavement areas to be painted shall be dry and sufficiently cleaned of sand and road debris so as to provide an acceptable bond between the paint and the pavement.
- D. All painting shall be performed in a neat and workmanlike manner. The lines shall be sharp and clear with no feathered edging or fogging and precautions shall be taken to prevent tracking by tires of the striping equipment. Paint shall be applied as shown on the Drawings with no unsightly deviations.
- E. Contractor shall protect the buildings, walks, pavement, curbing, trees, shrubs, mulch, etc. from over-spray of paint and damage by his operations.
- F. Operations shall be conducted only when the road surface temperature is at least 40°F or as allowed by Engineer. They shall be discontinued during periods of rain, and shall not continue until Engineer determines that the pavement surface is dry enough to achieve adhesion.
- G. After application, paint shall be protected from crossing vehicles using traffic cones or other acceptable method for a time at least equivalent to the drying or curing time of the paint.
- H. The material shall be applied to the pavement by equipment used specifically for the application of pavement markings and shall be of a standard commercial manufacturer.
- I. Contractor shall provide survey control for layout of pavement markings by utilizing his own surveyor or hiring a registered land surveyor. The cost of this survey control shall be included in other items of work.

3.2 WATERBORNE PAVEMENT MARKINGS

- A. Painted legend, arrows, and markings includes paint installed with a hand striping machine such as: stop bars, crosswalks, parking stalls, lane arrows, legends, markings within gore areas, and painting of paved islands or medians.
- B. Painted pavement markings and hot applied painted pavement markings include paint installed with a truck-mounted painting machine such as center lines, lane lines and shoulder lines.
- C. Waterborne Paint, Ambient Temperature
 - 1. Apply paint at a rate of 100 to 115 square feet per gallon, with glass beads applied at a rate of 6 pounds per gallon of paint for painted pavement markings and painted legend, arrows, and markings
- D. Waterborne Paint, Hot-Applied
 - 1. Hot-applied paint shall be applied at a temperature of 130°F to 145°F at the spray gun.
 - 2. Apply paint at a rate of 8 pounds per gallon of paint for hot-applied painted pavement markings.

3.3 EPOXY RESIN PAINTED PAVEMENT MARKINGS

- A. Epoxy resin pavement markings includes epoxy resin installed with a truck-mounted machine such as center lines, lane lines, and shoulder lines.
- B. Epoxy resin pavement markings, symbols and legends include stop bars, crosswalks, parking stalls, lane arrows, legends, and markings within areas such as paved islands, gore areas and paved medians.
- C. Equipment
 - 1. Equipment furnished shall include an applicator truck of adequate size and power, together with the following:
 - a. Remote application equipment designed to apply an epoxy resin material in a continuous pattern.
 - b. Portable glass bead applicators, one for each size bead, designed to provide uniform and complete coverage of the epoxy binder by a controlled free-fall method. Pressurized glass bead application shall not be used. Before epoxy color is changed, equipment shall be cleaned out sufficiently to ensure that the color of material applied will be correct.
 - 2. When working on a highway with more than one lane in either direction, the applicator truck (striper) shall have a permanently mounted direction variable illuminated arrow board, fully operational and visible to approaching traffic. There will be no additional payment for the arrow board. Its cost shall be included in the bid price for this item.
 - 3. For markings applied on pavements over one year old, equipment furnished shall also include a power washing machine capable of cleaning the pavement with a pressure of 2,400 to 2,800 psi with water heated to 180°F - 195°F. No chemicals shall be added to the water used in the process. The power washer shall be equipped with a turbo blast tip with an oscillating head and shall be capable of supplying a minimum of 5 gallons/minute gun.

4. All guns on the spray carriages shall be in full view of the operator(s) during operation.

D. Procedures

1. The road surface shall be cleaned at the direction of the Engineer just prior to application. Pavement cleaning shall consist of power washing using clean water heated to 180°F – 195 °F at a pressure of 2,240 - 2,800 psi. The areas to be power washed shall include all areas where epoxy marking symbols and legends (including stop bars and crosswalks) are to be applied and at least 1 inch beyond the area to be marked. The surface shall be cleaned to the satisfaction of the Engineer.
 - a. For other pavement areas, cleaning shall consist of brushing with rotary broom (non-metallic), and any additional work as recommended by the material manufacturer and acceptable to the Engineer.
 - b. New portland cement concrete surfaces shall be cleaned by abrasive blasting to remove any surface treatments and/or laitance.
 - c. New bituminous concrete surfaces are not to be power washed.
2. All surfaces that are power washed shall be allowed to dry sufficiently prior to the application of the epoxy markings. The areas to be marked shall be broom cleaned immediately prior to the application of the epoxy markings. Glass beads shall be applied immediately after application of the epoxy resin marking to provide an immediate notrack system.
3. Contractor will place necessary “spotting” at appropriate points to provide horizontal control for striping and to determine necessary starting and cutoff points. Broken line intervals will not be marked. Longitudinal joints, pavement edges and existing markings shall serve as horizontal control when so directed.
4. A tolerance of 0.25 inch under or 0.25 inch over the specified width shall be allowed for striping provided the variation is gradual and does not detract from the general appearance. Alignment deviations from the control guide shall not exceed 2 inches provided the variation is gradual and does not detract from the general appearance. Material shall not be applied over a longitudinal joint. Establishment of application tolerances shall not relieve Contractor of the responsibility to comply as closely as practicable with the planned dimensions.
5. Glass beads conforming to the requirements of Grading “B” (larger beads) as specified herein shall be applied at a rate of 12 pounds per gallon of epoxy pavement marking material, immediately followed by a second drop of glass beads conforming to the requirements of Grading “A” (smaller beads) as specified herein applied at a rate of 13 pounds per gallon of epoxy pavement marking material.
6. Time to No-Track: The material shall be in “no-tracking” condition within 15 minutes, or as allowed by Engineer. The no-tracking time shall be determined by passing over the line with a passenger car or pickup truck in the simulated passing maneuver. A marking showing no visual deposition of the material to the pavement surface when viewed from a distance of 50 feet (15 meters) shall be considered as showing “no-tracking” and conforming to this requirement for time to no-track.

7. When stencils are used during the application of epoxy markings, care must be used when removing the stencils so that the epoxy resin does not drip on the road, sidewalk, grass, etc., and so that the applied markings have edges which are clean, straight and neat.
8. Epoxy resin pavement markings may be applied over existing painted markings provided they are sufficiently worn to allow adequate adhesion. If required by the Engineer, existing plastic, thermoplastic, epoxy or freshly painted markings shall be removed prior to the application of epoxy markings.

E. Crosswalks

1. Only glass beads conforming to the requirements of Grading “A” (smaller beads) as specified herein shall be applied at a rate of 25 pounds per gallon of epoxy pavement marking material.

F. Performance

1. In order to be accepted, the applied markings must meet the following minimum retroreflectivity reading as measured using an LTL 2000 Retrometer with 30-meter geometry 1 to 2 weeks after installation:
 - a. White Epoxy 250 millicandelas per square foot per foot candle (millicandelas per square meter per lux).
 - b. Yellow Epoxy 175 millicandelas per square foot per foot candle (millicandelas per square meter per lux).

3.4 TEMPORARY PLASTIC PAVEMENT MARKING TAPE

- A. Contractor will pre-mark the pavement prior to application of the marking and use a string line if required to produce a neat appearing line.
- B. Install temporary plastic pavement marking tape in accordance with manufacturer’s procedures.
- C. Promptly replace marking tape which has become dislodged, torn or otherwise damaged.

3.5 PAVEMENT MARKING REMOVAL

- A. Pavement markings shall be removed before any change is made in the traffic pattern.
- B. Pavement markings shall be removed from the pavement by any method that does not materially damage the surface or texture of the pavement. Any damage to the pavement surface caused by pavement marking removal shall be repaired by Contractor at its expense by methods acceptable to Engineer.
 1. Removal of temporary plastic pavement marking tape shall be accomplished without the use of heat, solvents, grinding or sandblasting and in such a manner that no damage to the pavement results.
- C. Sand or other material deposited on the pavement as a result of removing pavement markings shall be removed as the work progresses. Accumulations of sand or other material which might interfere with drainage or might constitute a hazard to traffic will not be permitted.

- D. Where blast cleaning is used for the removal of pavement markings and such removal operation is being performed within 10 feet of a lane occupied by traffic, the residue including dust shall be removed immediately after contact between the sand and the surface being treated. Such removal shall be by a vacuum attachment operating concurrently with the blast cleaning operation, or by other methods approved by Engineer.

END OF SECTION

SECTION 32 90 00

PLANTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, equipment, services, and perform all operations necessary to complete the work of this section as indicated within the drawings and specified herein which shall include, but is not limited to, the following:
 - 1. Supplying Trees, Shrubs, Perennial, and Groundcover
 - 2. Landscape Edging
 - 3. Mulch
 - 4. Maintenance including watering
 - 5. Warranty
- B. The contractor is responsible for all health and safety.

1.2 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than sizes indicated; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
- C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than sizes indicated.
- D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of plant required.
- E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
- F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.
- G. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and

molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

- H. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- I. Planting Area: Areas to be planted.
- J. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- K. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- L. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

1.3 SUBMITTALS

- A. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
 - 1. Plant Photographs: Include color photographs in 3- by 5-inch print format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.
- B. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.
 - 1. Contractor shall follow all Connecticut DEEP regulations for pesticide and herbicide applications.
- C. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- D. Product Data: For each type of product indicated, including soils.
- E. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
 - 1. Submit material specifications, manufacturer's literature and installation instructions where applicable attesting that the following materials meet the requirements specified:
 - a. Fertilizer
 - b. Anti-Desiccant
 - c. Mulch

- d. Soil Amendments
 - e. Edging
 - f. Weed Control Barrier
 - 2. Manufacturer's certified analysis of standard products.
 - 3. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- F. Maintenance Manual
- 1. The landscape contractor shall submit a written manual, prepared for the Owner that outlines a schedule for proper maintenance of the plantings. This schedule should include timing and methods for watering, fertilization, mulching, pruning and other maintenance operations to be conducted after the three month maintenance contract period.
- G. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants including the preparation, mixing and installation of soil mixes to support planting.
- 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 - 2. Experience: Five years' experience in landscape installation of size and scope similar to this project.
 - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
 - a. Certified Landscape Technician - Exterior, with installation maintenance specialty area(s), designated CLT-Exterior.
 - b. Certified Landscape Technician - Interior, designated CLT-Interior.
 - c. Certified Ornamental Landscape Professional, designated COLP.
 - 5. Pesticide Applicator: State licensed, commercial.
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
- C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
- 1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
 - 2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

- D. Plant Material Observation: Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Landscape Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
 - 1. Notify Landscape Architect of sources of planting materials seven days in advance of delivery to site.
- E. Preinstallation Conference: Conduct conference at Project site.
- F. Work to be done shall be coordinated with all other trades on site. Work includes furnishing all labor, materials, equipment and services required to complete all planting indicated on the drawings, as specified in this section.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.
- B. Bulk Materials:
 - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - 3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.
- C. Deliver bare-root stock plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.
- D. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- E. Handle planting stock by root ball.
- F. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.
- G. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock. Soak roots that are in dry condition in water for two hours. Reject dried-out plants.
2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container-grown stock from containers before time of planting.
4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
 1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of each service or utility.
 2. Do not proceed with interruption of services or utilities without Construction Manager's written permission.
- C. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
 1. Spring:
 - a. Deciduous materials: March 1 to May 15
 - b. Evergreen Materials: March 1 to June 1
 2. Fall:
 - a. Deciduous materials: From September 1 until the ground freezes.
 - b. Evergreen Materials: August 15 - October 15
- D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
- E. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
 1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.7 PLANT WARRANTY

- A. Plant Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 2. Warranty Periods from Date of Substantial Completion:
 - a. Trees, Shrubs, Vines, and Ornamental Grasses: **12 months**
 - b. Ground Covers, Biennials, Perennials, and Other Plants: **12 months**
 - c. Annuals: **Three months**
 3. When the work is accepted in parts, the warranty periods shall extend from each of the partial Substantial Completion Acceptances to the terminal date of the last warranty period. Thus, all warranty periods for each class of plant warranty, shall terminate at one time.
 4. Include the following remedial actions as a minimum:
 - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
 - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 - c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
 - d. Provide extended warranty for period equal to original warranty period, for replaced plant material.
 5. Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in this specification. Make all necessary repairs due to plant replacements. Such repairs shall be done at no extra cost to the Owner.

1.8 MAINTENANCE SERVICE

- A. Initial Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until substantial completion but for not less than maintenance period below if substantial complete comes earlier.
1. Maintenance Period: Three months from date of planting completion.
- B. Initial Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately

after plants are installed and continue until substantial completion but for not less than maintenance period below if substantial completion comes earlier.

1. Maintenance Period: Three months from date of planting completion.
- C. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.9 PLANT SUBSTITUTIONS FOR PLANTS NOT AVAILABLE

- A. Submit all requests for substitutions of plant species, or size to the Owner's Representative, for approval, prior to purchasing the proposed substitution. Request for substitution shall be accompanied with a list of nurseries contacted in the search for the required plant and a record of other attempts to locate the required material. Requests shall also include sources of plants found that may be of a smaller or larger size, or a different shape or habit than specified, or plants of the same genus and species but different cultivar origin, or which may otherwise not meet the requirements of the specifications, but which may be available for substitution.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated on the Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.
 2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Labeling: Label at least one plant of each variety, size, and caliper in each planting bed with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

- E. If formal arrangements or consecutive order of plants is shown on the Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.
- F. Annuals: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.
- G. Plant List: If there is any discrepancy between quantities shown on the Plant Schedule and work shown on the drawings, the Landscape Contractor shall supply the plants necessary to complete the work as intended on the drawings. Where the size of a plant on the Plant Schedule is a variation between a minimum and maximum dimension, the sizes of the plants furnished will be equal to the average of the two dimensions. Where a single dimension is given, this dimension represents the minimum size of the plants to be furnished.

2.2 PLANTING SOIL

- A. See Specification Section 32 9100 – Planting Soil

2.3 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, perennials and groundcovers, consisting of one of the following:
 - 1. Type: Aged double-shredded bark.
 - 2. Size Range: 2 inches maximum, 1/2 inch minimum.
 - 3. Color: Natural.

2.4 PESTICIDES

- A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.5 WATERING BAGS

- A. Plastic tree watering bags holding a minimum of 15 gallons of water and with a slow drip hole(s) water release system, specifically designed to water establishing trees. Water should release over a several day period, not within a few hours.
- B. Watering bags shall be:

1. Treegator Irrigation Bags sized to the appropriate model for the requirements of the plant, manufactured by Spectrum Products, Inc., Youngsville, NC 27596.
 2. Ooze Tube sized to the appropriate model for the requirements of the plant, manufactured by Engineered Water Solutions, Atlanta, GA.
 3. Or approved equal.
- C. Submit manufacturer's product data for approval.

2.6 LANDSCAPE EDGING

- A. Heavy Duty Straight Profile Edging: 3/16" x 6" high, extruded aluminum, 6063 alloy, T-6 hardness, landscape edging for straight-line and curvilinear applications in corrugated straight profile.
- B. Section shall have loops on side of section to receive stakes spaced approximately 2 to 3 feet apart along its length.
- C. Thickness: 3/16 inch gage section at 0.116 inch minimum thick with 0.187 inch exposed top lip.
- D. Connection Method: Section ends shall splice together with an interlocking stakeless snap-down design.
- E. Stake: 12" extruded aluminum stake. Stakes to interlock into section loops.
- F. Finish: Mill Finish. Paint finish shall comply with AAMA 2603 for electrostatically baked on paint.

2.7 MISCELLANEOUS PRODUCTS

- A. Wood Pressure-Preservative Treatment: AWWA C2, with waterborne preservative for soil and freshwater use, acceptable to authorities having jurisdiction, and containing no arsenic; including ammoniacal copper arsenate, ammoniacal copper zinc arsenate, and chromated copper arsenate.
- B. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.
- C. Burlap: Non-synthetic, biodegradable.
- D. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine the surface grades and soil conditions to confirm that the requirements of the Specification Section – Planting Soil - and the soil and drainage modifications indicated on the Planting Soil Plan and Details (if applicable) have been completed. Notify the Owner's Representative in writing of any unsatisfactory conditions.
- B. Planting shall only be performed when weather and soil conditions are suitable for planting the materials specified in accordance with locally accepted practice. Install plants during the planting time as described below unless otherwise approved in writing by the Owner's Representative. In the event that the Contractor request planting outside the dates of the planting season, approval of the request does not change the requirements of the warranty.

3.2 LAYOUT AND PLANTING SEQUENCE

- A. Relative positions of all plants and trees are subject to approval of the Owner's Representative.
- B. Notify the Owner's Representative, one (1) week prior to layout. Layout all individual tree and shrub locations. Place plants above surface at planting location or place a labeled stake at planting location. Layout bed lines with paint for the Owner's Representative's approval. Secure the Owner's Representative's acceptance before digging and start of planting work.
- C. When applicable, plant trees before other plants are installed.
- D. It is understood that plants are not precise objects and that minor adjustments in the layout will be required as the planting plan is constructed. These adjustments may not be apparent until some or all of the plants are installed. Make adjustments as required by the Landscape Architect including relocating previously installed plants.

3.3 SOIL PROTECTION DURING PLANT DELIVERY AND INSTALLATION

- A. Protect soil from compaction during the delivery of plants to the planting locations, digging of planting holes and installing plants.
 - 1. Where possible deliver and plant trees that require the use of heavy mechanized equipment prior to final soil preparation and tilling. Where possible, restrict the driving lanes to one area instead of driving over and compacting a large area of soil.
 - 2. Till to a depth of 6 inches, all soil that has been driven over during the installation of plants

3.1 SOIL MOISTURE

- A. Volumetric soil moisture level, in both the Planting Soil and the root balls of all plants, prior to, during and after planting shall be above permanent wilt point and below field capacity for each type of soil texture within the following ranges.

Soil texture	Permanent wilting point	Field capacity
Sand, Loamy sand, Sandy loam	5-8%	12-18%
Loam, Sandy clay, Sandy clay loam	14-25%	27-36%
Clay loam, Silt loam	11-22%	31-36%
Silty clay, Silty clay loam	22-27%	38-41%

- B. The Contractor shall confirm the soil moisture levels with a moisture meter (Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent). If moisture is found to be too low, the planting holes shall be filled with water and allowed to drain before starting any planting operations. If the moisture is too high, suspend planting operations until the soil moisture drains to below field capacity.

3.2 INSTALLATION OF PLANTS - GENERAL

- A. Observe each plant after delivery and prior to installation for damage of other characteristics that may cause rejection of the plant. Notify the Owner's Representative of any condition observed.
- B. Excavation of the Planting Space: Using hand tools or tracked mini-excavator, excavate the planting hole into the Planting Soil to the depth of the root ball measured after any root ball modification to correct root problems, and wide enough for working room around the root ball or to the size indicated on the drawing or as noted below.
1. For trees and shrubs planted in soil areas that are NOT tilled or otherwise modified to a depth of at least 12 inches over a distance of more than 10 feet radius from each tree, or 5 feet radius from each shrub, the soil around the root ball shall be loosened as defined below or as indicated on the drawings.
 - a. The area of loosening shall be a minimum of 3 times the diameter of the root ball at the surface sloping to 2 times the diameter of the root ball at the depth of the root ball.
 - b. Loosening is defined as digging into the soil and turning the soil to reduce the compaction. The soil does not have to be removed from the hole, just dug, lifted and turned. Lifting and turning may be accomplished with a tracked mini excavator, or hand shovels.
- C. If an auger is used to dig the initial planting hole, the soil around the auger hole shall be loosened as defined above for trees and shrubs planted in soil areas that are NOT tilled or otherwise modified.
- D. The measuring point for root ball depth shall be the average height of the outer edge of the root ball after any required root ball modification.
- E. If motorized equipment is used to deliver plants to the planting area over exposed planting beds, or used to loosen the soil or dig the planting holes, all soil that has been driven over shall be tilled to a depth of 6 inches.

- F. For trees to be planted in prepared Planting Soil that is deeper than the root ball depth, compact the soil under the root ball using a mechanical tamper to assure a firm bedding for the root ball. If there is more than 12 inches of planting soil under the root ball excavate and tamp the planting soil in lifts not to exceed 12 inches.
- G. Set top outer edge of the root ball at the average elevation of the proposed finish. Set the plant plumb and upright in the center of the planting hole. The tree graft, if applicable, shall be visible above the grade. Do not place soil on top of the root ball.
- H. The Owner's Representative or Landscape Architect may request that plants orientation be rotated when planted based on the form of the plant.
- I. Backfill the space around the root ball with the same planting soil or existing soil that was excavated for the planting space.
- J. Brace root ball by tamping Planting Soil around the lower portion of the root ball. Place additional Planting Soil around base and sides of ball in six-inch (6") lifts. Lightly tamp each lift using foot pressure or hand tools to settle backfill, support the tree and eliminate voids. DO NOT over compact the backfill or use mechanical or pneumatic tamping equipment. Over compaction shall be defined as greater than 85% of maximum dry density, standard proctor when the volumetric soil moisture is lower than field capacity.
 - 1. When the planting hole has been backfilled to three quarters of its depth, water shall be poured around the root ball and allowed to soak into the soil to settle the soil. Do not flood the planting space. If the soil is above field capacity, allow the soil to drain to below field capacity before finishing the planting. Air pockets shall be eliminated and backfill continued until the planting soil is brought to grade level.
- K. Where indicated on the drawings, build a three-inch-high, level berm of Planting Soil around the outside of the root ball to retain water. Tamp the berm to reduce leaking and erosion of the saucer.
- L. Thoroughly water the Planting Soil and root ball immediately after planting.
- M. Remove all nursery plant identification tags and ribbons.
- N. Remove corrugated cardboard trunk protection after planting.

3.3 TREE, SHRUB, AND VINE PLANTING

- A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare flush with adjacent finish grades.

1. Use planting soil for backfill.
 2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Set container-grown stock plumb and in center of planting pit or trench with root flare flush with adjacent finish grades.
1. Use planting soil for backfill.
 2. Carefully remove root ball from container without damaging root ball or plant.
 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- E. Set and support bare-root stock in center of planting pit or trench with root flare flush with adjacent finish grade.
1. Use planting soil for backfill.
 2. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Puddle with water until backfill layers are completely saturated. Plumb before backfilling, and maintain plumb while working backfill around roots and placing layers above roots.
 3. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside soil-covered roots about 1 inch from root tips; do not place tablets in bottom of the hole or touching the roots.
 4. Continue backfilling process. Water again after placing and tamping final layer of soil.
- F. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.4 TREE, SHRUB, AND VINE PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.

- C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- D. Do not apply pruning paint to wounds.

3.5 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated in even rows with triangular spacing.
- B. Use planting soil for backfill.
- C. Dig holes large enough to allow spreading of roots.
- D. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.6 PLANTING BED FINISHING

- A. After planting, smooth out all grades between plants before mulching.
- B. Separate the edges of planting beds and lawn areas with a smooth, formed edge cut into the turf with the bed mulch level slightly lower, 1 and 2 inches, than the adjacent turf sod or as directed by the Owner's Representative. Bed edge lines shall be as depicted on the Drawings.

3.7 LANDSCAPE EDGING INSTALLATION

- A. Preparation: Ensure that all underground utility lines are located and will not interfere with the proposed edging installation before beginning work. Locate border line of edging with string or other means to assure border straightness and curves as designed. Bed edge lines shall be as depicted on the Drawings. Dig trench 1 inch deeper than set of edging bottom.
- B. Set edging into trench with top at 1/2 inch above compacted finish grade on turf side with side having loops for stakes placed on opposite side of turf. Drive stakes through edging loops until locked in place. Requires 3 stakes evenly spaced for each 8 feet section with a total of 8 stake loops available in each 16 feet section if necessary. Provide additional stakes at approximately 24 inches apart, longer stakes, heavier gage stakes, or any combination of previously mentioned as necessary to firmly secure edging for permanent intended use.

- C. Where edging sections turn at corners and at angled runs, cut edging partially up through its height from bottom and turn back to desired angle to form rounded exposed radius.
- D. Backfilling and Cleanup: Backfill both sides of edging, confirm and adjust if necessary that sections are securely held together, and compact backfill material along edging to provide top of edging at 1 inch above turf finish grade. Cleanup and remove excess material from site.

3.8 PLANTING AREA MULCHING

- A. Mulch backfilled surfaces of planting areas and other areas indicated.
 - 1. Trees in Turf Areas: Apply organic mulch ring of 3-inch average thickness, with four-foot radius around trunks or stems. Do not place mulch within 3 inches of trunks or stems.
 - 2. Organic Mulch in Planting Areas: Apply 2-inch average thickness of organic mulch extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

3.9 WATERING

- A. The Contractor shall be fully responsible to ensure that adequate water is provided to all plants from the point of installation until the date of Substantial Completion Acceptance. The Contractor shall adjust the automatic irrigation system, if available, and apply additional or adjust for less water using hoses as required.
- B. Hand water root balls of all plants to assure that the root balls have moisture above wilt point and below field capacity. Test the moisture content in each root ball and the soil outside the root ball to determine the water content.
- C. The Contractor shall install 15 gallon watering bag for each tree to be maintained and used for tree watering during the warranty period.
- D. The watering bags shall remain the property of the Owner at the completion of the work.

3.10 CLEANUP AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.
- B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- C. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.
- D. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

3.11 PLANT MAINTENANCE PRIOR TO SUBSTANTIAL COMPLETION

- A. During the project work period and prior to Substantial Completion Acceptance, the Contractor shall maintain all plants.
- B. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- C. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- D. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.12 SUBSTANTIAL COMPLETION ACCEPTANCE

- A. Upon written notice from the Contractor, the Owners Representative shall review the work and make a determination if the work is substantially complete.
 - 1. Notification shall be at least 7 days prior to the date the contractor is requesting the review.
- B. The date of substantial completion of the planting shall be the date when the Owner's Representative accepts that all work in Planting, Planting Soil, and Irrigation installation sections is complete.
- C. The Plant Warranty period begins at date of written notification of substantial completion from the Owner's Representative. The date of substantial completion may be different than the date of substantial completion for the other sections of the project.

3.13 END OF WARRANTY FINAL ACCEPTANCE

- A. At the end of the Warranty period the Owner's Representative shall observe the work and establish that all provisions of the contract are complete and the work is satisfactory.
- B. If the work is satisfactory, the maintenance period will end on the date of the final observation.
- C. If the work is deemed unsatisfactory, the maintenance period will continue at no additional expense to the Owner until the work has been completed, observed, and approved by the Owner's Representative.

END OF SECTION

SECTION 33 19 00

WATER SUPPLY SYSTEM

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Water distribution and fire protection piping.
 - 2. Pipe fittings, valves, and valve boxes.
 - 3. Hydrants.
 - 4. Anchors and thrust blocks.
 - 5. Miscellaneous water system appurtenances.
 - 6. Connections to existing water systems.
 - 7. Disinfection and testing of new systems and appurtenances.
- B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.2 COORDINATION WITH JURISDICTIONAL AUTHORITY

- A. Contractor shall notify and coordinate the work of this Section with the local authority having jurisdiction over water supply, whether public or private system owner/operator.
- B. Obtaining permits or approvals which may be required to perform the work of this section, including all costs, fees and taxes required or levied.
- C. Contractor shall obtain all required approvals for connection to, or extension of, any portion of the domestic or fire protection water systems.
- D. The closing of valves necessary for making connections with the existing water systems will be done by Contractor with the assistance of Engineer. Sufficient notice shall be given the jurisdictional authority for a planned connection. No allowance will be made for any delay in the closing of valves. A 48-hour notice shall be given to adjacent buildings/residences affected by the shutdown, and shall be done by Contractor to the satisfaction of jurisdictional authority and Engineer. Jurisdictional authority or Engineer may require the work be completed outside of normal working hours during low use time periods.

1.3 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.

- B. Code of Federal Regulations (CFR).
 - 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. State of Connecticut.
 - 1. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 819, 2024 and any supplements.
- D. ASTM International (ASTM)
 - 1. ASTM B88—Standard Specification for Seamless Copper Water Tube.
 - 2. ASTM F477—Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - 3. ASTM D3139—Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - 4. ASTM A536—Ductile Iron Castings.
 - 5. ASTM D1557—Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
- E. American National Standards Institute (ANSI)
 - 1. ANSI A21.50—Thickness Design of Ductile-Iron Pipe
 - 2. ANSI A21.51—Ductile-Iron Pipe, Centrifugally Cast, for Water
 - 3. ANSI A21.4—Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
 - 4. ANSI A21.10—Ductile-Iron and Gray-Iron Fittings, 3 in through 48 in (75 mm through 1200 mm), for Water and Other Liquids
 - 5. ANSI 61—Drinking Water System Components—Health Effects
- F. American Water Works Association (AWWA)
 - 1. AWWA C104—Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 - 2. AWWA C110—Standard for Ductile-Iron and Gray-Iron Fittings.
 - 3. AWWA C111—Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - 4. AWWA C150—Standard for Thickness Design of Ductile-Iron Pipe.
 - 5. AWWA C151—Standard for Ductile-Iron Pipe, Centrifugally Cast.
 - 6. AWWA C207—Standards for Steel Pipe Flanges for Waterworks Service—Sizes 4 In. through 144 In. (100 mm Through 3,600 mm).
 - 7. AWWA C502—Standard for Dry-Barrel Fire Hydrants.
 - 8. AWWA C504—Standard for Rubber-Seated Butterfly Valves.
 - 9. AWWA C509—Standard for Resilient-Seated Gate Valves for Water Supply Service.

10.AWWA C550—Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.

11.AWWA C651—Disinfecting Water Mains.

12.AWWA C900—Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In.–12 In. (100 mm–300 mm), for Water Transmission and Distribution.

13.AWWA C800—Standard for Underground Service Line Valves and Fittings.

G. State of Connecticut

1. State Building Code, including all Amendments, Supplements, and Errata.

H. Local Jurisdictional Authority

1. Comply with standards of the Local Jurisdictional Authority. Should this Specification differ from those standards, the standards of the Local Jurisdictional Authority will govern.

1.4 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section.
- B. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- C. Maintain all temporary facilities and controls in proper and safe condition throughout the progress of the work.

1.5 COORDINATION WITH JURISDICTIONAL AUTHORITY

- A. Contractor shall notify and coordinate the work of this Section with the local authority having jurisdiction over water supply, whether public or private system owner/operator.
- B. Contractor shall obtain all required approvals for connection to, or extension of, any portion of the domestic or fire protection water systems.
- C. Service Interruption: Provide Jurisdictional Authority five (5) days advanced notice for any planned interruption associated with the work. Comply with customer notification requirements of the Jurisdictional Authority.
- D. Jurisdictional Authority may require the work be completed outside of normal working hours during low use time periods.

1.6 SAFETY

- A. Contractor shall conduct all excavation activities in conformance with applicable regulations, including those relating to warning signs, excavation safety, sheeting, shoring, and stabilization.
- B. Contractor shall provide and maintain barricades, signs, lights, etc., required for the protection of personnel, materials and property. Temporary barricades, etc. shall conform all applicable codes and regulations, and shall be lighted at night with lanterns, flares and reflectorized paint

as required for safety. Adapt barricades, signs, lights, etc. to evolving site conditions throughout the progress of the work.

- C. Provide other safety devices as required, including adaptation of such safety devices to changing site conditions, to prevent unauthorized entry to construction areas and open excavations. Provide warning signs and other temporary construction safety devices necessary for proper completion of the work in compliance with applicable safety regulations.
- D. Contractor shall properly design and furnish all labor, materials, equipment, and tools necessary to completely construct the excavation support system, permanent or temporary, including sheet piling, trench shields, trench boxes, timber trench shoring, pneumatic/hydraulic shoring, steel sheeting or sheeting using other materials, sloping and benching. All of the proper materials and all equipment necessary to protect employees in excavations against cave-ins shall be furnished and installed.
- E. Any time an excavation is to remain open, at a minimum, provide full enclosure with safety barriers and fencing, warning signs, and additional safety control measures as appropriate.

1.7 SUBMITTALS

- A. Copies of all permits and/or approvals from Jurisdictional Authority.
- B. Shop Drawings:
 - 1. Submit shop drawings, descriptive literature, or both, showing pipe materials and appurtenances to be furnished. Shop Drawings shall be submitted to Engineer for approval prior to ordering materials.
 - 2. Shop drawings showing the configuration, dimensions, layout, and spacing of major and minor components such as pipe, joints, restraints, valves, and other proposed details of assembly. Show in large-scale details any unique assembly, and/or installation requirements.
- C. Copies of manufacturer-provided installation instructions, operation instructions, and maintenance material for all equipment furnished under this Section.
- D. Manufacturer's warranties and associated warranty registration data in Owner's name. Submit two (2) copies of each warranty to Engineer in the manufacturer's/supplier's standard form or if there is no standard form available, in a form specified by Engineer.
- E. As-Built Drawings.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Storage of pipe, fittings, valves, hydrants and other water line appurtenances on the site shall be in accordance with the manufacturer's recommendations, subject to the approval of Engineer.
- B. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe, fittings, valves, hydrants, and other water line appurtenances. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying and no piece shall be installed which is found to be defective. Any damage to pipe and fitting coatings shall be repaired as directed by Engineer.

- C. Pipe, fittings, valves, hydrants and other water system appurtenances which are defective from any cause, including damage caused by handling, and determined by Engineer as non-repairable, shall be unacceptable for installation and shall be replaced at no cost to the Owner.
- D. Pipe, and all water system appurtenances that are damaged or disturbed through any cause prior to acceptance of the work shall be repaired, realigned or replaced as required by Engineer at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 GENERAL

- A. The drawings are diagrammatic only and are intended to indicate the extent, but not all details, of the system, which shall be constructed. All materials and fittings are not shown; but Contractor shall furnish and install all materials and fittings required for the complete system.

2.2 DUCTILE IRON PIPE

- A. Centrifugally-cast ductile iron pipe, AWWA C151/A21.51, thickness Class 52, AWWA C150/A21.50. Pipe shall be furnished in 18-foot or 20-foot nominal lengths, unless otherwise required by Jurisdictional Authority standards.
- B. Pipes shall be cement-mortar lined in accordance with ANSI A21.4-03/AWWA C104, except that the cement lining shall be double thickness.
- C. The exterior of all pipe shall be factory coated, with a double coat of asphaltic material conforming to ANSI A21.51-02/AWWA C151. The interior of all pipe shall have a seal coat of bituminous material applied over the cement lining in accordance with ANSI A21.4-03/AWWA C104.

2.3 DUCTILE IRON PIPE FITTINGS

- A. Ductile iron pipe fittings shall have a pressure rating of 350 psi and shall conform to AWWA C110/ANSI A21.10-03. All fitting shall be compatible with pipe.
- B. The type of fittings for pipe and valve connections shall be determined by Contractor in accordance with the requirements shown on the Drawings prior to ordering the fittings.
- C. Fittings shall be cement-mortar lined and coated as specified for pipe.

2.4 DUCTILE IRON PIPE COUPLINGS

- A. Couplings and accessories shall be pressure rated at least equal to that of the pipe. Couplings shall be Dresser Style 153, Smith Blair 441 style, Rapidfit by Cascade Waterworks, or approved equal. Couplings shall be provided with corrosion resistant nuts and bolts. The interior of the coupling shall be epoxy-coated. Epoxy coating shall conform to AWWA C550-01.
- B. Transition couplings for joining pipe of different diameters shall be provided with corrosion resistant nuts and bolts.
- C. After assembly, all exterior surfaces including the bolts and nuts shall be completely coated with two coats of a heavy-duty protective asphaltic coating.

2.5 JOINTS FOR DUCTILE IRON PIPE

- A. Joints shall be mechanical joints, ANSI A21.11-00/AWWA C111-80. Mechanical joints shall be provided with required gaskets, lubricants and accessories conforming to ANSI A21.11-00/AWWA C111-80.
- B. Restrainers shall be MEGALUG by EBBA Iron, MJ Field Lok Gasket by U.S. Pipe & Foundry, Allgrip 3600 by Star Pipe Products, or approved equal.

2.6 POLYVINYL CHLORIDE (PVC) WATER PIPE

- A. If approved by Engineer, PVC water pipe may be substituted for ductile iron pipe in domestic water systems.
- B. PVC Plastic Municipal Water pipe shall have integral bell and spigot joints and shall meet the requirements of AWWA C900-97 PVC Pressure Pipe and Fabricated Fittings, 4" through 12", for "water distribution". Class 150 pipe shall conform to the requirements of DR18.
- C. All pipe shall be suitable for use as a pressure conduit. Provisions must be made for expansion, and contraction at each joint with an elastomeric ring, which meets the requirements of ASTM F477-02, Standard for Elastomeric Seals (Gaskets) for Joining Plastic Pipe. The wall thickness in the bell section shall conform to the requirements of ASTM D3139-98, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals. When used in potable water systems, the pipe shall meet ANSI/NSF 61-99. The pipe shall be manufactured to cast iron outside dimensions in accordance with AWWA C900-97.

2.7 GATE VALVES

- A. Gate valves shall be resilient seated conforming to the requirements of AWWA C509-01 and the requirements of the local water authority.
- B. Gate valves shall be cast iron body, bronze mounted, double disk, non-rising stem, O-ring type stuffing box.
- C. Gate valves shall open to the left (counter clockwise) and shall be mechanical joint type.
- D. Bolts, studs and nuts shall be made from a corrosion-resistant material such as low-zinc bronze, nickel copper alloy, or stainless steel.
- E. The operating nut shall be 2 inches square at the base, tapering to 1⁵/₁₆ inches square at the top.

2.8 BUTTERFLY VALVES

- A. Butterfly valves are generally used on pipe 16 inches and greater in diameter, and shall be installed in accordance with the standard practices of the Jurisdictional Authority.
- B. Butterfly valves shall be pressure Class 150B mechanical joint end with ductile iron body conforming to ASTM A536-84, Grade 65-45-R and stainless steel body seat, all in accordance with ANSI F1433-97/AWWA C504-00 Rubber-Seated Butterfly Valves.

2.9 VALVE BOXES

- A. Each gate valve shall be provided with a valve box and cover.
- B. Valve boxes shall be of the adjustable, telescoping, heavy-pattern type designed and constructed to prevent the direct transmission of traffic loads to the pipe or valve.

- C. Valve boxes shall be cast iron, asphalt coated with cast iron covers. The smallest inside diameter of the shaft shall not be less than 5¼ inches. The lower section of the box shall be designed to enclose the operating nut and stuffing box of the valve. Provisions shall be made for adjustment through at least 6-inches vertically while retaining a lap of at least 4 inches between sections.
- D. Covers shall be close fitting and substantially dirt-tight. The top of the cover shall be flush with the top of the box rim. Unless otherwise required by the Jurisdictional Authority, the word “WATER” shall be cast in the top surface of the cover.

2.10 HYDRANTS

- A. Hydrants: AWWA C502.
 - 1. Type of Thread: National Standard.
 - 2. Number of Outlets: 2 at 2½-inch hose connections and 1 at 4½-inch steamer connection.
 - 3. Diameter of Opening: 4½ inch.
 - 4. Size and Type of Inlet Connection: 6-inch mechanical joint
 - 5. Direction of Opening: Open left.
 - 6. Depth of cover: 5' feet minimum.
 - 7. Size and Shape of Operating Nut: Pentagonal.
 - 8. Bolts and nuts: corrosion-resistant material.
- B. Coatings: Two coats of primer; final finish color as required by the Jurisdictional Authority.

2.11 TAPPING SLEEVE AND VALVE

- A. Tapping sleeves: AWWA C223, bolted-sleeve type with mechanical joint connection to the existing water pipe and flanged end outlets for connecting the tapping valves. Tapping sleeves shall be suitable for a working water pressure of 200 psi and outlet flanges shall conform to the 125-pound American Standard with Cor-Ten or cadmium plated cast iron nuts and bolts.

2.12 THRUST BLOCKS

- A. Thrust blocks shall be installed in accordance with the details shown on the Drawings and/or as required by the Jurisdictional Authority.
- B. Concrete: Minimum 28-day compressive strength of 3,000 psi.
- C. In certain areas, thrust blocks cannot be used because of the density of other utilities and inability to construct thrust blocks bearing against “undisturbed soil”. In such case, restrained joints shall be used at that location.

2.13 CORPORATION STOPS AND CURB STOPS

- A. Corporation stops: ball type corporation valves threaded to a receive compression-type fitting as manufactured by Mueller Co., Ford Meter Box Co., Grand Junction Pipe & Supply, or approved equal.

- B. Curb stops: ball valve threaded to receive compression-type fittings by Mueller Co., Ford Meter Box Co., Grand Junction Pipe & Supply, or approved equal.
- C. Stops shall be sized to receive the service tubing without the use of enlargement/reduction fittings.

2.14 SERVICE BOXES

- A. Service boxes shall be cast iron improved extension type with arch pattern base. Covers shall be held in place with bronze bolts and the word "WATER" shall be cast into the top surface of the cover. Service box shafts shall have a minimum inside diameter of 2½ inches. Service boxes shall be as manufactured by Mueller Co., Ford Meter Box Co., Grand Junction Pipe & Supply, or approved equivalent.

2.15 WATER SERVICE

- A. Services, two inches or smaller: Copper water tubing, Type K, ASTM B88 and ANSI Standard 61 for underground water service.
 - 1. Joints: Three part compression couplings or an approved equal.
- B. Water Service Fittings: Fittings, couplings, adapters, check valves and service saddles shall be in conformance with AWWA C800.
- C. Services, 3 inches and greater: Ductile iron pipe or as otherwise required by the Jurisdictional Authority.

2.16 METER PITS/VAULTS

- A. As required by Jurisdictional Authority.

2.17 BACKFLOW PREVENTERS

- A. As required by Jurisdictional Authority.

2.18 PRESSURE REDUCING VALVES

- A. As required by Jurisdictional Authority.

2.19 METERS

- A. As required by Jurisdictional Authority.

2.20 BEDDING

- A. Unless otherwise indicated, bedding shall consist of screened gravel, maximum size ¾ inches and minimum size ⅜ inches.
- B. When clay, wet, soft or silty soil conditions prevail, ¾-inch crushed stone shall be used for bedding.

PART 3 EXECUTION

3.1 GENERAL

- A. Verify site conditions before proceeding with demolition work. Field check the accuracy of the Drawings and inspect structures, utilities, and other site features prior to start of work and notify Engineer in writing, of any hazardous conditions and/or discrepancies.
- B. All water pipes, fittings, valves, hydrants and other appurtenances shall be installed at the locations as shown on the Drawings and/or directed by Engineer.
- C. The proposed location and vertical alignment may be altered to avoid conflicts with existing and proposed utilities, as approved by Engineer.

3.2 LAYING DUCTILE IRON PIPE AND FITTINGS

- A. Ductile iron pipe and fittings shall be installed in accordance with the requirements of AWWA C600.
- B. Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a trench prepared and maintained in accordance with Section 31 2310—Earthwork.
- C. All pipe shall be clean before laying. When installation is stopped for any reason, the open ends of the pipe shall be closed by watertight plugs or other approved means. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been dewatered and all danger of water entering the pipe has been eliminated.
- D. Fittings, in addition to those shown on the Drawings, shall be provided if required to avoid utility conflicts.
- E. When cutting of pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a push-on bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be undamaged.
- F. Maximum allowable deflection for pipe laid without fittings shall not exceed the allowable amount established by the pipe manufacturer and shall not exceed those shown in AWWA C600.
- G. The pipe shall be laid with a minimum cover of 4½ feet (4.5 ft) below finished grade, unless otherwise required by the Municipality or directed by Engineer.

3.3 JOINTING DUCTILE IRON PIPE, PUSH-ON TYPE

- A. Push-on joints shall be made in strict accordance with the manufacturer's instructions. A rubber gasket shall be inserted in the groove of the bell end of the pipe and the joint surface cleaned and lubricated using the pipe manufacturer's suggested methods and materials. The plain end of the pipe to be laid shall be inserted in alignment with the bell of the pipe to which it is to be jointed and pushed home with a jack or by other means. After joining the pipe, a metal feeler gauge shall be used to make certain that the rubber gasket is correctly located and has not been twisted or otherwise displaced.

3.4 JOINTING MECHANICAL JOINT PIPE AND FITTINGS

- A. Mechanical joints shall be made in strict accordance with the manufacturer's instructions. Mechanical joints shall be made by first cleaning the surfaces against which the gaskets will come in contact with a wire brush. The gasket, bell and spigot shall be lubricated by washing with soapy water just prior to assembling the joint. After the nuts have been made up finger

tight, the bottom nut, then top and then diametrically opposite nuts shall be progressively tightened. Bolts shall be tightened to the torques listed:

Bolt Size (Inches)	Range of Torque (Foot-Pounds)
$\frac{5}{8}$	45–60
$\frac{3}{4}$	75–90
1	85–100

- B. After installation, a heavy bitumastic coating shall be applied to all bolts and nuts.
- C. Restraining device shall be ductile iron and shall have dimensions such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI A21.11 and ANSI A21.53-00/AWWA C153 latest revision.

3.5 PVC WATER PIPE

- A. PVC Water Pipe shall be installed in accordance with Uni-Bell Standard UNI-B-3-Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe (Nominal Diameters 4–36 inch) and AWWA C605-94.
- B. PVC pipe may be tapped directly or by using saddles. Only AWWA C900-97, DR 18 and DR 14 in sizes 6" through 12" can be directly tapped. When direct tapping, follow the procedures in Uni-Bell Standard UNI-B-8-Recommended Practice for the Direct Tapping of Polyvinyl Chloride (PVC) Pressure Water Pipe.
- C. Saddles or service clamps used with PVC Water Pipe shall provide full support around the pipe circumference and provide a bearing area of sufficient width along the pipe axis (minimum of 2 inches).
- D. Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a trench prepared and maintained in accordance with Section 31 2310—Earthwork.
- E. The pipe shall be laid with a minimum cover of 4½ feet (4.5 ft) below finished grade.

3.6 CONCRETE THRUST BLOCKS

- A. Where pipes change horizontal and vertical direction, at hydrants, tees and other fittings, and wherever abnormal thrust forces may be developed, the Contractor shall construct thrust and anchor blocks as detailed on the Drawings. They shall be concrete, of minimum dimensions as detailed on the drawings or of adequate additional size to suit actual conditions to withstand pressures anticipated, and shall be founded in undisturbed soil.
- B. Concrete for thrust blocks shall have a minimum 28-day compressive strength of 3,000 psi.
- C. Fittings, which do not use thrust blocks resting against natural occurring material with passive resistance pressure of 1,500 psf, shall be installed with a restrained joint system as specified in Article 3.7.

3.7 RESTRAINED JOINTS

- A. Restrained joints shall be installed at bends, reducers, tees, valves, dead ends, and hydrants. The minimum length of pipe to be restrained on either side of the joint shall be as shown on the table below. The fittings of the new piping shall be for restrained joints, as marked on the Drawings.

Number of Joints to Restrain
on Either Side of Fitting

Fitting Type	Number of Joints to Restrain on either Side of Fitting (Based on 18-foot pipe length)
90 Degree bend	3
45 Degree bend	2
22 ½ degree bend	2
Tee, Branch	3
Tee, Run	2

- B. No restraining is required in the direction of the existing pipe if only a short length of it is exposed in the trench for making a connection.
- C. Restrained joint assemblies for push-on pipe and fittings shall be made in strict accordance with the manufacturer's recommended installation procedures.
- D. Restrained joint assemblies for mechanical joint pipe shall be EBAA Iron MEGALUG, Cascade Waterworks Rapidfit, U.S Pipe Co. MJ Field Lok, or approved equivalent.

3.8 WATER / SANITARY SEWER SEPARATION

- A. When a sewer pipe crosses above or below a water pipe, Contractor shall comply with these following procedures:
1. Relation to Water Mains
 - a. Horizontal Separation: Whenever possible, sewers shall be laid below, and at a minimum at least 10 feet, horizontally, from any existing or proposed water main. Should local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet, but no closer than 2 feet, to a water main if:
 - 1) It is laid in a separate trench, or
 - 2) It is laid in the same trench with the water main located at one side on a bench of undistributed earth, and
 - 3) In either case, the elevation of the top (crown) of the sewer is at least 18 inches below the bottom (invert) of the water main.
 - b. Vertical Separation: Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of 10 feet on each side of the sewer. One full length of water main should be

- centered over the sewer so that both joints will be as far from the sewer as possible.
- c. When it is impossible to obtain horizontal and/or vertical separation as stipulated above, both the water main and sewer shall be constructed of mechanical-joint cement lined ductile iron pipe, or other equivalent based on watertightness and structural soundness. Both pipes shall be pressure tested by an approved method to assure watertightness, or both pipes shall be encased in concrete.

3.9 GATE VALVES AND BOXES

- A. Valves shall be set in firmly compacted and shaped soil. Where the soil in the trench subgrade is found to be soft, loose, freshly filled earth, unstable or unsuitable as a base, the unsuitable material shall be excavated to such additional depth and width as required. The excavated area shall be backfilled with gravel or crushed stone, compacted and shaped.
- B. Valve boxes shall be set centered and plumb over the operating nuts of all valves. The top of each valve box shall be set to finished grade with at least 10 inches of overlap remaining between the upper sections for vertical adjustment. Minimum overlap for lower, extension pieces shall be 4 inches.
- C. Boxes shall be adequately supported during backfilling to maintain vertical alignment.

3.10 TAPPING SLEEVES AND GATE VALVES

- A. Installation shall be made under pressure and the flow of water through the existing pipe shall be maintained at all times. The diameter of the tap shall be a minimum of $\frac{1}{4}$ inch less than the inside diameter of the branch line.
- B. The entire operation shall be conducted by workmen thoroughly experienced in the installation of tapping sleeves and valves, and under supervision of qualified personnel furnished by the manufacturer. The tapping machine shall be furnished by the Contractor.
- C. Contractor shall determine the location of the existing pipe to be tapped to confirm that interference will not be encountered from existing utilities or a joint or a fitting. No tap shall be made closer than 3 feet from a pipe joint.
- D. Pipe upon which tapping sleeve is to be installed shall be thoroughly cleaned of all foreign matter with scraping tools and wire brushes to a minimum of six inches beyond each side of the sleeve. The cleaned area shall be washed with a hypochlorite solution. The interior of tapping valve shall also be washed with hypochlorite solution.
- E. Tapping sleeves and valves with boxes shall be set vertically and squarely centered on the pipe to be tapped. Adequate support shall be provided under the sleeve and valve during the tapping operation. Thrust blocks shall be provided behind all tapping sleeves. the supporting earth around and under the valve and sleeve shall be compacted. After completing the tap, the valve shall be flushed to ensure that the valve set is clean.
- F. Before backfilling, all exposed portions of any bolts used to hold the two halves of the sleeve together shall be heavily coated with two coats of bituminous paint.

3.11 HYDRANTS

- A. Hydrants shall be installed at the locations and in conformance with the details shown on the drawings.
- B. Each hydrant shall be set vertically and be properly braced. Hydrants shall be installed with thrust blocks or restrained joints as specified in Articles 3.6 and 3.7. Care shall be taken to ensure that thrust block concrete does not plug the drain ports.

3.12 WATER SERVICES

- A. Service Pipe: Care shall be exercised in placing and laying of services to prevent kinks or sharp bends and contact with sharp stones or ledge which would damage to the pipe. At least 6 inches of sand shall be placed adjacent to, under, and above the pipe, and no stone larger than 2 inches shall be placed over the pipe until the depth of backfill above the pipe is in excess of 1 foot.
- B. Corporation Stop: Taps to the pipe shall be threaded and shall be made at the horizontal diameter of the main. The tap shall be made by means of a tapping machine manufactured for this purpose and supplied by the Contractor. The tap and drill shall be kept sharp and shall have threads matching those of the stop. Corporation stop threads shall be coated with sealing compound and the stop screwed firmly into the water with the key upward and the inlet end projecting at least 1/8-inch beyond the inside face of the pipe. The corporation stop shall be left in the on (open) position after installation of the service pipe.
- C. Curb Stop and Curb Boxes shall be of a size equal to the size of the service pipe and shall be installed in the locations shown on the drawings, or as ordered by Engineer. The boxes shall be set in a vertical position and flush with the proposed finish grade.
- D. Ductile Iron Service Pipe: ductile iron service pipe connections to the water main shall be made with tee fittings or tapping sleeves.

3.13 POLYETHYLENE ENCASEMENT

- A. Installation of polyethylene encasement shall be in accordance with the recommended procedures contained in ANSI A21.5-99/AWWA C105 and when directed by Engineer Water Department or Engineer.
- B. Care shall be taken during backfilling to prevent damage to polyethylene wrap. backfilling shall be in accordance with AWWA C600-99.

3.14 PRESSURE TESTING

- A. Hydrostatic and leakage test shall be conducted in accordance with AWWA Standard C600-99 and C900-97, and as directed by Engineer. Testing shall be conducted by a certified Independent Water Testing Company.
- B. Conduct pipe tests after concrete thrust blocks have cured to the required 3000-psi strength. Fill pipe 24 hours prior to testing, and apply test pressure to stabilize system. Use only potable water.
- C. Prior to pressure testing, the entire pipe section shall be flushed to remove any rocks or debris, which may have inadvertently entered the pipe during construction.
- D. Once the pipe section has been filled at normal pressure and all entrapped air removed, the Contractor shall raise the pressure to 150 psi or two times the operating pressure (whichever is greater) by a special pressure pump, taking water from a small tank of proper dimensions for satisfactorily measuring the rate of pumping into the pipe. This pressure shall be maintained for

a minimum of 2 hours, during which time the line shall be checked for leaks. Measured rate of water leakage shall not exceed the allowable leakage listed below.

Maximum Allowable Leakage

Test Pressure (psi)	Nominal Pipe Diameter (inches)	Allowable Leakage (gallons per hour per 1,000 feet of pipeline)
150	4	0.36
150	6	0.55
150	8	0.74
150	10	0.92
150	12	1.10
150	16	1.47

- E. Interior piping in vaults, buildings, etc. shall have zero leakage.
- F. Should leakage exceed this rate, the Contractor shall immediately locate the leak or leaks and repair them. Pipe will be accepted only when leakage is zero, or less than the allowable amount. Approval does not absolve the Contractor from responsibility if leaks develop later within the period of warranty.

3.15 DISINFECTION

- A. Before being placed in service, all new water pipe shall be chlorinated in accordance with AWWA C651-99 Standard for Disinfecting Water Mains or Engineer requirements/regulations, whichever is the more stringent.
- B. The location of the chlorination and sampling points will be determined by the jurisdictional authority in the field. Taps for chlorination and sampling shall be installed by Contractor. Contractor shall uncover and backfill the taps as required.
- C. The pipe section being disinfected shall be flushed to remove discolored water and sediment from the pipe. a 25-mg/l chlorine solution in approved dosages shall be inserted through a tap at one end while water is being withdrawn at the other end of the pipe section. The chlorine concentration in the water in the pipe shall be maintained at a minimum 25-mg/l available chlorine during filling. To assure that this concentration is maintained, the chlorine residual shall be measured at regular intervals in accordance with procedures described in Standard Methods and AWWA M12, Simplified Procedure for Water Examination [Section K].
- D. During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the pipe supplying the water. Chlorine application shall not cease until the entire pipe section is filled with chlorine solution. The chlorinated water shall be retained in the pipe for at least a twenty-four hour period. the treated water shall contain chlorine residual throughout the length of the pipe section as indicated in AWWA C651-99.
- E. Following the chlorination period, all treated water shall be flushed from the pipe section and replaced with water from the distribution system. Prior to disposal of treated water the Contractor shall check with local authorities to determine if the discharge will cause damage to the receiving body or sewer and, if required, the Contractor shall neutralize the chlorinated water in accordance with AWWA recommendations. Bacteriological sampling and analysis of the replacement water may then be made by the Contractor in full accordance with AWWA C651-

99. A minimum of three samples shall be taken by the Contractor at locations directed by Engineer along the length of water pipe being chlorinated and sent to a State approved private laboratory for analyses. The Contractor shall rechlorinate if the samples show presence of coliform, and the pipe section shall not be placed in service until all of the repeat samples show no presence of coliform.

- F. Furnish two copies of a Certificate of Disinfection Report to Engineer and one copy to Engineer.
- G. Contractor shall pay all costs for all testing, flushing, chlorinating, laboratory analyses, sampling, water supply and municipal charges.

3.16 AS-BUILT DRAWINGS

- A. Contractor shall be solely responsible for complying with the requirements of local permitting authorities for preparation and submittal of as-built drawings. The requirements for the preparation of as-built drawings as defined herein shall be considered the minimum requirements of Engineer, but shall in no way relive Contractor from satisfying the requirements of local permitting authorities.
- B. As work progresses, record the following on two (2) sets of Drawings:
 - C. All changes and deviations from the design in location, grade, size, material, or other feature as appropriate.
 - D. Any uncharted locations of utilities or other subsurface feature encountered during installation, including the characteristics of such uncharted utility or subsurface feature such as utility type, size, depth, material of construction, etc.
 - E. Recording of changes shall be clearly and neatly marked in red pen or pencil. All changes shall be noted on the appropriate Drawing sheets.
 - F. Make measurements from fixed, permanent points on the Project Site to accurately locate the work completed. Such measurements shall consist of at least three (3) ties showing the distance of each item relative to each of the fixed, permanent points.
 - G. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall also contain any additional information required by Engineer.

3.17 CLEAN UP

- A. Contractor shall remove all debris, residuals, and materials at the conclusion of the work.

END OF SECTION

SECTION 33 31 00

SANITARY SEWERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Installation of sanitary sewage pipe and fittings.
 - 2. Installation of sanitary specials, connection chimneys, laterals, outlets, and joint materials.
 - 3. Installation of sanitary sewer manholes.
- B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.
- D. Contractor is solely responsible for obtaining permits or approvals which may be required to perform the work of this section, including all costs, fees and taxes required or levied. Notify and obtain such permits or approvals from all agencies having jurisdiction prior to starting work.

1.2 REFERENCE STANDARDS

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR).
 - 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. ASTM International (ASTM).
 - 1. ASTM A47/A47M—Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process.
 - 2. ASTM A48—Standard Specification for Gray Iron Castings.
 - 3. ASTM A123/A123M—Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 4. ASTM A307—Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - 5. ASTM A536—Standard Specification for Ductile Iron Castings.
 - 6. ASTM A563—Standard Specification for Carbon and Alloy Steel Nuts.
 - 7. ASTM A615—Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

8. ASTM A74—Standard Specification for Cast Iron Soil Pipe and Fittings.
9. ASTM A746—Standard Specification for Ductile Iron Gravity Sewer Pipe.
10. ASTM C12—Standard Practice for Installing Vitrified Clay Pipe Lines.
11. ASTM C14—Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
12. ASTM C55—Standard Specification for Concrete Building Brick.
13. ASTM C76—Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
14. ASTM C94—Standard Specification for Ready-Mixed Concrete.
15. ASTM C139—Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
16. ASTM C150—Standard Specification for Portland Cement.
17. ASTM C207—Standard Specification for Hydrated Lime for Masonry Purposes.
18. ASTM C270—Standard Specification for Mortar for Unit Masonry.
19. ASTM C387—Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
20. ASTM C425—Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
21. ASTM C443—Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
22. ASTM C443—Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
23. ASTM C478—Standard Specification for Precast Reinforced Concrete Manhole Sections.
24. ASTM C507—Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.
25. ASTM C564—Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
26. ASTM C700—Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
27. ASTM C1628—Standard Specification for Joints for Concrete Gravity Flow Sewer Pipe, Using Rubber Gaskets.
28. ASTM C828—Low-Pressure Air Test of Vitrified Clay Pipe Lines.
29. ASTM C877—Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections.

30. ASTM C478—Standard Specification for Precast Reinforced Concrete Manhole Sections.
31. ASTM C923—Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
32. ASTM C924—Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
33. ASTM C969—Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
34. ASTM C972—Compression-Recovery of Tape Sealant.
35. ASTM C990—Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants.
36. ASTM D412—Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
37. ASTM D624—Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
38. ASTM D1784—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
39. ASTM D1785—Standard Specification for Poly (Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120.
40. ASTM D2235—Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
41. ASTM D2241—Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
42. ASTM D2321—Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
43. ASTM D2412—Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
44. ASTM D2464—Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
45. ASTM D2466—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
46. ASTM D2467—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
47. ASTM D2680—Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
48. AASTM D2751—Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.

49. ASTM D2996—Filament-Wound “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
50. ASTM D2997—Centrifugally Cast “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
51. ASTM D3034—Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
52. ASTM D3139—Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
53. ASTM D3212—Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
54. ASTM D3262—“Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
55. ASTM D3350—Polyethylene Plastics Pipe and Fittings Materials.
56. ASTM D3753—Glass-Fiber-Reinforced Polyester Manholes and Wetwells.
57. ASTM D3840—“Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Nonpressure Applications.
58. ASTM D4101—Standard Specification for Polypropylene Injection and Extrusion Materials.
59. ASTM D4161—“Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.
60. ASTM D4396—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds for Plastic Pipe and Fittings Used in Nonpressure Applications.
61. ASTM F402—Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.
62. ASTM F405—Corrugated Polyethylene (PE) Tubing and Fittings.
63. ASTM F477—Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
64. ASTM F679—Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
65. ASTM F714—Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
66. ASTM F758—Smooth-Wall Poly (Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage.
67. ASTM F794—Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
68. ASTM F894—Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe.

69. ASTM F949—Standard Specification for Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings.
 70. ASTM F1336—Standard Specification for Poly (Vinyl Chloride) (PVC) Gasketed Sewer Fittings.
 71. ASTM F1803—Standard Specification for Poly (Vinyl Chloride)(PVC) Closed Profile Gravity Pipe and Fittings Based on Controlled Inside Diameter.
- D. American Water Works Association (AWWA).
1. “PVC Pipe—Design and Installation,” M23 (latest edition. and applicable supplements thereto).
 2. “Concrete Pressure Pipe,” M9 (latest edition and applicable supplements thereto).
 3. ANSI/AWWA C104/A21.4—Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 4. ANSI/AWWA C105/A21.5—Polyethylene Encasement for Ductile-Iron Pipe Systems.
 5. ANSI/AWWA C110/A21.10—Ductile-Iron and Gray-Iron Fittings for Water.
 6. ANSI/AWWA C111/A21.11—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 7. ANSI/AWWA C150/A21.50—Thickness Design of Ductile-Iron Pipe.
 8. ANSI/AWWA C151/A21.51—Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
 9. ANSI/AWWA C153/A21.53—Ductile-Iron Compact Fittings for Water Service.
 10. ANSI/AWWA C600—Installation of Ductile-Iron Water Mains and Their Appurtenances.
- E. American Concrete Pipe Association (ACPA).
1. ACPA 01-103—Concrete Pipe and Box Culvert Installation (latest revision and applicable supplements thereto).
- F. UNI-BELL PVC PIPE ASSOCIATION (UBPPA).
1. UBPPA UNI-B-6 (1998) Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe.
- G. American Association of State High and Transportation Officials (AASHTO).
1. Standard Specifications for HS-20, Highway Loading (AASHTO H-20).

1.3 SUBMITTALS

- A. Submit to Engineer for his approval manufacturer’s name with details of the pipe, fittings, and joint offered before ordering. Engineer reserves the right to have the manufacturer submit to them a printed certified set of material specifications certifying to the manufacturer’s conformity with this Section.

- B. Product data for all materials provided under this Section.
- C. Prior to ordering material, submit shop drawings and descriptive literature showing dimensions, joint and other details of all materials to be furnished under this Section. Such shop drawings shall include, but not necessarily be limited to, joint and other details for precast manholes, manhole frames and covers, and flexible joint sealant for manholes.
- D. Samples of each size and type of pipe to be utilized. No pipe shall be ordered or delivered until Engineer has approved the pipe material.

E. As-Built Drawings

- 1. Submit two (2) copies of As-Built Drawings upon completion and acceptance of work.
- 2. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall include a minimum of three (3) ties showing the distance to each catch basin and manhole, and the location of service connections measured from fixed permanent objects. As-Built drawings shall also contain any additional information required by Engineer.

1.4 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- B. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.
- C. Sample pipe for testing, when requested by Engineer, shall be furnished by Contractor in sufficient numbers. The Contractor and/or the pipe manufacturer shall make the facilities and services for making the load tests available.
- D. All installation and field-testing shall be under the supervision and direction of Engineer and all cost for field tests shall be included in Contractor's cost of the work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Storage
 - 1. Manufacturer shall package the pipe in a manner designed to deliver the pipe to the Project Site neatly, intact, and without physical damage. Transportation carrier shall use an appropriate method to ensure the pipe is properly supported, stacked, and restrained during transport. Inspect materials delivered to site for damage; store with minimum of handling.
 - 2. Unloading of the pipe should be controlled so as not to collide with the other pipe sections or fittings, and care should be taken to avoid chipping or spalling, especially to the spigots and bells. For manhole sections, cone sections, bases, fittings and other precast appurtenances, utilize lifting holes or lifting eyes provided.
 - 3. In cold weather conditions, use caution to prevent impact damage. Handling methods considered acceptable for warm weather may be unacceptable during cold weather.

4. Storage:

- a. Store materials on site in enclosures or under protective coverings. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
- b. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging.
- c. Store solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials under cover out of direct sunlight. Provide additional storage measures in accordance with the manufacturer's recommendations. Discard materials if storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.
- d. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
- e. Cement, Aggregate, and Reinforcement: As specified in Section 033200—Site Cast-in-Place Concrete.
- f. Store manhole units in an upright position.

PART 2 PRODUCTS**2.1 GENERAL**

- A. Products furnished under this Section which are damaged or found defective in any way prior to being set in place and final acceptance, may be rejected. Engineer may reject an entire lot of pipe should the sample pipe from such lot fail to meet requirements.

2.2 CONCRETE GRAVITY PIPE

- A. Reinforced concrete pipe, ASTM C76, Class III or Class IV, Wall B or Wall C.
 1. Class III pipe shall be used unless otherwise indicated.
 2. Class IV pipe shall be used when depth of soil cover is less than 12 inches. Depth of cover shall not be considered to include pavements or similar surficial finishes.
 3. Wall B pipe shall be used for all pipe sizes less than 24", where depth is less than 16 feet.
 4. Wall C pipe shall be used for pipe sizes 24" and larger at any depth and for all pipe sizes where depth is 16 to 25 feet.
- B. Fittings and specials shall conform to the applicable requirements specified for the pipe.
- C. Gaskets and pipe ends for rubber gasket joint: ASTM C443. Gaskets shall be suitable for use with sewage.

2.3 CONCRETE PRESSURE PIPE

- A. Concrete pipe, ASTM C361. Pipe shall be designed for hydrostatic head of **[100] [125]** feet and external loading sufficient for the earth cover indicated on the drawings. Circular pipe

with elliptical reinforcement shall have a readily visible line at least 12 inches long painted or otherwise applied on the inside and outside of the pipe at each end so that when the pipe is laid in the proper position, the line will be at the center of the top of the pipe.

- B. Fittings and specials shall conform to the applicable requirements specified for the pipe, AWWA C302.
- C. Gaskets: ASTM C361, suitable for use with sewage.

2.4 POLYVINYL CHLORIDE (PVC) GRAVITY PIPE

- A. Pipe, 4-inch to 15-inch diameter: ASTM D3034, SDR-35. Integral bell gasket joints with factory-installed retained integral gaskets. Minimum pipe stiffness of 46 psi, ASTM D3412.
- B. Pipe, 18-inch to 36-inch diameter: ASTM F679. Integral bell gasket joints with factory-installed retained integral gaskets. Minimum pipe stiffness of 46 psi, ASTM D3412.
- C. PVC Cell classification: 12454 or 12364, ASTM D1784.
- D. Markings
 - 1. Manufacturer's name or trademark.
 - 2. The standard to which it conforms/ASTM Designation.
 - 3. Pipe size.
 - 4. Material designation code/PVC cell classification.
 - 5. SDR number or schedule number.
- E. Joints
 - 1. Joints: ASTM D3212, gasketed, bell-and-spigot, push-on type.
 - 2. Gaskets: ASTM F477. Gaskets shall be part of a complete pipe section, factory-installed or field-installed per pipe manufacturer's requirements. Lubricant shall be as recommended by the pipe manufacturer.
- F. Fittings: SDR-35, ASTM D3034 and ASTM F1336, specifications to match pipe.
- G. Waterstops: Elastomeric PVC, sized for outside diameter of pipe.
- H. No single piece of pipe shall be laid on any project covered by these specifications unless it is found to be generally straight. Such pipe shall have a maximum ordinate as measured from the concave side of the pipe not to exceed $\frac{1}{16}$ inch per foot of length. If the deviation from straightness exceeds this requirement, then the particular piece of pipe shall be rejected.

2.5 PVC FORCE MAIN PIPE

- A. Polyvinyl Chloride (PVC) Sanitary Sewer Force Main pipe shall be manufactured from a Type I, Grade I Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454-A or 12454-B per ASTM D1784.
- B. All pipes shall be suitable for use as a pressure conduit for sanitary sewage.

- C. Pipe shall be either SDR-14 (200 psi) meeting the requirements of AWWA C900 or Schedule 80 meeting the requirements of ASTM D1785.
- D. Fittings shall be gasketed joint meeting the requirements of ASTM D3139, and the joint gasket shall conform to ASTM F477.
- E. Force main pipe shall be a minimum of 3-inch diameter.

2.6 DUCTILE IRON PIPE

- A. Ductile Iron Pipe: ASTM A746 and ANSI/AWWA C151/A21.51. Thickness Class 52, ANSI/AWWA C150/A21.50, unless indicated otherwise on the Drawings or directed otherwise by Engineer.
 - 1. Push-on joints, except as otherwise specified. Mechanical joints shall only be used where indicated. Push-on joint pipe ends and fitting ends, gaskets, and lubricant for joint assembly shall conform to ANSI/AWWA C111/A21.11.
 - 2. Mechanical joint requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to ANSI/AWWA C111/A21.11.
 - 3. Cement Lining: Double Thickness, ANSI/AWWA C 104/A 21.4.
 - 4. Corrosion Control: Polyethylene wrap in tube or sheet form, ANSI/AWWA C105/A21.5.
- B. Fittings
 - 1. Bituminous coated inside and outside, furnished complete with necessary accessories including plain rubber gaskets, ductile-iron glands, bolts and nuts. Fittings shall have strength at least equivalent to that of the pipe and shall be installed as called-for on the Drawings or required to complete the work.
 - 2. Flanged Fittings: ANSI/AWWA C110/A21.10, flange drilling 125.
 - 3. Mechanical Joint Fittings: ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53 where applicable.
- C. Tees for capped outlets shall be installed and capped where called for on the Contract Drawings or as ordered by Engineer.
- D. All cuttings of ductile iron pipe shall be done with a pipe cutter or saw (not by chisel or other unapproved methods) at 90 degrees to the pipe. All cut edges shall be smoothed by filing/grinding.

2.7 JOINT LUBRICANT

- A. As specified by pipe manufacturer, ANSI/AWWA C111/A21.11.

2.8 CONCRETE MANHOLE

- A. Reinforced precast concrete base, riser, and top: ASTM C478. Sections shall consist of smooth circular sections in standard nominal inside diameters, type and dimensions as indicated on the Drawings. All components shall be free from cracks, damaged joints, exposed reinforcing, aggregate pockets, spalls, and dimensional distortions or other irregularities.

1. Diameter: 48 inches unless otherwise indicated.
 2. Concrete: 4,000 psi minimum.
 3. Top Section: Concentric-cone type, unless eccentric-cone or flat-slab-top type is indicated. Cones shall have the same wall thickness and reinforcement as riser sections. If required or called-for, flat slab shall be a minimum of 8 inches thick designed to carry AASHTO H-20 loading with one foot cover and conform to ASTM C478.
 4. Bottom: Bottoms shall be integrally cast unless specialty bases ("Dog-House") at points of connection to existing sewer mains are indicated on the Drawings or otherwise proposed for use. Unless indicated on the Drawings, any special bases or riser used must be detailed in shop drawings and submitted for approval.
 5. External damp-proofing: Asphalt, ASTM D449, Type A.
 6. [Internal waterproofing: Where required, 60-mil polyvinylchloride or polyethylene sheet with webs or ribs to mechanically lock the sheet to the manhole wall. Joint strips shall be ribless and shall be a minimum of 4 inches wide.]
 7. Openings or "knockouts" in precast units shall be located as shown on the Drawings and to accommodate the inflow and outflow pipe orientation required. Openings shall sized sufficiently to permit passage of the largest outside dimension of pipe or fittings. Prior to ordering precast manhole bases, all angles between incoming pipes are to be field checked to incorporate possible line changes required in the field layout.
- B. Gaskets for joints between manhole sections: Butyl rubber, ASTM C443.
- C. Grade Rings: ASTM C478, precast reinforced concrete, 1-inch to 4-inch thickness, diameter to match manhole and frame.
- D. [Frame and Cover: Ductile Cast Iron, ASTM A536, Grade 60-40-18.]
- E. [Frame and Cover: Grey Cast Iron, ASTM A48, Class 35B.]
1. Cover: 26 inch diameter, non-vented with non-penetrating pickholes. Unless otherwise detailed or indicated, covers shall be cast with 1½ inch wide, raised letters, indicating "SANITARY SEWER".
 2. Frame and cover shall be supplied as a pair from the same manufacturer. Castings shall be of tough, even-grained iron, free from scale, lumps, blisters, sand-holes and other injurious defects, and of the size and type shown on the drawings. Frames and covers shall have machined bearing surfaces to seat firmly and prevent rocking and rattling under traffic loads. Before leaving the foundry, castings shall be thoroughly cleaned, subjected to hammer tests for soundness and given two coats of coal tar pitch varnish.
- F. Resilient connectors for joints between manhole and pipes entering manhole: Continuous boot of ¾ inch minimum thickness neoprene, ASTM C923 or ASTM C990. Boots shall be either cast into the manhole wall or installed into a cored opening using internal compression rings. Installed boot shall result in a water-tight connection meeting the performance requirements of ASTM C443.
- G. Steps: ASTM C478 and OSHA 29 CFR 1910.27, drop front or equivalent. Steps shall be nine inches in depth and at least twelve inches in width with an abrasive step surface.

1. [Cast Aluminum Alloy: Aluminum alloy, 6061-T6, tensile 38,000 psi, yield 35,000 psi. Drop front design with upturned embedded ends. All parts of aluminum steps to be embedded in concrete or masonry shall be coated with bituminous paint or zinc chromate primer.]
2. [Composite Plastic-Steel: One-half (½) inch deformed steel reinforcing rod, ASTM A615, Grade 60, encapsulated in a co-polymer polypropylene plastic, ASTM D2146, Type II, Grade 16906.]
3. Steps shall be placed in vertical alignment as indicated on the Drawings. Steps shall be uniformly spaced not more than sixteen inches (16") on center, including the spacing between the top step and the manhole cover. Steps shall be embedded in the wall a minimum distance of 4 inches in either cast or drilled holes. Steps shall not be driven or vibrated into fresh concrete and shall withstand a pullout resistance of 2,000 lbs when tested in accordance with ASTM C497. Each step shall project a minimum of 5 inches from the wall measured from the point of embedment.

2.9 DROP MANHOLE

- A. Provide Concrete Manhole as specified herein.
- B. Drop inlet shall be constructed with ductile iron gravity sewer pipe laid in undisturbed soil in conformance with ASTM A746-82. Adapt to PVC with Fernco coupling or approved equivalent.
- C. Vertical drop pipe shall be 8", 10", or 12" maximum SDR 35 PVC with 90-degree short bend radius shall conform to ASTM D3034.
- D. Vertical drop pipe shall be anchored a minimum of every 4 feet with ½" x 1½" type 304 stainless steel pipe straps set as ordered with lag bolts and shields.

2.10 MORTAR

- A. Mortar: ASTM C270/ASTM C387.
 1. Portland Cement: ASTM C150, Type I.
 2. Sand: ASTM C144.
 3. Hydrated Lime: ASTM C207.
 4. Water: Potable.
 5. Mix proportions for manhole rims and covers: 1 part portland cement, 2 parts sand, and ¼ part hydrated lime by dry volume. Hydrated lime shall not exceed 10 percent by weight of the total dry mix. Quantity of water in mixture shall be sufficient to produce a stiff, workable mortar, but in no case shall exceed 5½ gallons of water per sack of cement.
 6. Mix Proportions for invert construction: 1 part portland cement and 2 parts sand by volume. Quantity of water in mixture shall be sufficient to produce a stiff, workable mortar, but in no case shall exceed 5½ gallons of water per sack of cement.

2.11 THRUST BLOCKS

- A. Provide concrete thrust blocks for pipe anchorage sized and positioned as indicated on the Drawings or as otherwise required.
- B. Concrete: ASTM C94, minimum compressive strength of 2,000 psi at 28 days.

2.12 GREASE TRAP

- A. Precast concrete or fiberglass of the configuration and dimensions shown on the Drawings.
- B. Units shall be as manufactured by United Concrete Products, Inc. (Yalesville, CT); Rotondo Precast (Rehoboth, MA); Sparkling Clear Industries (Houston, TX), or approved equal.
- C. Concrete units
 - 1. All components shall be free from cracks, damaged joints, exposed reinforcing, aggregate pockets, spalls, and dimensional distortions or other irregularities.
 - 2. H-20 loading with one foot of cover, manhole riser with frame and cones, plus the weight of the soil above.
 - 3. Anchorage system for high groundwater/buoyancy.
 - 4. Joints: Butyl rubber gasket joints, ASTM C990.
- D. Fiberglass Units
 - 1. Glass-fiber construction that uses a thixotropic polyester resin specifically for the manufacturer of reinforced products. The material shall be inert, non-corrosive and impervious to retained wastes.
 - 2. H-20 loading with one foot of cover, manhole riser with frame and cover, plus the weight of soil above.
 - 3. Anchorage system for high groundwater/buoyancy.
- E. Unit manufacturer shall provide cleanout, sample and ventilation ports and a grease level monitoring and alarm system.

2.13 BEDDING

- A. Pipes: Unless otherwise indicated or directed by Engineer, screened gravel, maximum size $\frac{3}{4}$ inches and minimum size $\frac{3}{8}$ inches consisting of clean, hard, and durable fragments. No limestone shall be permitted.
- B. Manholes: Screened Gravel or Crushed Stone, well graded in size from $\frac{3}{4}$ inch to $\frac{3}{8}$ inch consisting of clean, hard, and durable fragments. No limestone shall be permitted.

PART 3 EXECUTION

3.1 GENERAL

- A. Depending upon pipe type, comply with ASTM C1479, ASTM D2321, and pipe manufacturer's requirements for installation.

- B. Inspect each pipe, fitting or other material before and after installation; replace those found defective and remove from Project Site.
- C. Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry or hoist, do not drag, pipe to trench. Provide proper facilities for lowering sections of pipe, manholes or other appurtenances into trenches and excavations without damage.
- D. Wyes, tees and bends and adapters may not be explicitly indicated on the drawings but shall be installed as required to route pipe as indicated. Plans for such fittings showing cross sectional views with dimensions shall be provided by Contractor to Engineer for approval prior to use.
- E. Dry conditions shall be maintained at all times and under no circumstances shall pipe be laid or appurtenances installed in water.

3.2 EARTHWORK

- A. Excavation, the type of materials to be used in bedding and backfilling, and the method of placement shall conform to the requirements of Section 31 2310—Earthwork and the details shown on the Drawings.
- B. Excavation for cover:
 - 1. Under Roads and similar areas: Unless shown on the Drawings or otherwise specified, three (3) feet six (6) inches.
 - 2. Landscape and grass areas: Unless shown on the Drawings or otherwise specified, four (4) feet.
- C. Trenches should be excavated to the dimensions and grade specified on the Drawings or as ordered by engineer. The width of the trenches should be kept to the minimum required for installation of pipe sections.
 - 1. Maximum trench width in soil: 1.25 times outside pipe diameter, in inches, plus one (1) foot measured at the springline of the pipe.
 - 2. Maximum trench width in rock: Four (4) feet plus outside pipe diameter measured at the springline of the pipe.
- D. The bottom of trenches shall be sufficiently graded to ensure uniform bearing for the full length of all pipes.
- E. Backfill, with approved materials, and properly compact the following:
 - 1. Over excavated areas
 - 2. Soft, unstable, or unsuitable material.
- F. Trenches shall be maintained in a safe condition at all times. Contractor shall furnish and employ such stay braces, sheeting, shoring, pumps, etc., as may be necessary for the proper completion of work, the protection of property and the safety of the public, employees of Contractor, Local Public Agencies, the Engineer, or the State; all in accordance with the

current regulations of the Applicable Safety Code and pertinent local ordinances and regulations.

- G. Contractor shall be entirely and solely responsible for the adequacy and sufficiency of all supports and of all sheeting, bracing shoring, underpinning, cofferdamming, etc. The Contractor shall assume the entire and sole liability for damages on account of injury to persons or damage to adjacent pavements and public and private property (including but not limited to, the Work under construction, existing buildings, facilities, etc.) which injury or damage results directly from Contractor's failure to install or to leave in place adequate and sufficient supports, sheeting, bracing, underpinning, cofferdamming, etc.
- H. When blasting is required for the rock excavation, adequate provisions for safety shall be provided and such work shall be performed in compliance with applicable local requirements.
- I. Backfill: Trenches shall be backfilled only after pipe has been inspected and approved and locations of pipes and appurtenances have been recorded.

3.3 COORDINATION WITH OTHER UTILITIES

- A. Verify clearances for other utilities as required prior to proceeding with the work.
- B. Crossing Water and Sewer Lines
 - 1. Crossings shall be as close to perpendicular as possible.
 - 2. Separation: Minimum 18-inch vertical separation.
 - 3. Sewer line crossing below water line
 - a. Unless approved by Engineer, sewer lines shall cross beneath water lines.
 - b. Ensure adequate support for water line to avoid deflection or damage.
 - c. Lay sewer pipe so that no joint in the sewer line will be closer than three (3) feet, horizontal distance, to the water line.
 - d. Provide screened gravel or crushed stone at the crossing as indicated on the Drawings.
 - e. Pressure Sewer Lines
 - 1) Separation: minimum two (2) feet separation.
 - 2) All portions of the pressure line within 10-feet of the water line shall be concrete-encased or enclosed in a continuous sleeve.
 - 4. Sewer line above water line
 - a. Pressure lines shall not be installed above water lines.
 - b. Provide adequate support for the sewer pipe to maintain line and grade and prevent loading of the water line.
 - c. Lay sewer pipe so that no joint in the sewer line will be closer than three (3) feet, horizontal distance, to the water line.

- d. For a distance of 10-feet on each side of the crossing, provide either gasketed PVC pressure pipe or a minimum of six (6) inches of concrete encasement.
- 5. Unusual conditions: When conditions prevent the minimum vertical separation indicated above for any type of crossing, obtain Engineer's approval prior to proceeding.
 - a. Comply with the following minimum requirements:
 - 1) Provide sewer pipe meeting AWWA standards for potable water conveyance for a distance of 10-feet on each side of the crossing. Pressure test this segment in-place per AWWA standards without leakage prior to backfilling; or
 - 2) Encase the lower pipe in a minimum of six (6) inches of concrete for a distance of 10-feet on each side of the crossing.
- C. Parallel Water and Sewer Lines
 - 1. Normal conditions: Sanitary piping or manholes shall be laid at least ten 10-feet horizontally from a water line whenever possible. The distance shall be measured edge-to-edge.
 - 2. Unusual conditions: When conditions prevent a horizontal separation of ten 10-feet, the sanitary piping or manhole may be laid closer to a water line provided that:
 - a. The top (crown) of the sanitary piping shall be at least 18 inches below the bottom (invert) of the water main.
 - b. Where this separation cannot be obtained, provide sanitary pipe meeting AWWA standards for potable water conveyance pressure tested in place without leakage prior to backfilling.
 - c. Sewer manholes shall be of watertight construction and tested in place.
- D. Sanitary sewer manholes: No water piping shall pass through or come in contact with any part of a sanitary sewer manhole.

3.4 PIPE INSTALLATION

- A. All pipe shall be installed per the recommendations of the pipe manufacturer, unless otherwise specified.
- B. Clean and dry surfaces receiving lubricants, cements, or adhesives. Affix gaskets to pipe not more than 24 hours prior to the installation of the pipe. Protect gaskets from sun, blowing dust, and other deleterious agents at all times. Before installation of the pipe, inspect gaskets and remove and replace loose or improperly affixed gaskets. Align each pipe section with the previously installed pipe section, and pull the joint together.
- C. Commencing at the lowest point in the system, the pipe and fittings shall be carefully laid true to line and grade with the bell or groove-end upgrade.
- D. A stopper shall be kept in the pipe mouth when the pipe laying is not in progress.
- E. The ends of pipe, which enter masonry, shall be neatly cut to fit the inner face of the masonry.

1. The upper surface of the screened gravel shall be shaped as necessary to provide proper grade for the pipe to be laid thereon, bell holes shall be made in the screened gravel so the pipe shall be supported on its barrel portion only, and the pipe laid thereon to line and grade in the manner described in these Specifications.
- F. When the pipe is properly positioned, screened gravel, unless otherwise required by the drawings or Engineer, shall be pulled or scraped up against the pipe and rammed into place along the barrel of the pipe only, to firmly hold the pipe in position. Care shall be taken during these operations to assure that the pipe is not disturbed.
- G. Screened Gravel Haunching and Sand Stop:
1. All pipe and laterals connected thereto, shall be haunched with bedding from the foundation to a point at least to the top of the pipe and to this same elevation out to the trench wall. Care shall be taken when placing bedding in haunching, to assure that the pipe is not disturbed.
 2. Contractor shall use any means necessary to assure firm compaction of haunching and adequate side support for the pipe.
 3. Contractor shall provide and install a filter fabric sand stop per Section 02290 for the full trench width for all sanitary sewer mains and laterals. Filter fabric shall be placed on top of the screened gravel prior to placement of 12" gravel/sand cushion. All costs for furnishing and placing of the filter fabric shall be included in the price bid per foot of pipe of all sizes.
- H. Backfill trenches from the top of the screened gravel haunching and sand stop to 12" above the top of pipe with firmly compacted sand or fine gravel or other suitable material exercising care so as not to damage or disturb the pipe.
- I. Backfill from 12" above the top of pipe to top of trench with bank run gravel, sand, or other approved material in roadway areas, otherwise suitable existing material may be used if approved by Engineer.
- J. Fill on both sides of pipe and up to a depth of 12 inches over top of pipe shall be placed carefully by hand in layers, 6 inches thick, and each layer will be tamped and compacted before the next layer is placed. Care must be taken that the fill is compact and tight under the lower half of the pipe. Remaining backfill shall be placed in layers of not more than 12 inches in depth after compaction and shall be thoroughly compacted by means of mechanical rammers or vibrators or by pneumatic tampers. Hand tampers shall be used only around the pipe as approved by Engineer. All voids along sides of trench, behind sheeting, under bracing or other objects, shall be completely and carefully filled, using such fine materials, hand labor and tools as may be necessary. All backfill materials shall be compacted to a minimum of 95% of the maximum dry density as determined by AASHTO T-180 Method D or as directed by Engineer.
- K. At Engineer's discretion, the Contractor may compact the backfill from 12 inches over the pipe to finish grade by means of a Ho-Pac. Engineer shall also have the right to approve or disapprove the compaction equipment to be used and also the height of backfill to be compacted in one lift.
- L. Backfill, screened gravel foundation and haunching shall be provided and installed as shown on the typical trench cross-section shown on the Drawings.

3.5 SPECIAL REQUIREMENTS

- A. The following subarticles supplement execution requirements set forth in Article 3.4.
- B. Cast Iron Piping
 - 1. Make joints with rubber gaskets specified for cast iron pipe joints and assemble in accordance with the recommendations of the pipe manufacturer.
- C. Clay Piping
 - 1. Install pipe and fittings in accordance with Article 3.4 and with the requirements of ASTM C12 for pipe laying. Make joints with a compression joint material specified for clay pipe joints and assemble in accordance with the recommendations of the manufacturer of the pipe.
- D. Concrete Gravity Sewer Piping
 - 1. Install pipe and fittings in accordance with Article 3.4 and ACPA 01-103. Make joints with the gaskets specified.
- E. Installation of Concrete Pressure Lines
 - 1. Install pipe and fittings in accordance with Article 3.4 and AWWA M9.
 - a. Joints: Make joints with the gaskets specified for concrete pressure pipe joints, using an approved lubricant recommended by the pipe manufacturer. Assemble these joints in accordance with the joining requirements specified in AWWA M9.
 - b. Pipe anchorage: Provide concrete thrust blocks for pipe anchorage. Size and position thrust blocks as indicated on the Drawings or as otherwise required.
- F. Installation of Ductile Iron Gravity Sewer Pipe
 - 1. Install pipe and fittings in accordance with Article 3.4 and AWWA C600.
 - 2. Make push-on joints with the gaskets and lubricant specified for this type joint and assemble in accordance with the applicable requirements of AWWA C600 for joint assembly.
 - 3. Make mechanical-joints with the gaskets, glands, bolts, and nuts specified for this type joint and assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and the recommendations of Appendix A to AWWA C111/A21.11.
 - 4. Exterior protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet in accordance with AWWA C105/A21.5, using **[Class A]** **[Class C]** polyethylene film.
- G. Installation of Ductile-Iron Pressure Lines
 - 1. Install pipe and fittings in accordance with Article 3.4 and AWWA C600.
 - 2. Make push-on joints with the gaskets and lubricant specified for this type joint and assemble in accordance with the applicable requirements of AWWA C600 for joint assembly.

3. Make mechanical-joints with the gaskets, glands, bolts, and nuts specified for this type joint. Assemble joints in accordance with the applicable requirements of AWWA C600 for joint assembly and the recommendations of AWWA C111/A21.11.
 4. Make flanged joints with gaskets, bolts, and nuts specified for this type joint. Align bolt holes for each joint and make joints up tight, taking care to avoid undue strain on flanges, fittings, and other accessories.
 - a. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted.
 - b. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange.
 - c. When flanged pipe or fittings have dimensions that do not allow the making of a proper flanged joint as specified, replace it by one of proper dimensions.
 - d. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer, as approved.
 - e. Make grooved and shouldered type joints with the couplings previously specified for this type joint connecting pipe with the grooved or shouldered ends specified for this type joint and assemble in accordance with the recommendations of the coupling manufacturer, as approved.
 - f. Groove pipe in the field only with approved groove cutting equipment designed especially for the purpose and produced by a manufacturer of grooved joint couplings; secure approval for field-cut grooves before assembling the joint.
 5. Exterior protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet in accordance with AWWA C105/A21.5, using **[Class A]** **[Class C]** polyethylene film.
 6. Pipe anchorage: Provide concrete thrust blocks for pipe anchorage. Size and position thrust blocks as indicated on the Drawings or as otherwise required.
- H. Installation of ABS Composite Plastic Piping
1. Install pipe and fittings in accordance with Article 3.4 and the recommendations of the plastic pipe manufacturer. Make joints with the primer and solvent cement specified for this joint and assemble in accordance with the recommendations of the pipe manufacturer.
 2. Handle cements, primers, and cleaners in accordance with ASTM F402.
- I. Installation of ABS Solid-Wall Plastic Piping
1. Install pipe and fittings in accordance with Article 3.4 and the recommendations of the plastic pipe manufacturer. Make joints with the primer and solvent cement specified for this joint and assemble in accordance with the recommendations of the pipe manufacturer.
 2. Make elastomeric joints with the gaskets specified for this type joint and assemble in accordance with the recommendations of the pipe manufacturer.
 3. Handle cements, primers, and cleaners in accordance with ASTM F402.

J. Installation of PVC Plastic Piping

1. Install pipe and fittings in accordance with Article 3.4 and ASTM D2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

K. Installation of PVC Plastic Pressure Pipe and Fittings

1. Install pipe and fittings in accordance with Article 3.4 and AWWA C605 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23.

a. Pipe Less Than 4-Inch Diameter:

- 1) Threaded joints shall be made by wrapping the male threads with joint tape or by applying an approved thread lubricant, then threading the joining members together. The joints shall be tightened with strap wrenches which will not damage the pipe and fittings. The joint shall be tightened no more than 2 threads past hand-tight.
- 2) Push-On Joints: The ends of pipe for push-on joints shall be beveled to facilitate assembly. Pipe shall be marked to indicate when the pipe is fully seated. The gasket shall be lubricated to prevent displacement. Care shall be exercised to ensure that the gasket remains in proper position in the bell or coupling while making the joint.
- 3) Solvent-weld joints shall comply with the manufacturer's instructions.

- b. Pipe greater than 4-Inch Diameter: Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to fittings, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of AWWA C605 for laying the pipe and the recommendations in AWWA M23 for pipe joint assembly. Assemble push-on joints for connection to fittings in accordance with the requirements of AWWA C605 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners specified for this type joint and assemble in accordance with the requirements of AWWA C605 for joining PVC pipe to fittings and accessories, with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111/A21.11. Cut off spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel.

2. Pipe anchorage: Provide concrete thrust blocks for pipe anchorage. Size and position thrust blocks as indicated on the Drawings or as otherwise required.

3.6 MANHOLE INSTALLATION

- A. Furnish complete manhole assemblies conforming to the Drawings and as specified herein.
- B. Precast reinforced concrete manhole sections shall be set so as to be vertical and with section in true alignment. Joints of the base and precast section shall be formed and sealed with "O" ring type rubber gaskets. Joints shall be painted with mortar and exterior joints thoroughly tooled so as to be slightly concave with a hard polished surface free from drying cracks. Interior joints shall be tooled flush in a similar manner. Mortar shall be as specified herein for brick masonry.
- C. All holes in sections, used for their handling, shall be thoroughly plugged with mortar. Finish smooth and flush with adjoining surfaces.
- D. The manufacturer shall provide waterstops acceptable to Engineer, which shall be applied to the outside of the plastic pipe where the pipe is to be enclosed in any structure where concrete or mortar is used to prevent leakage along the outer wall of the barrel of the pipe.
- E. Manhole frames shall be set with the tops conforming accurately to the grade of or finished ground surface or as indicated on the plans or directed. Adjust to grade with clay bricks and mortar, not to exceed five brick courses. Frames shall be set concentric with the top of the masonry and in a full bed of mortar so that the space between the top of the manhole masonry and the bottom flange of the frame shall be completely filled and made watertight. A thick ring or mortar extending to the outer edge of the masonry shall be placed all around the bottom flange and have a slight slope to shed water away from the frame.
- F. Manhole covers shall be left in place in the frames on completion of other work at the manholes.

3.7 GREASE TRAP

- A. Grease traps shall be installed in accordance with the manufacturer's recommendations.
- B. The unit shall be placed on a minimum of 12 inches of compacted gravel on compacted subgrade.
- C. The joints of field-assembled sections shall be waterproof.
- D. Manhole riser sections, frames and covers shall be installed as required and detailed.

3.8 FIELD PERFORMANCE TESTS

- A. Joints shall sustain a maximum limit of 50 gallons per inch of diameter per foot per day per mile when field tested by actual infiltration conditions. All sanitary sewers which lie between 25 feet and 75 feet of a water supply well shall not exceed a leakage of 25 gallons per day per inch diameter of pipe per mile of sewer.
- B. These requirements will be met for every section (between manholes) of pipe; it is not a cumulative average over several sections of pipe. The low pressure air test as described in these specifications will be required for all sanitary sewer installations.

3.9 LEAKAGE TESTS FOR SEWER MANHOLES

- A. General: Leakage tests shall be made and observed by Engineer on each manhole. The test shall be an exfiltration test or vacuum test, made as described below.
- B. Preparation for Test: After the manhole has been assembled in place, all lifting holes and those exterior joints within 6 feet of the ground surface shall be filled and pointed with an approved non-shrinking mortar. The test shall be made prior to placing the self and invert and before filling and pointing the horizontal joints below the 6-foot depth line. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test. All pipes and other openings into the manhole shall be suitably plugged and the plugs braced to prevent blow out.
- C. Test Procedure: The manhole shall then be filled with water to the top of the cone section. If the excavation has not been backfilled and observations indicate no visible leakage, that is, no water visibly moving down the surface of the manhole, the manhole may be considered to be satisfactorily water-tight. If the test as described above is satisfactory, as determined by Engineer, or if the manhole excavation has been backfilled, the test shall be continued. A period of time may be permitted if the Contractor so wishes to allow for absorption. At the end of this period, the manhole shall be refilled to the top of the cone, if necessary, and the measuring time of at least 8 hours begun. At the end of the test period, the manhole shall be refilled to the top of the cone, measuring the volume of water added. This amount shall be extrapolated to a 24-hour rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed 1 gallon per vertical foot for a 24-hour period. If the test fails this requirement, but the leakage does not exceed 3 gallons per vertical foot per day, repairs by approved methods may be made as directed by Engineer to bring the leakage within the allowable rate of 1 gallon per vertical foot per day. Leakage due to a defective section of joint, or exceeding the 3 gallon per vertical foot per day, shall be cause for the rejection of the manhole. It shall be the Contractor's responsibility to uncover the manhole as necessary and to disassemble, reconstruct or replace it as directed by Engineer. The manhole shall then be retested and, if satisfactory, interior joints shall be filled and pointed.
- D. Backfilling: The test may be conducted either before or after backfilling around the manhole. However, if the Contractor elects to backfill prior to testing, for any reason, it shall be at their own risk and it shall be incumbent upon the Contractor to determine the reason for any failure of the test. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc., i.e., it will be assumed that all loss of water during the test is a result of leaks through the concrete. Furthermore, the Contractor shall take any steps necessary to assure Engineer that the water table is below the bottom of the manhole throughout the test.
- E. Infiltration Test: If the groundwater table is above the highest joint in the manhole, and if there is no leakage into the manhole as determined by Engineer, such a test can be used to evaluate the water-tightness of the manhole. However, if Engineer is not satisfied, the Contractor shall lower the water table and carry out the test as described herein before.
- F. Vacuum Testing
 - 1. The vacuum testing system shall be a unit as supplied by P.A. Glazier, Inc.—Worcester, MA 01613 (508) 755-3849, Cherne Industries, Inc.—Minneapolis, MN 55436 (800-843-7584); IEQ industries—Ada, MI 49307 (800-544-9053), or approved equivalent.

2. The testing shall be done immediately after assembly of the manhole and before backfilling. A 60 lb-in torque wrench shall be used to tighten the external clamps that secure the test cover to the top of the manhole. All lift holes shall be plugged with an approved non-shrink grout. No grout will be placed in the horizontal joints before testing. All pipes entering the manhole shall be plugged, taking care to securely brace the plugs from being drawn into the manhole.
3. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass the test if the time is greater than 60 seconds for a 48"-diameter manhole, 75 seconds for a 60" manhole, and 90 seconds for a 72" manhole.
4. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn or the test shall be stopped, repairs made and all steps of the test repeated. Re-testing shall proceed until a satisfactory test is obtained.

3.10 SEWER PIPE JOINT TESTING

- A. The main sewer line and laterals shall be tested for leakage by the use of low-pressure air as approved by Engineer. The test length shall not exceed one length of pipe between two structures. Air test procedures may be dangerous and the Contractor shall take all necessary precautions to prevent blowouts.
- B. Pneumatic Plugs
 1. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested.
 2. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
 3. All air used shall pass through a single control panel.
 4. Three individual hoses shall be used for the following connections:
 - a. From control panel to pneumatic plugs for inflation;
 - b. From control panel to sealed line for introducing the low pressure air;
 - c. From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.
- C. The following testing procedures shall be explicitly followed:
 1. All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.
 2. After the pipe has been backfilled and cleaned, pneumatic plugs shall be placed in the line at each manhole and inflated to 25 psi. Low-pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psi greater than the average back pressure of

any ground water that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.

3. After the stabilization period (3.5 psi minimum pressure in the pipe), the portion of pipe tested shall be acceptable if the time required in minutes for the pressure to decrease from 3.5 to 3.0 psi (greater than the average back pressure of any ground water that may be over the pipe) is not less than the time indicated in the following table:

Minimum Pressure Drop Time

Pipe Size (in.)	Time (sec)
4	0.190L
6	0.427L
8	0.760L
10	1.187L
12	1.709L
15	2.671L

- D. Correction of Defective Work: If leakage exceeds the specified amount, the Contractor shall make the necessary repairs or replacements required to permanently reduce the leakage to within the specified limit, and the tests shall be repeated until the leakage requirement is met.
- E. Compliance with Agency Requirements: In the event of conflict between the leakage test requirements specified herein with the leakage test requirements of agencies having jurisdiction over all or any portion of the sewer system installed under this Contract, the more restrictive requirements shall govern.

3.11 CLEANING AND REPAIR

- A. The Contractor shall clean the entire sewer system of all debris and obstructions. This cleaning shall include, the removal of all formwork from structures, concrete and mortar droppings, construction debris and dirt. The system shall be thoroughly flushed clean and the Contractor shall furnish all necessary hose, pumps, pipe and other equipment that may be required for this purpose. No debris shall be flushed into existing sewers, storm drains and or streams.
- B. All work of cleaning and repair shall be performed at no additional cost to Owner.

3.12 FINAL INSPECTION

- A. Upon completion of the work, and before final acceptance by Engineer, the entire sewer system shall be subjected to a final inspection in the presence of Engineer. The work shall not be considered as complete until all requirements for line, grade, cleanliness, leakage tests and other requirements have been met.

3.13 AS-BUILT DRAWINGS

- A. As work progresses, record on one set of plans all changes and deviations from the Contract Drawings in size, line, and grade. Make sufficient measurements to accurately locate the

- completed work. Record the locations of any uncharted locations of utilities encountered during installation of the sewer. Deliver the final As-Built drawings to Engineer.
- B. Contractor shall be solely responsible for complying with the requirements of local permitting authorities for preparation and submittal of as-built drawings. The requirements for the preparation of as-built drawings as defined herein shall be considered the minimum requirements of Engineer, but shall in no way relive Contractor from satisfying the requirements of local permitting authorities.
 - C. As work progresses, record the following on two (2) sets of Drawings:
 - 1. All changes and deviations from the design in location, grade, size, material, or other feature as appropriate.
 - 2. Any uncharted locations of utilities or other subsurface feature encountered during installation, including the characteristics of such uncharted utility or subsurface feature such as utility type, size, depth, material of construction, etc.
 - D. Recording of changes shall be clearly and neatly marked in red pen or pencil. All changes shall be noted on the appropriate Drawing sheets.
 - E. Make measurements from fixed, permanent points on the Project Site to accurately locate the work completed. Such measurements shall consist of at least three (3) ties showing the distance of each item relative to each of the fixed, permanent points.
 - F. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall also contain any additional information required by Engineer.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE SYSTEM

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Installation of new storm drain pipe, manholes and catch basins.
 - 2. Relocation and/or replacement of existing storm drain pipe and catch basins.
 - 3. Connection of exterior building roof drains and perimeter drains.
 - 4. Installation of under-drains.
 - 5. Installation of stormwater treatment units.
- B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.
- D. Contractor is solely responsible for obtaining permits or approvals which may be required to perform the work of this section, including all costs, fees and taxes required or levied. Notify and obtain such permits or approvals from all agencies having jurisdiction prior to starting work.

1.2 REFERENCE STANDARDS

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR)
 - 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. ASTM International (ASTM)
 - 1. ASTM A36—Standard Specification for Carbon Structural Steel.
 - 2. ASTM A48—Standard Specification for Gray Iron Castings.
 - 3. ASTM A123—Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 4. ASTM A307—Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - 5. ASTM A536—Standard Specification for Ductile Iron Castings.
 - 6. ASTM A615—Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

7. ASTM C12—Standard Practice for Installing Vitrified Clay Pipe Lines.
8. ASTM C14—Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
9. ASTM C55—Standard Specification for Concrete Building Brick.
10. ASTM C76—Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
11. ASTM C94—Standard Specification for Ready-Mixed Concrete.
12. ASTM C139—Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
13. ASTM C150—Standard Specification for Portland Cement.
14. ASTM C207—Standard Specification for Hydrated Lime for Masonry Purposes.
15. ASTM C270—Standard Specification for Mortar for Unit Masonry.
16. ASTM C387—Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
17. ASTM C425—Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
18. ASTM C443—Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
19. ASTM C443—Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
20. ASTM C478—Standard Specification for Precast Reinforced Concrete Manhole Sections.
21. ASTM F493—Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
22. ASTM C507—Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.
23. ASTM C564—Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
24. ASTM F656—Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
25. ASTM C700—Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
26. ASTM C877—Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections.
27. ASTM C890—Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.

28. ASTM C913—Standard Specification for Precast Concrete Water and Wastewater Structures.
29. ASTM C923—Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
30. ASTM C990—Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants.
31. ASTM C1479—Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations
32. ASTM C 1628—Standard Specification for Joints for Concrete Gravity Flow Sewer Pipe, Using Rubber Gaskets.
33. ASTM D1784—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
34. ASTM D1785—Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120.
35. ASTM D2235—Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
36. ASTM D2241—Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
37. ASTM D2321—Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
38. ASTM D2412—Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
39. ASTM D2466—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
40. ASTM D2467—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
41. ASTM D2564—Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
42. ASTM D2855—Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
43. ASTM D2665—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
44. ASTM D2729—Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
45. ASTM D2855—Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

46. ASTM D3212—Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
 47. ASTM D3350—Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
 48. ASTM D4396—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds for Plastic Pipe and Fittings Used in Nonpressure Applications.
 49. ASTM F402—Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.
 50. ASTM F405—Corrugated Polyethylene (PE) Tubing and Fittings.
 51. ASTM F477—Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 52. ASTM F656—Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
 53. ASTM F679—Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
 54. ASTM F714—Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
 55. ASTM F758—Smooth-Wall Poly (Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage.
 56. ASTM F894—Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe.
 57. ASTM F1803—Standard Specification for Poly (Vinyl Chloride)(PVC) Closed Profile Gravity Pipe and Fittings Based on Controlled Inside Diameter.
 58. ASTM F2306—Standard Specification for 12 to 60 inch [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.
 59. ASTM F2648—Standard Specification for 2 to 60 inch [50 to 1500 mm] Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications.
- D. American Concrete Pipe Association (ACPA).
1. ACPA 01-103—Concrete Pipe and Box Culvert Installation (latest revision and applicable supplements thereto).
- E. American Association of State High and Transportation Officials (AASHTO).
1. AASHTO H20—Standard Specifications for HS-20, Highway Loading.
 2. AASHTO M105—Standard Specification for Gray Iron Castings.

3. AASHTO M198—Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets.
 4. AASHTO M252—Standard Specification for Corrugated Polyethylene Drainage Pipe.
 5. AASHTO M294—Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm Diameter.
- F. Corrugated Polyethylene Pipe Association (CPPA), division of the Plastics Pipe Institute (PPI).
1. Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings (latest revision and applicable supplements thereto).
- G. State of Connecticut Department of Transportation (ConnDOT)
1. Standard Specifications for Roads, Bridges, Facilities, and Incidental Construction, Form 819, 2024 and any supplements.

1.3 SUBMITTALS

- A. Shop Drawings:
1. Submit shop drawings, descriptive literature, or both, showing pipe materials and appurtenances to be furnished. Shop drawings shall be submitted to Engineer for approval prior to ordering materials.
 2. Shop drawings showing the configuration, dimensions, layout, and spacing of major and minor components such as pipe, joints, couplings, restraints, and other proposed details of assembly. Show in large-scale details any unique assembly, pipe/pipe transitions, pipe/structure transitions, and/or installation requirements.
- B. Copies of manufacturer-provided installation instructions, operation instructions, and maintenance material for all equipment furnished under this Section.
- C. Manufacturer's warranties and associated warranty registration data in Owner's name. Submit two (2) copies of each warranty to Engineer in the manufacture/supplier standard form or if there is no standard form available, in a form specified by Engineer.
- D. As-Built Drawings.

1.4 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- B. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.
- C. Sample pipe for testing, when requested by Engineer, shall be furnished by Contractor in sufficient numbers. The Contractor and/or the pipe manufacturer shall make the facilities and services for making the load tests available.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage

1. Manufacturer shall package the pipe and other drainage materials in a manner designed to deliver the pipe to the Project Site neatly, intact, and without physical damage. Transportation carrier shall use an appropriate method to ensure the pipe is properly supported, stacked, and restrained during transport. Inspect materials delivered to site for damage; store with minimum of handling.
2. Unloading of the pipe and other drainage materials should be controlled so as not to collide with the other pipe sections or fittings, and care should be taken to avoid chipping or spalling, especially to the spigots and bells. For manhole sections, cone sections, bases, fittings and other precast appurtenances, utilize lifting holes or lifting eyes provided.
3. In cold weather conditions, use caution to prevent impact damage. Handling methods considered acceptable for warm weather may be unacceptable during cold weather.
4. Storage:
 - a. Store materials on site in enclosures or under protective coverings. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
 - b. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging.
 - c. Store solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials under cover out of direct sunlight. Provide additional storage measures in accordance with the manufacturer's recommendations. Discard materials if storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.
 - d. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
 - e. Cement, Aggregate, and Reinforcement: As specified in Section 033200—Site Cast-in-Place Concrete.
 - f. Store manhole units in an upright position.

PART 2 MATERIALS

2.1 GENERAL

- A. Products furnished under this Section which are damaged or found defective in any way prior to being set in place and final acceptance, may be rejected. Engineer may reject an entire lot of pipe should the sample pipe from such lot fail to meet requirements.

2.2 CONCRETE GRAVITY PIPE

- A. Reinforced concrete pipe:

1. Pipe less than 12 inches in diameter: ASTM C14, Class 3.
 2. Pipe greater than 12 inches in diameter: ASTM C76, Class 3.
 3. Class 4 pipe shall be required when cover is less than 12 inches.
- B. Fittings and specials: conform to the applicable requirements specified for the pipe.
- C. Gaskets and pipe ends for rubber gasket joint: ASTM C443.

2.3 CORRUGATED POLYETHYLENE PIPE

- A. Pipe: High density polyethylene, corrugated, smooth interior, ASTM D3350, Cell Classification 424420C.
1. Four (4) inch through 10 inch diameter pipe: AASHTO M252, Type S.
 2. 12 inch through 60 inch diameter pipe: AASHTO M294, Type S or ASTM F2306.
- B. Joints: Bell-and-spigot joint, AASHTO M252, AASHTO M294, or ASTM F2306. Bell shall be an integral part of the pipe and provide a minimum pull-apart strength of 400 pounds. Bell-and-spigot joint shall incorporate a gasket making it silt-tight. Gaskets shall be installed in the bell, or on the pipe by the pipe manufacturer.
1. Four-inch (4") through 60-inch (60") diameter pipe joint, watertight, ASTM D3212. Gaskets: polyisoprene, ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.
 2. 12-inch (12") through 60-inch (60") diameter pipe shall have a reinforced bell with a bell tolerance device. The bell tolerance device shall be installed by the manufacturer.
 3. Coupling bands shall conform to the manufacturer's specifications. Couplers shall cover not less than one corrugation on each section of pipe.
- C. Fittings: AASHTO M252, AASHTO M294, or ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the watertight joint performance requirements of AASHTO M252, AASHTO M294 or ASTM F2306.
- D. Saddle Tee
1. Saddle tees shall be manufactured saddle tees designed to connect to the corrugated polyethylene pipe.
 2. Fittings shall conform to AASHTO M 294. Fabricated fittings shall be welded on the interior and exterior of all junctions.
 3. A soil-tight seal shall be obtained with the coupling at the saddle tee stub to the storm service pipe.

2.4 POLYVINYL CHLORIDE (PVC) GRAVITY PIPE

- A. Polyvinyl Chloride Pipe formulated for drainage application:

1. Pipe 4-inch to 15-inch diameter: ASTM D3034, SDR-35. Elastomeric gasket joints, retained gaskets, part of a complete pipe section and supplied as such.
2. Pipe 18 inch to 36 inch diameter: ASTM F679. Elastomeric gasket joints, retained gaskets, part of a complete pipe section and supplied as such.
- B. PVC Cell classification: 12454 or 12364, ASTM D1784.
- C. Pipe shall have a minimum pipe stiffness that equals or exceeds 46 psi (lbs/in.²).
- D. Pipe shall be marked along the outside of the barrel with the following:
 1. The manufacturer's name or trademark.
 2. The standard to which it conforms/ASTM Designation.
 3. Pipe size.
 4. Material designation code/PVC cell classification.
 5. SDR number or schedule number.
- E. Standard length of pipe: maximum of 20 feet with the following exceptions.
 1. Length of 6-inch pipe shall be a maximum of 13 feet unless otherwise approved by Engineer.
 2. Pipe used in house connections and/or laterals shall not exceed 6.5 feet in length unless otherwise approved by Engineer.
- F. PVC Plastic Gravity Joints and Jointing Material.
 1. Joints: ASTM D3213, gasketed, bell-and-spigot, push-on type.
 2. Gaskets: ASTM F477. Since each pipe manufacturer has a different design for push-on joints, gaskets shall be part of a complete pipe section and provided as such. Gaskets may be factory installed or field installed as recommended by the pipe manufacturer. Lubricant shall be as recommended by the pipe manufacturer.
- G. Fittings: SDR-35, ASTM D3034 and ASTM F1336, specifications as pipe.
- H. The manufacturer shall provide waterstops acceptable to Engineer, which shall be applied to the outside of the plastic pipe where the pipe is to be enclosed in any structure where concrete or mortar is used to prevent leakage along the outer wall of the barrel of the pipe.
- I. No single piece of pipe shall be laid on any project covered by these specifications unless it is found to be generally straight. Such pipe shall have a maximum ordinate as measured from the concave side of the pipe not to exceed $\frac{1}{16}$ inch per foot of length. If the deviation from straightness exceeds this requirement, then the particular piece of pipe shall be rejected.

2.5 CORRUGATED ALUMINIZED STEEL PIPE

- A. Aluminized steel pipe: Type 2, metallic coated, AASHTO M36. Material: AASHTO M274. The ends of helically corrugated pipe shall have a minimum of two annular corrugations reformed to provide a minimum of two (2) annular end corrugations.

1. Gauge: 16, unless otherwise indicated.
 2. Pipe shall be round, pipe arch, or slotted drain as indicated on the Drawings.
 3. Slotted drain pipe shall have 1.75 inch wide drain waterway opening and solid web spacer spaced 6 inches on center.
- B. Slotted Corrugated Plastic Pipe for Subdrain: Materials, dimensions, physical properties and fabrication of pipe or tubing, couplings and fittings shall be in conformance with AASHTO M252.
1. Piping and fittings (3"–6" diameters): ASTM F405.
 2. Piping and fittings (8", 10", 12", 15", 18", 24"): ASTM F667.

2.6 VITRIFIED CLAY PIPE (V.C.P.)

- A. Pipe: ASTM C700.
- B. All pipe shall be bell and spigot pattern, first quality, free from fractures, large or deep cracks, and blisters, laminations, and surface roughness.
- C. Straight clay pipe shall, in general, be provided in 5 foot or 6 foot lengths, except that not over two pieces of 2 foot lengths may be inserted at one point where needed to provide the correct length of pipe between two fittings or between a fitting and end of connection or section without cutting pipe. Wye and tee sections may be furnished in 2-foot lengths at option of Contractor. Bends shall be 24-inch minimum radius bends. Stubs, slants, etc. built into walls of manholes or sides of pipe, when capped, should be only long enough to pass through the wall where set and to bring their sockets or bells clear on the outside of the structure into which they are built.
- D. At the discretion of Engineer, pipe shall be tested for Crushing Strength, Absorption and Acid Resistance as described in ASTM C301.
- E. Clay Piping Jointing Materials: ASTM C425.

2.7 DUCTILE IRON PIPE

- A. Ductile Iron Pipe: ASTM A746 and ANSI/AWWA C151/A21.51. Thickness Class 52, ANSI/AWWA C150/A21.50, unless indicated otherwise on the Drawings or directed otherwise by Engineer.
1. Push-on joints, except as otherwise specified. Mechanical joints shall only be used where indicated. Push-on joint pipe ends and fitting ends, gaskets, and lubricant for joint assembly shall conform to ANSI/AWWA C111/A21.11.
 2. Mechanical joint requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to ANSI/AWWA C111/A21.11.
 3. Cement Lining: Double Thickness, ANSI/AWWA C104/A21.4.
 4. Corrosion Control: Polyethylene wrap in tube or sheet form, ANSI/AWWA C105/A21.5.
- B. Fittings

1. Bituminous coated inside and outside, furnished complete with necessary accessories including plain rubber gaskets, ductile-iron glands, bolts and nuts. Fittings shall have strength at least equivalent to that of the pipe and shall be installed as called-for on the Drawings or required to complete the work.
 2. Flanged Fittings: ANSI/AWWA C110/A21.10, flange drilling 125.
 3. Mechanical Joint Fittings: ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53 where applicable.
- C. Tees for capped outlets shall be installed and capped where called for on the Contract Drawings or as ordered by Engineer.
- D. All cuttings of ductile iron pipe shall be done with a pipe cutter or saw (not by chisel or other unapproved methods) at 90 degrees to the pipe. All cut edges shall be smoothed by filing/grinding.

2.8 UNDERDRAIN

- A. Pipe: Perforated Polyvinyl Chloride (PVC) Gravity Pipe or Corrugated Polyethylene Pipe as indicated on the Drawings.
1. Perforated Polyvinyl Chloride (PVC) Gravity Pipe: ASTM F758.
 - a. Perforations shall be uniformly spaced along the length and circumference of the pipe.
 - b. Joints: Solvent weld with primer (ASTM F656) and solvent cement (ASTM F493) per ASTM D2855 or integrally-formed bell and spigot gasketed connections with elastomeric seals (gaskets) meeting the requirements of ASTM F477.
 2. Corrugated Polyethylene Pipe: AASHTO M252 Type SP (Double Wall).
 - a. Perforations: Class 2 slotted perforations per AASHTO M252. Perforations shall be uniformly spaced along the length and circumference of the pipe.
 - b. Joints: Joint: Silt-tight, ASTM D3212.

2.9 JOINT LUBRICANT

- A. As specified by pipe manufacturer, ANSI/AWWA C111/A21.11.

2.10 CATCH BASINS

- A. Reinforced precast concrete base, sump, transition, riser, corbel, and top: ASTM C913 for precast rectangular catch basins, ASTM C478 for precast circular catch basins. Type, construction, and dimensions as indicated on the Drawings.
1. Concrete: 4,000 psi minimum, 4%–7% entrained air.
 2. Reinforcement: ASTM C890. Steel bars, ASTM A615. Welded-wire fabric, ASTM A185. Additional reinforcing at openings.

3. Precast sections shall consist of smooth sections in standard nominal inside diameters. All precast concrete sections shall be free from cracks, damaged joints, exposed reinforcing, aggregate pockets, spalls, and dimensional distortions or other irregularities. Lifting holes shall be filled with mortar, or other approved material.
4. Openings or “knockouts” in precast units shall be located as shown on the Drawings and to accommodate the inflow and outflow pipe orientation required. Openings shall be sized sufficiently to permit passage of the largest outside dimension of pipe or fittings. Prior to ordering precast manhole bases, all angles between incoming pipes are to be field checked to incorporate possible line changes required in the field layout.

5. [External damp-proofing: Asphalt, ASTM D449, Type A.]

- B. Gaskets for joints between sections: Butyl rubber, ASTM C443.
- C. Grade Rings: ASTM C478, precast reinforced concrete, 1-inch to 4-inch thickness, dimensions to match basin and top section.

D. [Catch basin trap]

1. [Cast Iron] [Polyethylene] [Neenah Model R-3701, LeBaron Oil and Grease Trap Model L-219, Neenah Model R-3707, or approved equivalent.] Type and dimensions as indicated on the Drawings.

E. [Catch basin hood]

1. [Cast Iron] [Polyethylene] Type and dimensions as indicated on the Drawings.

F. Frame and Grate.

1. Cast iron: AASHTO M 105, Class 25 for frames and Class 30 for grates.
2. Cast steel: ASTM A27, Grade optional, thoroughly annealed.
3. Structural Steel: ASTM A36, or A283, Grade B or better, as to quality and details of fabrication, except that in the chemical composition of the steel, the 2/10 of 1% of copper may be omitted.
4. Grate type: ConnDOT “Type A” unless otherwise specified.
5. Covers and gratings shall bear uniformly on their supports.
6. Frame and grate shall be painted or galvanized, ConnDOT Form 819 M.06.03. Cast Iron frames and grates shall not be galvanized.

2.11 YARD DRAIN/AREA DRAIN

- A. Configured as indicated on the Drawings. Pre-formed PVC unit with integral inlets/outlets or PVC pipe stock assembled to provide a complete unit. Provide pipe adaptors as required to connect to drainage piping of the type specified.
- B. Frame and Grate: Ductile iron as an integral part of the surface drainage inlet and furnished by the same manufacturer of the drain, frame and grate set manufactured for use on PVC pipe, or insert-type grate manufactured for use on PVC pipe.

1. Grates for drain basins shall be capable of supporting H-20 wheel loading for traffic areas or H-10 loading for pedestrian areas.
2. 12" and 15" square grates will be hinged to the frame using pins. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron.
3. Grates shall be provided painted black.

2.12 CONCRETE MANHOLE

- A. Precast concrete manhole risers, base sections, and tops: ASTM C478. Precast manhole sections shall consist of smooth circular sections in standard nominal inside diameters. All precast concrete manhole sections shall be free from cracks, damaged joints, exposed reinforcing, aggregate pockets, spalls, and dimensional distortions or other irregularities. Lifting holes, when provided, shall be filled with mortar, or other approved material.
 1. Concrete: 4,000 psi minimum, 4%–7% entrained air.
 2. Diameter: 48 inches unless otherwise indicated.
 3. Base and first riser: Monolithic and built to the dimensions and requirements indicated on the Drawings.
 - a. Bottoms shall be integrally cast unless specialty bases at points of connection to existing piping ("Dog-House") is indicated on the Drawings or otherwise proposed for use. Unless indicated on the Drawings, any special bases or riser used must be detailed in shop drawings and submitted for approval.
 4. Riser sections: As required to provide depths indicated.
 5. Top Section: Concentric-cone type, unless eccentric-cone or flat-slab-top type is indicated. Cones shall have the same wall thickness and reinforcement as riser sections. If required or called-for, flat slab shall be a minimum of 8 inches thick designed to carry AASHTO H-20 loading with one foot cover and conform to ASTM C478.
 6. External damp-proofing: Asphalt, ASTM D449, Type A.
 7. [Internal waterproofing: Where required, 60-mil polyvinylchloride or polyethelene sheet with webs or ribs to mechanically lock the sheet to the manhole wall. Joint strips shall be ribless and shall be a minimum of 4 inches wide.]
 8. Openings or "knockouts" in precast units shall be located as shown on the Drawings and to accommodate the inflow and outflow pipe orientation required. Openings shall be sized sufficiently to permit passage of the largest outside dimension of pipe or fittings. Prior to ordering precast manhole bases, all angles between incoming pipes are to be field checked to incorporate possible line changes required in the field layout.
- B. Gaskets for joints between manhole sections: Butyl rubber, ASTM C443.
- C. Grade Rings: ASTM C478, precast reinforced concrete, 1 inch to 4 inch thickness, diameter to match manhole and frame.

- D. Mortar: Packaged, ASTM C387 or as Specified in Section 033200—Site Cast-in-Place Concrete.
- E. [Frame and Cover: Ductile Cast Iron, ASTM A536, Grade 60-40-18.]
- F. [Frame and Cover: Grey Cast Iron, ASTM A48, Class 25B (Frame) and Class 30B (Covers), uncoated.]
 - 1. Cover: 26 inch diameter, non-vented with non-penetrating pickholes. Unless otherwise detailed or indicated, covers shall be cast with 1½ inch wide, raised letters, indicating “STORM SEWER” unless other lettering is called-for.
 - 2. Frame and cover shall be supplied as a pair from the same manufacturer. Castings shall be of tough, even-grained iron, free from scale, lumps, blisters, sand-holes and other injurious defects, and of the size and type shown on the Drawings. Frames and covers shall have machined bearing surfaces to seat firmly and prevent rocking and rattling under traffic loads. Before leaving the foundry, castings shall be thoroughly cleaned, subjected to hammer tests for soundness and given two coats of coal tar pitch varnish.
- G. Resilient connectors for joints between manhole and pipes entering manhole: Continuous boot of ¾ inch minimum thickness neoprene, ASTM C923 or ASTM C990. Boots shall be either cast into the manhole wall or installed into a cored opening using internal compression rings. Installed boot shall result in a water-tight connection meeting the performance requirements of ASTM C443.
- H. Manhole Steps: ASTM C478 and OSHA 29 CFR 1910.27, drop front or equivalent. Steps shall be nine inches in depth and at least twelve inches in width with an abrasive step surface.
 - 1. [Cast Aluminum Alloy: Aluminum alloy, 6061-T6, tensile 38,000 psi, yield 35,000 psi. Drop front design with upturned embedded ends. All parts of aluminum steps to be embedded in concrete or masonry shall be coated with bituminous paint or zinc chromate primer.]
 - 2. [Composite Plastic-Steel: One-half (½) inch deformed steel reinforcing rod, ASTM A615, Grade 60, encapsulated in a co-polymer polypropylene plastic, ASTM D2146, Type II, Grade 16906.]
 - 3. Steps shall be placed in vertical alignment as indicated on the Drawings. Steps shall be uniformly spaced not more than sixteen inches (16”) on center, including the spacing between the top step and the manhole cover. Steps shall be embedded in the wall a minimum distance of 4 inches in either cast or drilled holes. Steps shall not be driven or vibrated into fresh concrete and shall withstand a pullout resistance of 2000 lbs when tested in accordance with ASTM C497. Each step shall project a minimum of 5 inches from the wall measured from the point of embedment.

2.13 DROP MANHOLE

- A. Drop inlet shall be constructed with ductile iron gravity pipe laid in undisturbed soil in conformance with ASTM A746-82. Adapt to PVC with Fernco coupling or approved equivalent.
- B. Vertical drop pipe shall be 8”, 10”, or 12” maximum SDR 35 PVC with 90 degree short bend radius shall conform to ASTM D3034.

- C. Vertical drop pipe shall be anchored a minimum of every 4 feet with $\frac{1}{8}$ " x $1\frac{1}{2}$ " type 304 stainless steel pipe straps set as ordered with lag bolts and shields.

2.14 MASONRY UNITS

- A. Brick: ASTM C32 Grade MS or ASTM C62 Grade SW.
- B. Concrete block: Solid block, ASTM C139.

2.15 MORTAR

- A. Mortar: ASTM C387.
 - 1. Portland Cement: ASTM C150, Type I.
 - 2. Sand: ASTM C144.
 - 3. Hydrated Lime: ASTM C207.
 - 4. Water: Potable.
 - 5. Mix proportions for manhole rims and covers: 1 part portland cement, 2 parts sand, and $\frac{1}{4}$ part hydrated lime by dry volume. Hydrated lime shall not exceed 10 percent by weight of the total dry mix. Quantity of water in mixture shall be sufficient to produce a stiff, workable mortar, but in no case shall exceed $5\frac{1}{2}$ gallons of water per sack of cement.
 - 6. Mix Proportions for invert construction: 1 part portland cement and 2 parts sand by volume. Quantity of water in mixture shall be sufficient to produce a stiff, workable mortar, but in no case shall exceed $5\frac{1}{2}$ gallons of water per sack of cement.

2.16 STORMWATER TREATMENT UNIT

- A. Stormwater Treatment Units shall be hydrodynamic separators made of precast concrete sections and shall have the capacity and dimensions indicated on the Drawings. Treatment units shall be Vortechs®, as manufactured by CONTECH Stormwater Solutions, Scarborough, Maine (877-907-8676); Stormceptor® by CSR—Farmington, CT (860-677-1374); or approved equivalent.
- B. Units shown on the Drawings have been sized to meet specific criteria as indicated. Contractor shall submit only those units that are sized and manufactured to meet such criteria as shown with the details and/or listed below:
 - 1. Unit 1
 - a. Conveyed flow = xxxxxx c.f.s. (total flow to the treatment system)
 - b. Treated flow = xxxxx c.f.s. (total flow actually subjected to treatment)
 - c. Removal efficiency particle size = maximum of 100 microns
 - d. Evidence of Independent Third Party field testing
 - e. Evidence of full scale laboratory testing

f. Minimum removal of 80% Total Suspended Solids (TSS) for 1 inch of rainfall on the impervious surfaces within its drainage area.

- C. Precast Sections: portland cement shall be Type II, ASTM C150, 4,000 psi minimum.
- D. Loading requirements:
 - 1. H-20 loading, manhole riser with frame and cones, plus the weight of soil above.
 - 2. Weight of precast concrete structure.
 - 3. Initial handling and erection loadings.
- E. Construction joints shall be sealed with a butyl rubber based sealant.
- F. Manhole riser sections, manhole steps, frames and covers shall be as detailed on the Drawings.

2.17 BEDDING

- A. Bedding for concrete and PVC pipes: Bedding, Haunching and Initial Backfill shall consist of screened gravel, maximum size $\frac{3}{4}$ inches and minimum size $\frac{3}{8}$ inches.
- B. Bedding for HDPE pipes: Bedding, Haunching and Initial Backfill shall consist of ConnDOT No. 6, No. 67, or No. 8 aggregate, or other materials meeting the requirements of ASTM D2321 for Class IA, Class IB, Class II, or Class III unless otherwise specified by the pipe manufacturer.
- C. Bedding for Catch Basins: Screened Gravel or Crushed Stone, well graded in size from $\frac{3}{4}$ inch to $\frac{3}{8}$ inch consisting of clean, hard, and durable fragments. No limestone shall be permitted.

PART 3 EXECUTION

3.1 PIPE INSTALLATION

- A. As soon as the excavation is completed to the normal grade of the bottom of the trench, the Contractor shall immediately place the bedding material in the trench. Then the pipe shall be firmly bedded in the compacted bedding material to conform accurately to the lines and grade indicated on the Drawings.
- B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions.
 - 1. Concrete pipe shall be installed per ASTM C1479, as may be modified by the pipe manufacturer's instructions.
 - 2. HDPE pipe shall be installed per ASTM D2321, as may be modified by the pipe manufacturer's instructions.
- C. Notch under pipe bells and joints, where applicable to provide for uniform bearing under entire length of pipe.
- D. Excavation, backfilling and compaction shall be as specified in Section 312310—Earthwork of these Specifications.
- E. Maintain optimum moisture content of bedding material to attain required compaction density.

3.2 MANHOLES AND CATCH BASINS

- A. Manholes and Catch Basins shall be constructed at the locations and to the lines, grades and dimensions noted on the Drawings, or as required.
- B. Precast concrete construction shall be done in a manner to insure watertight construction and all leaks in precast concrete shall be sealed. If required, precast concrete shall be repaired or replaced to obtain watertight construction.
- C. Concrete barrels and cones shall be precast concrete sections.
 - 1. Bases shall be either precast with a barrel integrally cast with the base, or poured concrete suitably shaped by means of accurate bell-rung forms to receive the barrel sections. Manhole invert channels in manholes shall be formed in concrete.
 - 2. Precast manholes shall have an adjustment ring at the top of the cone to permit the frame and cover to meet the finished surface. This shall consist of courses of brick or reinforced grading rings not to exceed 11 inches.
- D. Stubs shall be short pieces cut from the bell ends of the appropriate size and class of pipe. Concrete stubs shall be plugged with brick masonry unless otherwise directed.
- E. Manhole inverts shall conform accurately to the size of the adjoining pipes.
 - 1. Manhole inverts shall be constructed of concrete developing 3,500 psi with the concrete being placed to the spring line of the pipe form.
 - 2. Smooth plastic pipe, matching the dimension of the outlet pipe, shall be used to form the invert.
 - 3. Side inverts and main inverts, where the direction changes, shall be laid out in smooth curves of the longest possible radius, which is tangent, within the manhole, to the centerline of adjoining pipelines.
 - 4. Invert shelves shall be graded to provide a 1-inch per 1-foot wash from the manhole walls.
- F. Manhole sections shall contain manhole steps accurately positioned and embedded in the concrete when the section is cast. Precast-reinforced concrete manhole sections shall be set so as to be vertical and with sections and steps in true alignment.
- G. All holes in sections used for their handling shall be thoroughly plugged with rubber plugs, made specifically for this purpose, or with mortar. The mortar shall be one part cement to 1½ parts sand, mixed slightly damp to the touch (just short of “balling”), hammered into the holes until it is dense and an excess of paste appears on the surface, and then finished smooth and flush with the adjoining surfaces.
- H. The Contractor may, as an alternate to suitable nonshrink mortar joints, use premolded elastomeric-sealed joints for pipe into precast manhole bases.
 - 1. All materials, accessories and construction methods used in making the joints shall be supplied or approved by the manufacturer of the premolded elastomeric-sealed joint.
- I. Openings for pipe and materials to be embedded in the walls of the base for these joints shall be cast in the base at the required locations during the manufacture of the base. Incorrectly cast and patched pipe openings will be rejected.

- J. Manhole risers and tops shall be installed using approved “o-ring” type, neoprene gaskets for sealing joints. Units shall be installed level and plumb. Water shall not be permitted to rise over newly made joints nor until after inspection as to their acceptability. All jointing shall be done in a manner to insure water tightness.
- K. Openings shall be provided in the risers to receive entering pipes. These openings may be made at the place of manufacture. The openings shall be sized to provide a uniform 1 inch maximum annular space between the outside of the pipe wall and the opening in the riser. After the pipe is in position, the annular space shall be solidly filled with nonshrink mortar. Care shall be taken to assure that the openings are located to permit setting of the entering pipe at its correct elevation as indicated.
- L. Openings, which are cut in the risers in the field, shall be carefully made by coring so as not to damage the riser. Damaged risers will be rejected and shall be replaced at no additional expense to the Owner.
- M. Where required by the Drawings, a slot and opening shall be cast in the catch basin wall suitable for mounting the cast iron hood and discharge pipe. The hood hinge may be furnished to the precast supplier by the Contractor for incorporation into the casting during manufacture.

3.3 BRICK MASONRY

- A. Brick Masonry Construction shall be done in a manner to insure watertight construction and all leaks in brick masonry shall be sealed. All workmanship shall conform to the best standard practice and all brick masonry shall be laid by skilled workmen.
- B. All beds on which masonry is to be laid shall be cleaned and wetted properly. Brick shall be wetted as required and shall be damp but free of any surface water when placed in the Work. Bed joints shall be formed of a thick layer of mortar, which shall be smoothed or furrowed slightly. Head joints shall be formed by applying to the brick to be laid a full coat of mortar on the entire end, or on the entire side as the case requires, and then shoving the mortar covered end or side of the brick tightly against the bricks laid previously. The practice of buttering at the corners of the brick and then throwing the mortar or crappings in the empty joints will not be permitted. Dry or butt joints will not be permitted. Joints shall be uniform in thickness and shall be approximately 1¼ inch thick.
- C. Brickwork shall be constructed accurately to dimensions and brickwork at top of manholes shall be to the dimensions of the flanges of the cast-iron frames.
- D. Joints on the inside face of walls shall be tooled slightly concave with an approved jointer when the mortar is thumbprint hard. The mortar shall be compressed with complete contact along the edges to seal the surface of the joints.
- E. All castings to be embedded in the brickwork shall be accurately set and built-in as the Work progresses. Cast-iron frames and manhole covers shall be well bedded in mortar and accurately set to finished grade indicated or as directed.
- F. Water shall not be allowed to flow against brickwork or to rise on the masonry for 60 hours after it has been laid, and any brick masonry damaged in this manner shall be replaced as directed at no additional expense to the Owner. Adequate precautions shall be taken in freezing weather to protect the masonry from damage by frost.

3.4 CONCRETE MASONRY UNITS

- A. Concrete Masonry unit construction shall be soaked in water before laying. As circular concrete block walls are laid-up, the horizontal joints and keyways shall be flushed full with mortar. As rectangular blocks are laid-up, all horizontal and vertical joints shall be flushed full with mortar. Plastering of the outside of block structures will not be required. The joints in precast units shall be wetted and completely mortared immediately prior to setting a section. No structure shall be backfilled until all mortar has completely set.

3.5 MANHOLE STEPS

- A. Placement of steps into the precast walls shall be by a proven method as recommended by the supplier of the precast manhole sections. Details of the steps and method of placement shall be submitted for approval.
- B. Plastic steps shall be placed into the wet concrete wall during manufacture or if designed for press fit installation shall be driven into a wall opening according to the manufacturer's specifications. Steps shall not be mortared into place after the concrete has set.
- C. All manholes, catch basins, lawn inlets, etc., which are in excess of five feet in depth, shall be constructed with standard aluminum steps, spaced at 12-inch on center.

3.6 DROP INLETS

- A. Drop inlets shall be constructed to the lines, grades, dimensions and design at the locations indicated on the Drawings or as required.
- B. Construction shall conform to requirements outlined in Section 033013—Site Cast-in-Place Concrete.
- C. Engineer may permit brick or concrete masonry construction. If this alternate is being employed, construction shall be done in accordance with paragraphs 3.04 or 3.05 in this Section.

3.7 CASTINGS

- A. Cast-iron frames for grates and covers shall be well bedded in cement mortar and accurately set to the grades indicated or as directed. The frames shall be encased with a thick cement-mortar collar around the entire perimeter of the frames.
- B. All voids between the bottom flange shall be completely filled to make a watertight fit. A ring of mortar, at least one inch thick and pitched to shed water away from the frame shall be placed over and around the outside of the bottom flange. The mortar shall extend to the outer edge of the masonry all around its circumference and shall be finished smooth. No visible leakage will be permitted.
- C. Structures within the limits of bituminous concrete pavement shall be temporarily set at the elevation of the bottom of the binder course or as ordered. After the binder course has been compacted, these structures shall be set at their final grade. Backfill necessary around such structures after the binder course has been completed shall be made with Class A concrete unless otherwise ordered.

3.8 TRENCH DRAINS/SLOTTED DRAINS

- A. Precast, pre-sloped trench drain metals, accessories, and installation methods shall be in accordance with the manufacturer's recommendations and the details shown on the Drawings.

- B. Slotted drains shall be installed in accordance with the manufacturer's recommendations and the details shown on the Drawings.
- C. Contractor shall furnish to Engineer the manufacturer's written instructions for installation prior to such installation.

3.9 STORMWATER TREATMENT UNIT

- A. Stormwater Treatment Units shall be installed in accordance with the manufacturer's instructions.
- B. Vaults shall be placed on a minimum foundation of 12 inches of gravel material. If groundwater is encountered, the foundation base shall be a minimum of 12 inches of crushed stone.
- C. If precast sections are to be field assembled, adequate waterproofing shall be used at the joints.
- D. Stormwater Treatment Units installed on interior floor drain discharges from parking garages shall have gasoline trapping capabilities in accordance with local and state regulations.

3.10 CLEANING

- A. At the completion of the Work, clean all piping, structures and open drainage courses, through and to which water from this construction is directed, to the satisfaction of Engineer.

3.11 AS-BUILT DRAWINGS

- A. Contractor shall be solely responsible for complying with the requirements of local permitting authorities for preparation and submittal of as-built drawings. The requirements for the preparation of as-built drawings as defined herein shall be considered the minimum requirements of Engineer, but shall in no way relieve Contractor from satisfying the requirements of local permitting authorities.
- B. As work progresses, record the following on two (2) sets of Drawings:
 - 1. All changes and deviations from the design in location, grade, size, material, or other feature as appropriate.
 - 2. Any uncharted locations of utilities or other subsurface feature encountered during installation, including the characteristics of such uncharted utility or subsurface feature such as utility type, size, depth, material of construction, etc.
- C. Recording of changes shall be clearly and neatly marked in red pen or pencil. All changes shall be noted on the appropriate Drawing sheets.
- D. Make measurements from fixed, permanent points on the Project Site to accurately locate the work completed. Such measurements shall consist of at least three (3) ties showing the distance of each item relative to each of the fixed, permanent points.
- E. As-Built drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall also contain any additional information required by Engineer.

END OF SECTION

Exhibit A

Preservation Brief 1 Assessing Cleaning and Water-Repellant Treatments for Historic Buildings

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1 PRESERVATION BRIEFS

Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings

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Anne Grimmer



U.S. Department of the Interior
National Park Service
Cultural Resources
Heritage Preservation Services

Inappropriate cleaning and coating treatments are a major cause of damage to historic masonry buildings. While either or both treatments may be appropriate in some cases, they can be very destructive to historic masonry if they are not selected carefully. Historic masonry, as considered here, includes stone, brick, architectural terra cotta, cast stone, concrete and concrete block. It is frequently cleaned because cleaning is equated with improvement. Cleaning may sometimes be followed by the application of a water-repellent coating. However, unless these procedures are carried out under the guidance and supervision of an architectural conservator, they may result in irrevocable damage to the historic resource.

The purpose of this Brief is to provide information on the variety of cleaning methods and materials that are available for use on the *exterior* of historic masonry buildings, and to provide guidance in selecting the most appropriate method or combination of methods. The difference between

water-repellent coatings and waterproof coatings is explained, and the purpose of each, the suitability of their application to historic masonry buildings, and the possible consequences of their inappropriate use are discussed.

The Brief is intended to help develop sensitivity to the qualities of historic masonry that makes it so special, and to assist historic building owners and property managers in working cooperatively with architects, architectural conservators and contractors (Fig. 1). Although specifically intended for historic buildings, the information is applicable to all masonry buildings. This publication updates and expands *Preservation Brief 1: The Cleaning and Waterproof Coating of Masonry Buildings*. The Brief is not meant to be a cleaning manual or a guide for preparing specifications. Rather, it provides general information to raise awareness of the many factors involved in selecting cleaning and water-repellent treatments for historic masonry buildings.



Figure 1. Low-to medium-pressure steam (hot-pressurized water washing), is being used to clean the exterior of the U.S. Tariff Commission Building, the first marble building constructed in Washington, D.C., in 1839. This method was selected by an architectural conservator as the "gentlest means possible" to clean the marble. Steam can soften heavy soiling deposits such as those on the cornice and column capitals, and facilitate easy removal. Note how these deposits have been removed from the right side of the cornice which has already been cleaned.

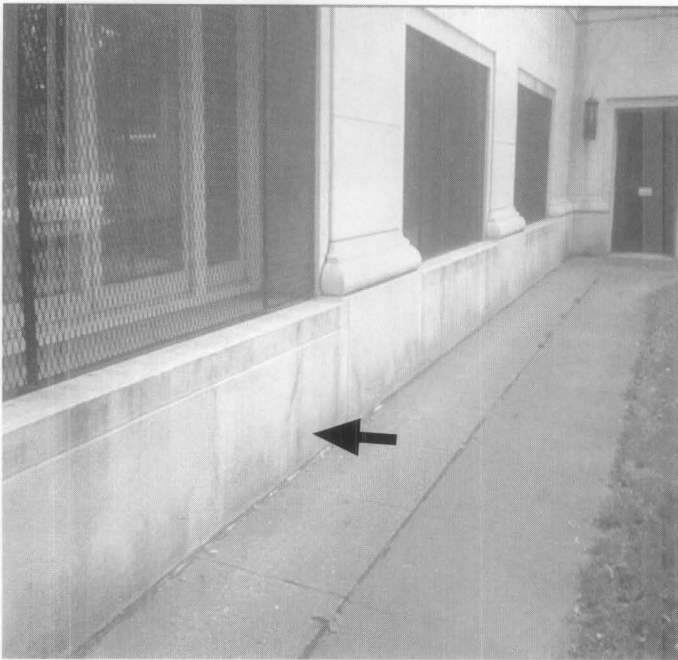


Figure 2. Biological growth as shown on this marble foundation can usually be removed using a low-pressure water wash, possibly with a non-ionic detergent added to it, and scrubbing with a natural or synthetic bristle brush.



Figure 3. This small test area has revealed a red brick patch that does not match the original beige brick. This may explain why the building was painted, and may suggest to the owner that it may be preferable to keep it painted.

Preparing for a Cleaning Project

Reasons for cleaning. First, it is important to determine whether it is appropriate to clean the masonry. The objective of cleaning a historic masonry building must be considered carefully before arriving at a decision to clean. There are several major reasons for cleaning a historic masonry building: **improve the appearance of the building** by removing unattractive dirt or soiling materials, or non-historic paint from the masonry; **retard deterioration** by removing soiling materials that may be damaging the masonry; or **provide a clean surface** to accurately match repointing mortars or patching compounds, or to conduct a condition survey of the masonry.

Identify what is to be removed. The general nature and source of dirt or soiling material on a building must be identified to remove it in the *gentlest means possible* — that is, in the most effective, yet least harmful, manner. Soot and smoke, for example, require a different cleaning agent to remove than oil stains or metallic stains. Other common cleaning problems include biological growth such as mold or mildew, and organic matter such as the tendrils left on masonry after removal of ivy (Fig. 2).

Consider the historic appearance of the building. If the proposed cleaning is to remove paint, it is important in each case to learn whether or not unpainted masonry is historically appropriate. And, it is necessary to consider why the building was painted (Fig. 3). Was it to cover bad repointing or unmatched repairs? Was the building painted to protect soft brick or to conceal deteriorating stone? Or, was painted masonry simply a fashionable

treatment in a particular historic period? Many buildings were painted at the time of construction or shortly thereafter; retention of the paint, therefore, may be more appropriate historically than removing it. And, if the building appears to have been painted for a long time, it is also important to think about whether the paint is part of the character of the historic building and if it has acquired significance over time.

Consider the practicalities of cleaning or paint removal. Some gypsum or sulfate crusts may have become integral with the stone and, if cleaning could result in removing some of the stone surface, it may be preferable not to clean. Even where unpainted masonry is appropriate, the retention of the paint may be more practical than removal in terms of long range preservation of the masonry. In some cases, however, removal of the paint may be desirable. For example, the old paint layers may have built up to such an extent that removal is necessary to ensure a sound surface to which the new paint will adhere.

Study the masonry. Although not always necessary, in some instances it can be beneficial to have the coating or paint type, color, and layering on the masonry researched before attempting its removal. Analysis of the nature of the soiling or of the paint to be removed from the masonry, as well as guidance on the appropriate cleaning method, may be provided by professional consultants, including architectural conservators, conservation scientists and preservation architects. The State Historic Preservation Office (SHPO), local historic district commissions, architectural review boards and preservation-oriented websites may also be able to supply useful information on masonry cleaning techniques.

Understanding the Building Materials

The construction of the building must be considered when developing a cleaning program because inappropriate cleaning can have a deleterious effect on the masonry as well as on other building materials. The masonry material or materials must be correctly identified. It is sometimes difficult to distinguish one type of stone from another; for example, certain sandstones can be easily confused with limestones. Or, what appears to be natural stone may not be stone at all, but cast stone or concrete. Historically, cast stone and architectural terra cotta were frequently used in combination with natural stone, especially for trim elements or on upper stories of a building where, from a distance, these substitute materials looked like real stone (Fig. 4). Other features on historic buildings that appear to be stone, such as decorative cornices, entablatures and window hoods, may not even be masonry, but metal.

Identify prior treatments. Previous treatments of the building and its surroundings should be researched and building maintenance records should be obtained, if available. Sometimes if streaked or spotty areas do not seem to get cleaner following an initial cleaning, closer inspection and analysis may be warranted. The discoloration may turn out not to be dirt but the remnant of a water-repellent coating applied long ago which has darkened the surface of the masonry over time (Fig. 5). Successful removal may require testing several cleaning agents to find something that will dissolve and remove the coating. Complete removal may not always be possible. Repairs may have been stained to match a dirty building, and cleaning may make these differences apparent. De-icing salts used near the building that have dissolved can



Figure 4. The foundation of this brick building is limestone, but the decorative trim above is architectural terra cotta intended to simulate stone.



Figure 5. Repeated water washing did not remove the staining inside this limestone porte cochere. Upon closer examination, it was determined to be a water-repellent coating that had been applied many years earlier. An alkaline cleaner may be effective in removing it.

migrate into the masonry. Cleaning may draw the salts to the surface, where they will appear as efflorescence (a powdery, white substance), which may require a second treatment to be removed. Allowances for dealing with such unknown factors, any of which can be a potential problem, should be included when investigating cleaning methods and materials. Just as more than one kind of masonry on a historic building may necessitate multiple cleaning approaches, unknown conditions that are encountered may also require additional cleaning treatments.

Choose the appropriate cleaner. The importance of testing cleaning methods and materials cannot be over emphasized. Applying the wrong cleaning agents to historic masonry can have disastrous results. Acidic cleaners can be extremely damaging to acid-sensitive stones, such as marble and limestone, resulting in etching and dissolution of these stones. Other kinds of masonry can also be damaged by incompatible cleaning agents, or even by cleaning agents that are usually compatible. There are also numerous kinds of sandstone, each with a considerably different geological composition. While an acid-based cleaner may be safely used on some sandstones, others are acid-sensitive and can be severely etched or dissolved by an acid cleaner. Some sandstones contain water-soluble minerals and can be eroded by water cleaning. And, even if the stone type is correctly identified, stones, as well as some bricks, may contain unexpected impurities, such as iron particles, that may react negatively with a particular cleaning agent and result in staining. Thorough understanding of the physical and chemical properties of the masonry will help avoid the inadvertent selection of damaging cleaning agents.

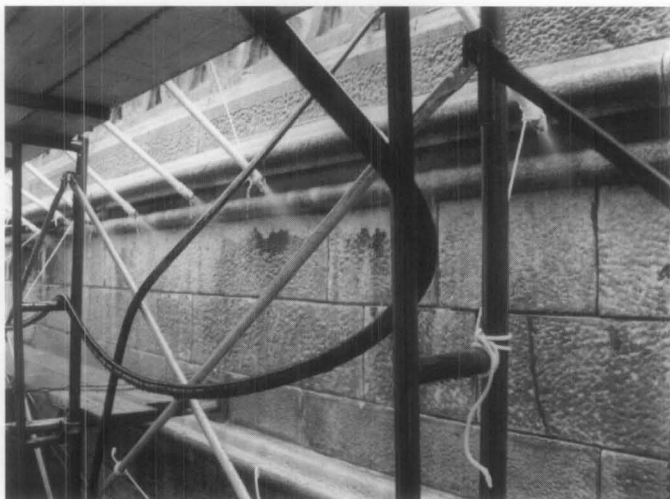


Figure 6. Timed water soaking can be very effective for cleaning limestone and marble as shown here at the Marble Collegiate Church in New York City. In this case, a twelve-hour water soak using a multi-nozzle manifold was followed by a final water rinse. Photo: Diane S. Kaese, Wiss, Janney, Elstner Associates, Inc., N.Y., N.Y.

Other building materials also may be affected by the cleaning process. Some chemicals, for example, may have a corrosive effect on paint or glass. The portions of building elements most vulnerable to deterioration may not be visible, such as embedded ends of iron window bars. Other totally unseen items, such as iron cramps or ties which hold the masonry to the structural frame, also may be subject to corrosion from the use of chemicals or even from plain water. The only way to prevent problems in these cases is to study the building construction in detail and evaluate proposed cleaning methods with this information in mind. However, due to the very likely possibility of encountering unknown factors, any cleaning project involving historic masonry should be viewed as unique to that particular building.

Cleaning Methods and Materials

Masonry cleaning methods generally are divided into three major groups: water, chemical, and abrasive. *Water methods* soften the dirt or soiling material and rinse the deposits from the masonry surface. *Chemical cleaners* react with dirt, soiling material or paint to effect their removal, after which the cleaning effluent is rinsed off the masonry surface with water. *Abrasive methods* include blasting with grit, and the use of grinders and sanding discs, all of which mechanically remove the dirt, soiling material or paint (and, usually, some of the masonry surface). Abrasive cleaning is also often followed with a water rinse. *Laser cleaning*, although not discussed here in detail, is another technique that is used sometimes by conservators to clean small areas of historic masonry. It can be quite effective for cleaning limited areas, but it is expensive and generally not practical for most historic masonry cleaning projects.

Although it may seem contrary to common sense, masonry cleaning projects should be carried out starting at the

bottom and proceeding to the top of the building always keeping all surfaces wet below the area being cleaned. The rationale for this approach is based on the principle that dirty water or cleaning effluent dripping from cleaning in progress above will leave streaks on a dirty surface but will not streak a clean surface as long as it is kept wet and rinsed frequently.

Water Cleaning

Water cleaning methods are generally the *gentlest means possible*, and they can be used safely to remove dirt from all types of historic masonry.* There are essentially four kinds of water-based methods: soaking; pressure water washing; water washing supplemented with non-ionic detergent; and steam, or hot-pressurized water cleaning. Once water cleaning has been completed, it is often necessary to follow up with a water rinse to wash off the loosened soiling material from the masonry.

Soaking. Prolonged spraying or misting with water is particularly effective for cleaning limestone and marble. It is also a good method for removing heavy accumulations of soot, sulfate crusts or gypsum crusts that tend to form in protected areas of a building not regularly washed by rain. Water is distributed to lengths of punctured hose or pipe with non-ferrous fittings hung from moveable scaffolding or a swing stage that continuously mists the surface of the masonry with a very fine spray (Fig. 6). A timed on-off spray is another approach to using this cleaning technique. After one area has been cleaned, the apparatus is moved on to another. Soaking is often used in combination with water washing and is also followed by a final water rinse. Soaking is a very slow method — it may take several days or a week—but it is a very gentle method to use on historic masonry.

Water Washing. Washing with low-pressure or medium-pressure water is probably one of the most commonly used methods for removing dirt or other pollutant soiling from historic masonry buildings (Fig. 7). Starting with a very low pressure (100 psi or below), even using a garden hose, and progressing as needed to slightly higher pressure —generally no higher than 300-400 psi —is always the recommended way to begin. Scrubbing with natural bristle or synthetic bristle brushes—never metal which can abrade the surface and leave metal particles that can stain the masonry—can help in cleaning areas of the masonry that are especially dirty.

Water Washing with Detergents. Non-ionic detergents—which are not the same as soaps—are synthetic organic compounds that are especially effective in removing oily soil. (Examples of some of the numerous proprietary non-ionic detergents include Igepal by GAF, Tergitol by Union Carbide and Triton by Rohm & Haas.) Thus, the addition of a non-ionic detergent, or surfactant, to a low- or medium-pressure water wash can be a useful aid in the cleaning

*Water cleaning methods may not be appropriate to use on some badly deteriorated masonry because water may exacerbate the deterioration, or on gypsum or alabaster which are very soluble in water.

process. (A non-ionic detergent, unlike most household detergents, does not leave a solid, visible residue on the masonry.) Adding a non-ionic detergent and scrubbing with a natural bristle or synthetic bristle brush can facilitate cleaning textured or intricately carved masonry. This should be followed with a final water rinse.

Steam/Hot-Pressurized Water Cleaning. Steam cleaning is actually low-pressure hot water washing because the steam condenses almost immediately upon leaving the hose. This is a gentle and effective method for cleaning stone and particularly for acid-sensitive stones. Steam can be especially useful in removing built-up soiling deposits and dried-up plant materials, such as ivy disks and tendrils. It can also be an efficient means of cleaning carved stone details and, because it does not generate a lot of liquid water, it can sometimes be appropriate to use for cleaning interior masonry (Figs. 8-9).

Potential hazards of water cleaning. Despite the fact that water-based methods are generally the most gentle, even they can be damaging to historic masonry. Before beginning a water cleaning project, it is important to make sure that all mortar joints are sound and that the building is watertight. Otherwise water can seep through the walls to the interior, resulting in rusting metal anchors and stained and ruined plaster.

Some water supplies may contain traces of iron and copper which may cause masonry to discolor. Adding a chelating or complexing agent to the water, such as EDTA (ethylene diamine tetra-acetic acid), which inactivates other metallic ions, as well as softens minerals and water hardness, will help prevent staining on light-colored masonry.

Any cleaning method involving water should never be done in cold weather or if there is any likelihood of frost or freezing because water within the masonry can freeze, causing spalling and cracking. Since a masonry wall may take over a week to dry after cleaning, no water cleaning should be permitted for several days prior to the first average frost date, or even earlier if local forecasts predict cold weather.

Most essential of all, it is important to be aware that using water at too high a pressure, a practice common to "power washing" and "water blasting", is very abrasive and can easily etch marble and other soft stones, as well as some types of brick (Figs. 10-11). In addition, the distance of the nozzle from the masonry surface and the type of nozzle, as well as gallons per minute (gpm), are also important variables in a water cleaning process that can have a significant impact on the outcome of the project. This is why it is imperative that the cleaning be closely monitored to ensure that the cleaning operators do not raise the pressure or bring the nozzle too close to the masonry in an effort to "speed up" the process. The appearance of grains of stone or sand in the cleaning effluent on the ground is an indication that the water pressure may be too high.



Figure 7. Glazed architectural terra cotta often may be cleaned successfully with a low-pressure water wash and hand scrubbing supplemented, if necessary, with a non-ionic detergent. Photo: National Park Service Files.

Chemical Cleaning

Chemical cleaners, generally in the form of proprietary products, are another material frequently used to clean historic masonry. They can remove dirt, as well as paint and other coatings, metallic and plant stains, and graffiti. Chemical cleaners used to remove dirt and soiling include **acids**, **alkalies** and **organic compounds**. Acidic cleaners, of course, should not be used on masonry that is acid sensitive. Paint removers are **alkaline**, based on **organic solvents** or other chemicals.

Chemical Cleaners to Remove Dirt

Both alkaline and acidic cleaning treatments include the use of water. Both cleaners are also likely to contain surfactants (wetting agents), that facilitate the chemical reaction that removes the dirt. Generally, the masonry is wet first for both types of cleaners, then the chemical cleaner is sprayed on at very low pressure or brushed onto the surface. The cleaner is left to dwell on the masonry for an amount of time recommended by the product manufacturer or, preferably, determined by testing, and rinsed off with a low- or moderate-pressure cold, or sometimes hot, water wash. More than one application of the cleaner may be necessary, and it is always a good practice to test the product manufacturer's recommendations concerning dilution rates and dwell times. Because each cleaning situation is unique, dilution rates and dwell times can vary considerably. The masonry surface may be scrubbed lightly with natural or synthetic bristle brushes prior to rinsing. After rinsing, pH strips should be applied to the surface to ensure that the masonry has been neutralized completely.

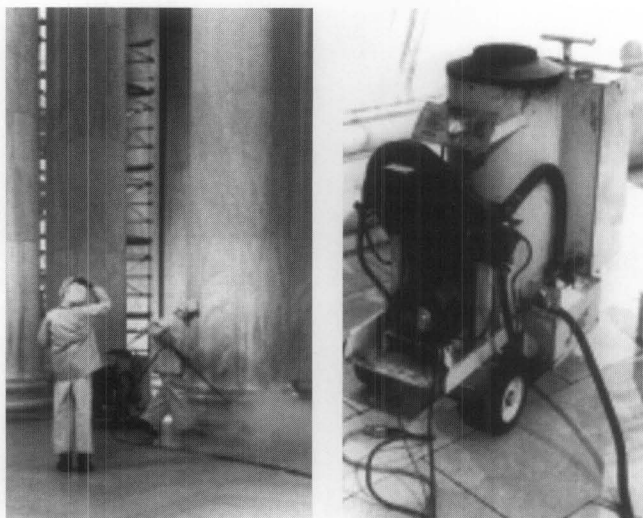


Figure 8. (Left) Low-pressure (under 100 psi) steam cleaning (hot-pressurized water washing), is part of the regular maintenance program at the Jefferson Memorial, Washington, D.C. The white marble interior of this open structure is subject to constant soiling by birds, insects and visitors. (Right) This portable steam cleaner enables prompt cleanup when necessary. Photos: National Park Service Files.

Acidic Cleaners. Acid-based cleaning products may be used on **non-acid sensitive** masonry, which generally includes: granite, most sandstones, slate, unglazed brick and unglazed architectural terra cotta, cast stone and concrete (Fig. 12). Most commercial acidic cleaners are composed primarily of hydrofluoric acid, and often include some phosphoric acid to prevent rust-like stains from developing on the masonry after the cleaning. Acid cleaners are applied to the pre-wet masonry which should be kept wet while the acid is allowed to "work", and then removed with a water wash.

Alkaline Cleaners. Alkaline cleaners should be used on **acid-sensitive** masonry, including: limestone, polished and unpolished marble, calcareous sandstone, glazed brick and glazed architectural terra cotta, and polished granite. (Alkaline cleaners may also be used sometimes on masonry materials that are not acid sensitive—after testing, of course

—but they may not be as effective as they are on acid-sensitive masonry.) Alkaline cleaning products consist primarily of two ingredients: a non-ionic detergent or surfactant; and an alkali, such as potassium hydroxide or ammonium hydroxide. Like acidic cleaners, alkaline products are usually applied to pre-wet masonry, allowed to dwell, and then rinsed off with water. (Longer dwell times may be necessary with alkaline cleaners than with acidic cleaners.) Two additional steps are required to remove alkaline cleaners after the initial rinse. First the masonry is given a slightly acidic wash—often with acetic acid—to neutralize it, and then it is rinsed again with water.

Chemical Cleaners to Remove Paint and Other Coatings, Stains and Graffiti

Removing paint and some other coatings, stains and graffiti can best be accomplished with alkaline paint removers, organic solvent paint removers, or other cleaning compounds. The removal of layers of paint from a masonry surface usually involves applying the remover either by brush, roller or spraying, followed by a thorough water wash. As with any chemical cleaning, the manufacturer's recommendations regarding application procedures should always be tested before beginning work.

Alkaline Paint Removers. These are usually of much the same composition as other alkaline cleaners, containing potassium or ammonium hydroxide, or trisodium phosphate. They are used to remove oil, latex and acrylic paints, and are effective for removing multiple layers of paint. Alkaline cleaners may also remove some acrylic, water-repellent coatings. As with other alkaline cleaners, both an acidic neutralizing wash and a final water rinse are generally required following the use of alkaline paint removers.

Organic Solvent Paint Removers. The formulation of organic solvent paint removers varies and may include a combination of solvents, including methylene chloride, methanol, acetone, xylene and toluene.

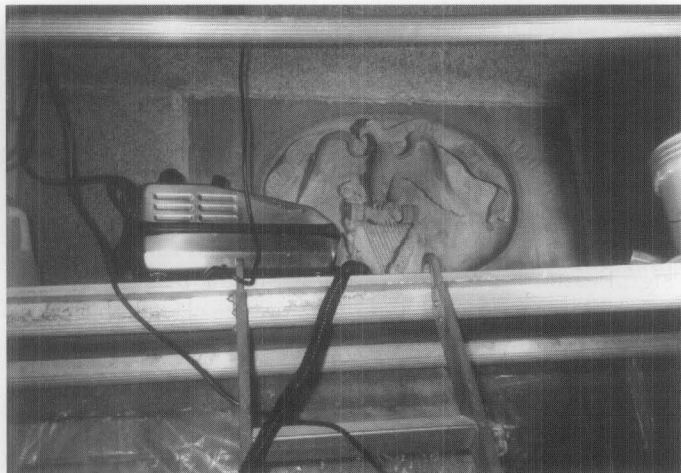


Figure 9. (Left) This small steam cleaner—the size of a vacuum cleaner—offers a very controlled and gentle means of cleaning limited, or hard-to-reach areas or carved stone details. (Right) It is particularly useful for interiors where it is important to keep moisture to a minimum, such as inside the Washington Monument, Washington, D.C., where it was used to clean the commemorative stones. Photos: Audrey T. Tepper.



Figure 10. High-pressure water washing too close to the surface has abraded and, consequently, marred the limestone on this early-20th century building.

Other Paint Removers and Cleaners. Other cleaning compounds that can be used to remove paint and some painted graffiti from historic masonry include paint removers based on N-methyl-2-pyrrolidone (NMP), or on petroleum-based compounds. Removing stains, whether they are industrial (smoke, soot, grease or tar), metallic (iron or copper), or biological (plant and fungal) in origin, depends on carefully matching the type of remover to the type of stain (Fig. 13). Successful removal of stains from historic masonry often requires the application of a number of different removers before the right one is found. The removal of layers of paint from a masonry surface is usually accomplished by applying the remover either by brush, roller or spraying, followed by a thorough water wash (Fig. 14).

Potential hazards of chemical cleaning. Since most chemical cleaning methods involve water, they have many of the potential problems of plain water cleaning. Like water methods, they should not be used in cold weather because of the possibility of freezing. Chemical cleaning should never be undertaken in temperatures below 40 degrees F (4 degrees C), and generally not below 50 degrees F. In addition, many chemical cleaners simply do not work in cold temperatures. Both acidic and alkaline cleaners can be dangerous to cleaning operators and, clearly, there are environmental concerns associated with the use of chemical cleaners.

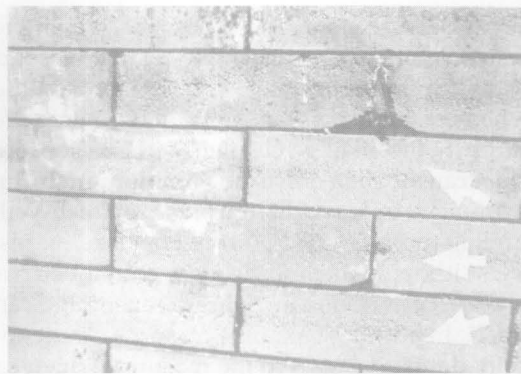


Figure 11. Rinsing with high-pressure water following chemical cleaning has left a horizontal line of abrasion across the bricks on this late-19th century row house.

If not carefully chosen, chemical cleaners can react adversely with many types of masonry. Obviously, acidic cleaners should not be used on acid-sensitive materials; however, it is not always clear exactly what the composition is of any stone or other masonry material. For this reason, testing the cleaner on an inconspicuous spot on the building is always necessary. While certain acid-based cleaners may be appropriate if used as directed on a particular type of masonry, if left too long or if not adequately rinsed from the masonry they can have a negative effect. For example, hydrofluoric acid can etch masonry leaving a hazy residue (whitish deposits of silica or calcium fluoride salts) on the surface. While this efflorescence may usually be removed by a second cleaning—although it is likely to be expensive and time-consuming—hydrofluoric acid can also leave calcium fluoride salts or a colloidal silica deposit on masonry which may be impossible to remove (Fig. 15). Other acids, particularly hydrochloric (muriatic) acid, which is very powerful, should not be used on historic masonry, because it can dissolve lime-based mortar, damage brick and some stones, and leave chloride deposits on the masonry.



Figure 12. A mild acidic cleaning agent is being used to clean this heavily soiled brick and granite building. Additional applications of the cleaner and hand-scrubbing, and even poulticing, may be necessary to remove the dark stains on the granite arches below. Photo: Sharon C. Park, FAIA.

Alkaline cleaners can stain sandstones that contain a ferrous compound. Before using an alkaline cleaner on sandstone it is always important to test it, since it may be difficult to know whether a particular sandstone may contain a ferrous compound. Some alkaline cleaners, such as **sodium hydroxide (caustic soda or lye)** and **ammonium bifluoride**, can also damage or leave disfiguring brownish-yellow stains and, in most cases, should not be used on historic masonry. Although alkaline cleaners will not etch a masonry surface as acids can, they are caustic and can burn the surface. In addition, alkaline cleaners can deposit potentially damaging salts in the masonry which can be difficult to rinse thoroughly.

Abrasive and Mechanical Cleaning

Generally, abrasive cleaning methods are not appropriate for use on historic masonry buildings. Abrasive cleaning methods are just that—abrasive. Grit blasters, grinders, and sanding discs all operate by *abrading* the dirt or paint off the surface of the masonry, rather than *reacting* with the dirt and the masonry which is how water and chemical methods work. Since the abrasives do not differentiate between the dirt and the masonry, they can also remove the outer surface of the masonry at the same time, and result in permanently damaging the masonry. Brick, architectural terra cotta, soft stone, detailed carvings, and polished surfaces are especially susceptible to physical and aesthetic damage by abrasive methods. Brick and architectural terra cotta are fired products which have a smooth, glazed surface which can be removed by abrasive blasting or grinding (Figs. 18-19). Abrasively-cleaned masonry is damaged aesthetically as well as physically, and it has a rough surface which tends to hold dirt and the roughness will make future cleaning more difficult. Abrasive cleaning processes can also increase the likelihood of subsurface cracking of the masonry. Abrasion of carved details causes a rounding of sharp corners and other loss of delicate features, while abrasion of polished surfaces removes the polished finish of stone.

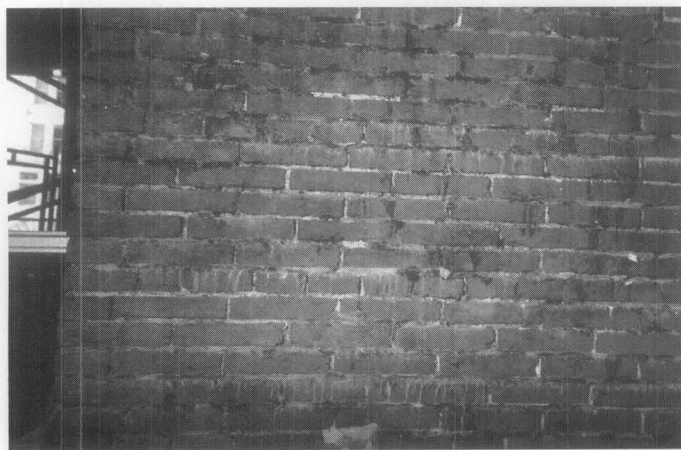


Figure 13. Sometimes it may be preferable to paint over a thick asphaltic coating rather than try to remove it, because it can be difficult to remove completely. However, in this case, many layers of asphaltic coating were removed through multiple applications of a heavy duty chemical cleaner. Each application of the cleaner was left to dwell following the manufacturer's recommendations, and then rinsed thoroughly. (As much as possible of the asphalt was first removed with wooden scrapers.) Although not all the asphalt was removed, this was determined to be an acceptable level of cleanliness for the project.



Figure 14. Chemical removal of paint from this brick building has revealed that the cornice and window hoods are metal rather than masonry.

Mortar joints, especially those with lime mortar, also can be eroded by abrasive or mechanical cleaning. In some cases, the damage may be visual, such as loss of joint detail or increased joint shadows. As mortar joints constitute a significant portion of the masonry surface (up to 20 per cent in a brick wall), this can result in the loss of a considerable amount of the historic fabric. Erosion of the mortar joints may also permit increased water penetration, which will likely necessitate repointing.



Figure 15. The whitish deposits left on the brick by a chemical paint remover may have resulted from inadequate rinsing or from the chemical being left on the surface too long and may be impossible to remove.

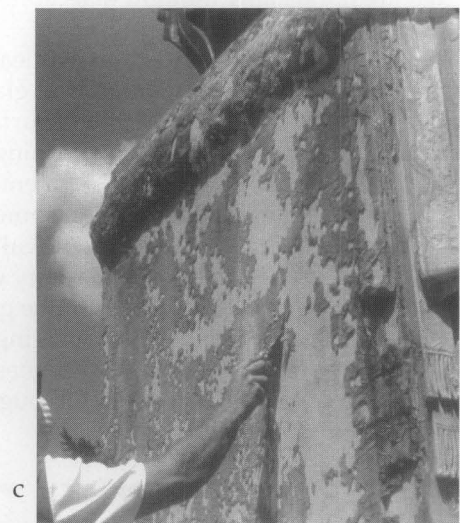
Poulticing to Remove Stains and Graffiti



a



b



c



d

Figure 16. (a) The limestone base was heavily stained by runoff from the bronze statue above. (b) A poultice consisting of copper stain remover and ammonia mixed with fuller's earth was applied to the stone base and covered with plastic sheeting to keep it from drying out too quickly. (c) As the poultice dried, it pulled the stain out of the stone. (d) The poultice residue was removed carefully from the stone surface with wooden scrapers and the stone was rinsed with water. Photos: John Dugger.

Graffiti and stains, which have penetrated into the masonry, often are best removed by using a poultice. A poultice consists of an absorbent material or clay powder (such as kaolin or fuller's earth, or even shredded paper or paper towels), mixed with a liquid (solvent or other remover) to form a paste which is applied to the stain (Figs. 16-17). As it dries, the paste absorbs the staining material so that it is not redeposited on the masonry surface. Some commercial cleaning products and paint removers are specially formulated as a paste or gel that will cling to a vertical surface and remain moist for a longer period of time in order to prolong the action of the chemical on the stain. Pre-mixed poultices are also available as a paste or in powder form needing only the addition of the appropriate liquid. The masonry must be pre-wet before applying an alkaline cleaning agent, but not when using a solvent. Once the stain has been removed, the masonry must be rinsed thoroughly.



Figure 17. A poultice is being used to remove salts from the brownstone statuary on the facade of this late-19th century stone church. Photo: National Park Service Files.



Figure 18. The glazed bricks in the center of the pier were covered by a signboard that protected them from being damaged by the sandblasting which removed the glaze from the surrounding bricks.

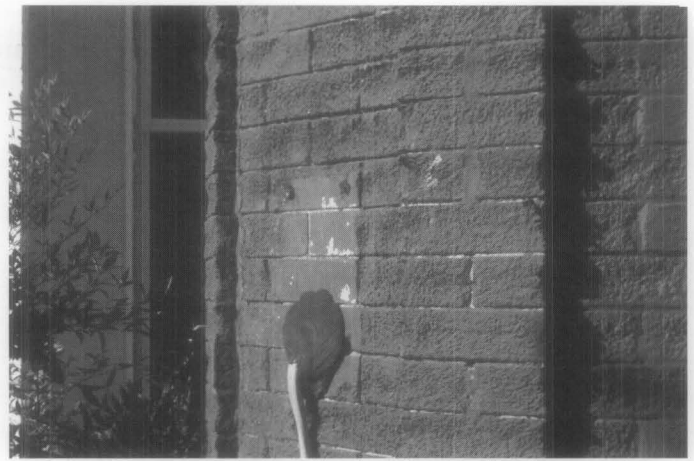


Figure 19. A comparison of undamaged bricks surrounding the electrical conduit with the rest of the brick facade emphasizes the severity of the erosion caused by sandblasting.

Abrasive Blasting. Blasting with abrasive grit or another abrasive material is the most frequently used abrasive method. *Sandblasting* is most commonly associated with abrasive cleaning. Finely ground silica or glass powder, glass beads, ground garnet, powdered walnut and other ground nut shells, grain hulls, aluminum oxide, plastic particles and even tiny pieces of sponge, are just a few of the other materials that have also been used for abrasive cleaning. Although abrasive blasting is not an appropriate method of cleaning historic masonry, it can be safely used to clean some materials. Finely-powdered walnut shells are commonly used for cleaning monumental bronze sculpture, and skilled conservators clean delicate museum objects and finely detailed, carved stone features with very small, micro-abrasive units using aluminum oxide.

A number of current approaches to abrasive blasting rely on materials that are not usually thought of as abrasive, and not as commonly associated with traditional abrasive grit cleaning. Some patented abrasive cleaning processes—one dry, one wet—use finely-ground glass powder intended to "erase" or remove dirt and surface soiling only, but not paint or stains (Fig. 20). Cleaning with baking soda (sodium bicarbonate) is another patented process. Baking soda blasting is being used in some communities as a means of quick graffiti removal. However, it should not be used on historic masonry which it can easily abrade and can permanently "etch" the graffiti into the stone; it can also leave potentially damaging salts in the stone which cannot be removed. Most of these abrasive grits may be used either dry or wet, although dry grit tends to be used more frequently.

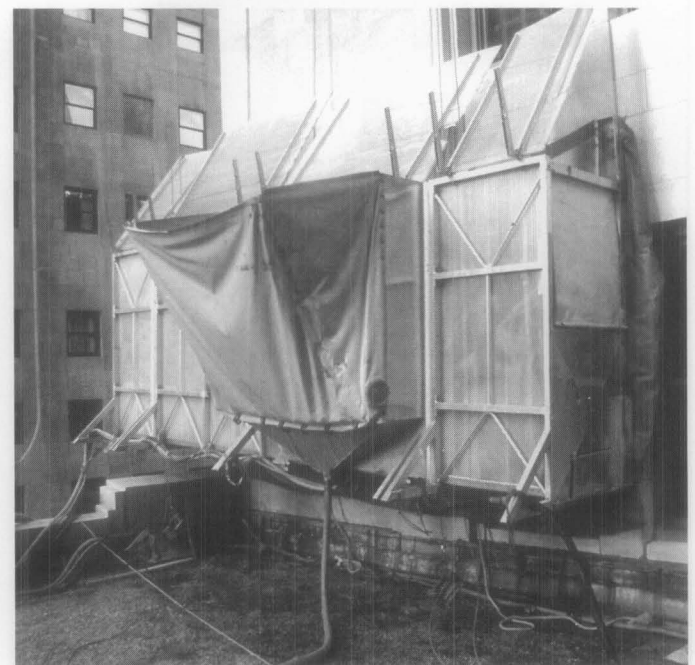
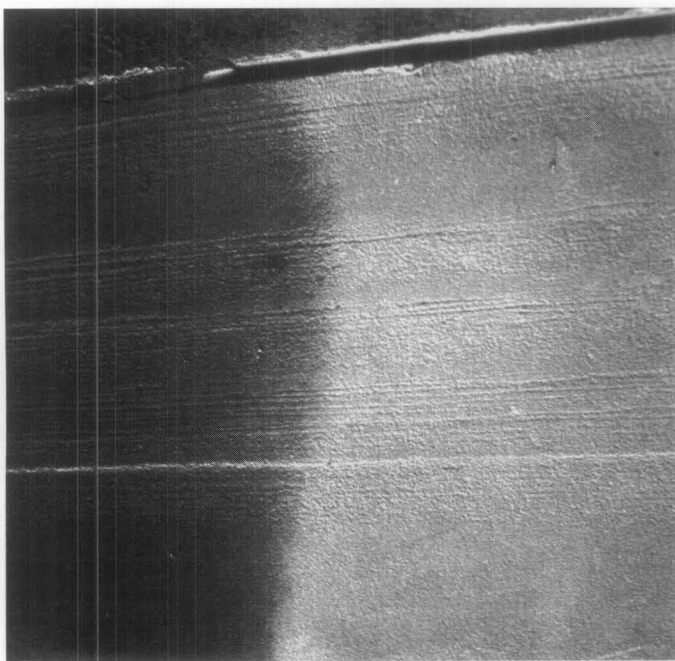


Figure 20. (Left) A comparison of the limestone surface of a 1920s office building before and after "cleaning" with a proprietary abrasive process using fine glass powder clearly shows the effectiveness of this method. But this is an abrasive technique and it has "cleaned" by removing part of the masonry surface with the dirt. Because it is abrasive, it is generally not recommended for large-scale cleaning of historic masonry, although it may be suitable to use in certain, very limited cases under controlled circumstances. (Right) A vacuum chamber where the used glass powder is collected for environmentally safe disposal is a unique feature of this particular process. The specially-trained operators in the chamber wear protective clothing, masks and breathing equipment. Photos: Tom Keohan.

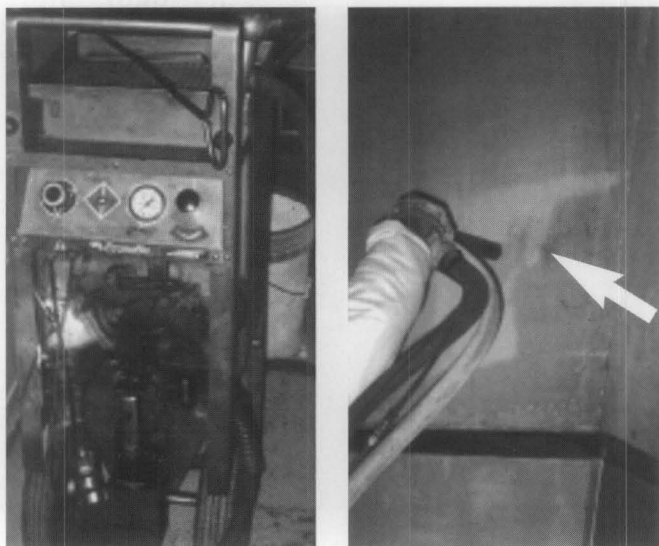


Figure 21. Low-pressure blasting with ice pellets or ice crystals (left) is an abrasive cleaning method that is sometimes recommended for use on interior masonry because it does not involve large amounts of water. However, like other abrasive materials, ice crystals "clean" by removing a portion of the masonry surface with the dirt, and may not remove some stains that have penetrated into the masonry without causing further abrasion (right). Photos: Audrey T. Tepper.

Ice particles, or pelletized dry ice (carbon dioxide or CO₂), are another medium used as an abrasive cleaner (Fig. 21). This is also too abrasive to be used on most historic masonry, but it may have practical application for removing mastics or asphaltic coatings from some substrates.

Some of these processes are promoted as being more environmentally safe and not damaging to historic masonry buildings. However, it must be remembered that they are abrasive and that they "clean" by removing a small portion of the masonry surface, even though it may be only a minuscule portion. The fact that they are essentially abrasive treatments must always be taken into consideration when planning a masonry cleaning project. *In general, abrasive methods should not be used to clean historic masonry buildings.* In some, very limited instances, highly-controlled, gentle abrasive cleaning may be appropriate on selected, hard-to-clean areas of a historic masonry building if carried out under the watchful supervision of a professional conservator. But, abrasive cleaning should never be used on an entire building.

Grinders and Sanding Disks. Grinding the masonry surface with mechanical grinders and sanding disks is another means of abrasive cleaning that should not be used on historic masonry. Like abrasive blasting, grinders and disks do not really clean masonry but instead grind away and abrasively remove and, thus, damage the masonry surface itself rather than remove just the soiling material.

Planning A Cleaning Project

Once the masonry and soiling material or paint have been identified, and the condition of the masonry has been evaluated, planning for the cleaning project can begin.

Testing cleaning methods. In order to determine the *gentlest means possible*, several cleaning methods or materials may have to be tested prior to selecting the best one to use on the building. Testing should always begin with the gentlest and least invasive method proceeding gradually, if necessary, to more complicated methods, or a combination of methods. All too often simple methods, such as low-pressure water wash, are not even considered, yet they frequently are effective, safe, and not expensive. Water of slightly higher pressure or with a non-ionic detergent additive also may be effective. It is worth repeating that these methods should always be tested prior to considering harsher methods; they are safer for the building and the environment, often safer for the applicator, and relatively inexpensive.

The level of cleanliness desired also should be determined prior to selection of a cleaning method. Obviously, the intent of cleaning is to remove most of the dirt, soiling material, stains, paint or other coating. A "brand new" appearance, however, may be inappropriate for an older building, and may require an overly harsh cleaning method to be achieved. When undertaking a cleaning project, it is important to be aware that some stains simply may not be removable. It may be wise, therefore, to agree upon a slightly lower level of cleanliness that will serve as the standard for the cleaning project. The precise amount of residual dirt considered acceptable may depend on the type of masonry, the type of soiling and difficulty of total removal, and local environmental conditions.

Cleaning tests should be carried out in an area of sufficient size to give a true indication of their effectiveness. It is preferable to conduct the test in an inconspicuous location on the building so that it will not be obvious if the test is not successful. A test area may be quite small to begin, sometimes as small as six square inches, and gradually may be increased in size as the most appropriate methods and cleaning agents are determined. Eventually the test area may be expanded to a square yard or more, and it should include several masonry units and mortar joints (Fig. 22). It should be remembered that a single building may have several types of masonry and that even similar materials may have different surface finishes. Each material and different finish should be tested separately. Cleaning tests should be evaluated only after the masonry has dried completely. *The results of the tests may indicate that several methods of cleaning should be used on a single building.*

When feasible, test areas should be allowed to weather for an extended period of time prior to final evaluation. A waiting period of a full year would be ideal in order to expose the test patch to a full range of seasons. If this is not possible, the test patch should weather for at least a month or two. For any building which is considered historically important, the delay is insignificant compared to the potential damage and disfigurement which may result from using an incompletely tested method. *The successfully cleaned test patch should be protected as it will serve as a standard against which the entire cleaning project will be measured.*

Environmental considerations. The potential effect of any method proposed for cleaning historic masonry should be evaluated carefully. Chemical cleaners and paint removers may damage trees, shrubs, grass, and plants. A plan must be provided for environmentally safe removal and disposal of the cleaning materials and the rinsing effluent before beginning the cleaning project. Authorities from the local regulatory agency—usually under the jurisdiction of the federal or state Environmental Protection Agency (EPA)—should be consulted prior to beginning a cleaning project, especially if it involves anything more than plain water washing. This advance planning will ensure that the cleaning effluent or run-off, which is the combination of the cleaning agent and the substance removed from the masonry, is handled and disposed of in an environmentally sound and legal manner. Some alkaline and acidic cleaners can be neutralized so that they can be safely discharged into storm sewers. However, most solvent-based cleaners cannot be neutralized and are categorized as pollutants, and must be disposed of by a licensed transport, storage and disposal facility. Thus, it is always advisable to consult with the appropriate agencies before starting to clean to ensure that the project progresses smoothly and is not interrupted by a stop-work order because a required permit was not obtained in advance.

Vinyl guttering or polyethylene-lined troughs placed around the perimeter of the base of the building can serve to catch chemical cleaning waste as it is rinsed off the building. This will reduce the amount of chemicals entering and polluting the soil, and also will keep the cleaning waste contained until it can be removed safely. Some patented cleaning systems have developed special equipment to facilitate the containment and later disposal of cleaning waste.

Concern over the release of volatile organic compounds (VOCs) into the air has resulted in the manufacture of new, more environmentally responsible cleaners and paint removers, while some materials traditionally used in cleaning may no longer be available for these same reasons. Other health and safety concerns have created additional cleaning challenges, such as lead paint removal, which is likely to require special removal and disposal techniques.

Cleaning can also cause damage to non-masonry materials on a building, including glass, metal and wood. Thus, it is usually necessary to cover windows and doors, and other features that may be vulnerable to chemical cleaners. They should be covered with plastic or polyethylene, or a masking agent that is applied as a liquid which dries to form a thin protective film on glass, and is easily peeled off after the cleaning is finished. Wind drift, for example, can also damage other property by carrying cleaning chemicals onto nearby automobiles, resulting in etching of the glass or spotting of the paint finish. Similarly, airborne dust can enter surrounding buildings, and excess water can collect in nearby yards and basements.

Safety considerations. Possible health dangers of each method selected for the cleaning project must be considered before selecting a cleaning method to avoid harm to the

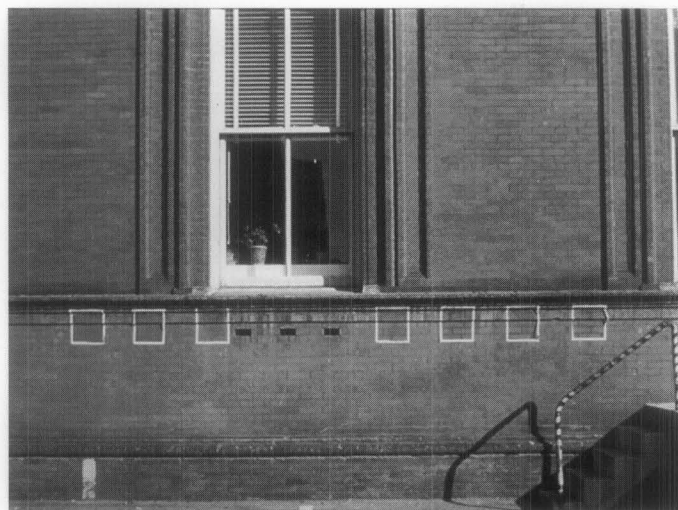


Figure 22. Cleaning test areas may be quite small at first and gradually increase in size as testing determines the "gentlest means possible".
Photo: Frances Gale.

cleaning applicators, and the necessary precautions must be taken. The precautions listed in Material Safety Data Sheets (MSDS) that are provided with chemical products should always be followed. Protective clothing, respirators, hearing and face shields, and gloves must be provided to workers to be worn at all times. Acidic and alkaline chemical cleaners in both liquid and vapor forms can also cause serious injury to passers-by (Fig. 23). It may be necessary to schedule cleaning at night or weekends if the building is located in a busy urban area to reduce the potential danger of chemical overspray to pedestrians. Cleaning during non-business hours will allow HVAC systems to be turned off and vents to be covered to prevent dangerous chemical fumes from entering the building which will also ensure the safety of the building's occupants. Abrasive and mechanical methods produce dust which can pose a serious health hazard, particularly if the abrasive or the masonry contains silica.

Water-Repellent Coatings and Waterproof Coatings

To begin with, it is important to understand that waterproof coatings and water-repellent coatings are not the same. Although these terms are frequently interchanged and commonly confused with one another, they are completely different materials. **Water-repellent coatings**—often referred to incorrectly as "sealers", but which do not or should not seal—are intended to keep liquid water from penetrating the surface but to allow water vapor to enter and leave, or pass through, the surface of the masonry (Fig. 24). Water-repellent coatings are generally *transparent*, or clear, although once applied some may darken or discolor certain types of masonry while others may give it a glossy or shiny appearance. **Waterproof coatings** seal the surface from liquid water and from water vapor. They are usually *opaque*, or pigmented, and include bituminous coatings and some elastomeric paints and coatings.

Water-Repellent Coatings

Water-repellent coatings are formulated to be vapor permeable, or "breathable". They do not seal the surface completely to water vapor so it can enter the masonry wall as well as leave the wall. While the first water-repellent coatings to be developed were primarily acrylic or silicone resins in organic solvents, now most water-repellent coatings are water-based and formulated from modified siloxanes, silanes and other alkoxysilanes, or metallic stearates. While some of these products are shipped from the factory ready to use, other waterborne water repellents must be diluted at the job site. Unlike earlier water-repellent coatings which tended to form a "film" on the masonry surface, modern water-repellent coatings actually penetrate into the masonry substrate slightly and, generally, are almost invisible if properly applied to the masonry. They are also more vapor permeable than the old coatings, yet they still reduce the vapor permeability of the masonry. Once inside the wall, water vapor can condense at cold spots producing liquid water which, unlike water vapor, cannot escape through a water-repellent coating. The liquid water within the wall, whether from condensation, leaking gutters, or other sources, can cause considerable damage.

Water-repellent coatings are not consolidants. Although modern water repellents may penetrate slightly beneath the masonry surface, instead of just "sitting" on top of it, they do not perform the same function as a consolidant which is to "consolidate" and replace lost binder to strengthen deteriorating masonry. Even after many years of laboratory study and testing few consolidants have proven very effective. The composition of fired products such as brick and architectural terra cotta, as well as many types of building stone, does not lend itself to consolidation.

Some modern water-repellent coatings which contain a binder intended to replace the natural binders in stone that have been lost through weathering and natural erosion are described in product literature as both a water repellent and a consolidant. The fact that newer water-repellent coatings penetrate beneath the masonry surface instead of just forming a layer on top of the surface may indeed convey at least some consolidating properties to certain stones. However, a water-repellent coating cannot be considered a consolidant. In some instances, a water-repellent or "preservative" coating, if applied to already damaged or spalling stone, may form a surface crust which, if it fails, may exacerbate the deterioration by pulling off even more of the stone (Fig. 25).

Is a Water-Repellent Treatment Necessary?

Water-repellent coatings are frequently applied to historic masonry buildings for the wrong reason. They also are often applied without an understanding of what they are and what they are intended to do. And these coatings can be very difficult, if not impossible, to remove from the masonry if they fail or become discolored. Most importantly, the application of water-repellent coatings to historic masonry is usually unnecessary.



Figure 23. A tarpaulin protects and shields pedestrians from potentially harmful spray while chemical cleaning is underway on the granite exterior of the U.S. Treasury Building, Washington, D.C.

Most historic masonry buildings, unless they are painted, have survived for decades without a water-repellent coating and, thus, probably do not need one now. Water penetration to the interior of a masonry building is seldom due to porous masonry, but results from poor or deferred maintenance. Leaking roofs, clogged or deteriorated gutters and downspouts, missing mortar, or cracks and open joints around door and window openings are almost always the cause of moisture-related problems in a historic masonry building. **If historic masonry buildings are kept watertight and in good repair, water-repellent coatings should not be necessary.**

Rising damp (capillary moisture pulled up from the ground), or condensation can also be a source of excess moisture in masonry buildings. A water-repellent coating will not solve this problem either and, in fact, may be likely to exacerbate it. Furthermore, a water-repellent coating should never be applied to a damp wall. Moisture in the wall would reduce the ability of a coating to adhere to the masonry and to penetrate below the surface. But, if it did adhere, it would hold the moisture inside the masonry because, although a water-repellent coating is permeable to water vapor, liquid water cannot pass through it. In the case of rising damp, a coating may force the moisture to go even higher in the wall because it can slow down evaporation, and thereby retain the moisture in the wall.

Excessive moisture in masonry walls may carry waterborne soluble salts from the masonry units themselves or from the mortar through the walls. If the water is permitted to come to the surface, the salts may appear on the masonry surface as efflorescence (a whitish powder) upon evaporation. However, the salts can be potentially dangerous if they remain in the masonry and crystallize



Figure 24. Although the application of a water-repellent coating was probably not needed on either of these buildings, the coating on the brick building (above), is not visible and has not changed the character of the brick. But the coating on the brick column (below), has a high gloss that is incompatible with the historic character of the masonry.



beneath the surface as subflorescence. Subflorescence eventually may cause the surface of the masonry to spall, particularly if a water-repellent coating has been applied which tends to reduce the flow of moisture out from the subsurface of the masonry. Although many of the newer water-repellent products are more breathable than their predecessors, they can be especially damaging if applied to masonry that contains salts, because they limit the flow of moisture through masonry.

When a Water-Repellent Coating May be Appropriate

There are some instances when a water-repellent coating may be considered appropriate to use on a historic masonry building. Soft, incompletely fired brick from the 18th- and early-19th centuries may have become so porous that paint or some type of coating is needed to protect it from further deterioration or dissolution. When a masonry building has been neglected for a long period of time, necessary repairs may be required in order to make it watertight. If, following a reasonable period of time after the building has been made watertight and has dried out completely, moisture appears actually to be penetrating through the repointed and repaired masonry walls, then the application of a water-repellent coating may be considered *in selected areas only*. This decision should be made in consultation with an architectural conservator. And, if such a treatment is undertaken, it should not be applied to the entire exterior of the building.

Anti-graffiti or barrier coatings are another type of clear coating—although barrier coatings can also be pigmented—that may be applied to exterior masonry, but they are not formulated primarily as water repellents. The purpose of these coatings is to make it harder for graffiti to stick to a masonry surface and, thus, easier to clean. But, like water-repellent coatings, in most cases the application of anti-graffiti coatings is generally not recommended for historic masonry buildings. These coatings are often quite shiny which can greatly alter the appearance of a historic masonry surface, and they are not always effective (Fig. 26). Generally, other ways of discouraging graffiti, such as improved lighting, can be more effective than a coating. However, the application of anti-graffiti coatings may be appropriate in some instances on vulnerable areas of historic masonry buildings which are frequent targets of graffiti that are located in out-of-the-way places where constant surveillance is not possible.

Some water-repellent coatings are recommended by product manufacturers as a means of keeping dirt and pollutants or biological growth from collecting on the surface of masonry buildings and, thus, reducing the need for frequent cleaning. While this at times may be true, in some cases a coating may actually retain dirt more than uncoated masonry. Generally, the application of a water-repellent coating is not recommended on a historic masonry building as a means of preventing biological growth. Some water-repellent coatings may actually encourage biological growth on a masonry wall. Biological growth on masonry buildings has traditionally been kept at bay through regularly-scheduled cleaning as part of a maintenance plan. Simple cleaning of the masonry with low-pressure water using a natural- or synthetic-bristled scrub brush can be very effective if done on a regular basis. Commercial products are also available which can be sprayed on masonry to remove biological growth.

In most instances, a water-repellent coating is not necessary if a building is watertight. The application of a water-repellent coating is not a recommended treatment for historic masonry buildings unless there is a specific



Figure 25. The clear coating applied to this limestone molding has failed and is taking off some of the stone surface as it peels. Photo: Frances Gale.

problem which it may help solve. If the problem occurs on only part of the building, it is best to treat only that area rather than an entire building. Extreme exposures such as parapets, for example, or portions of the building subject to driving rain can be treated more effectively and less expensively than the entire building. Water-repellent coatings are not permanent and must be reapplied

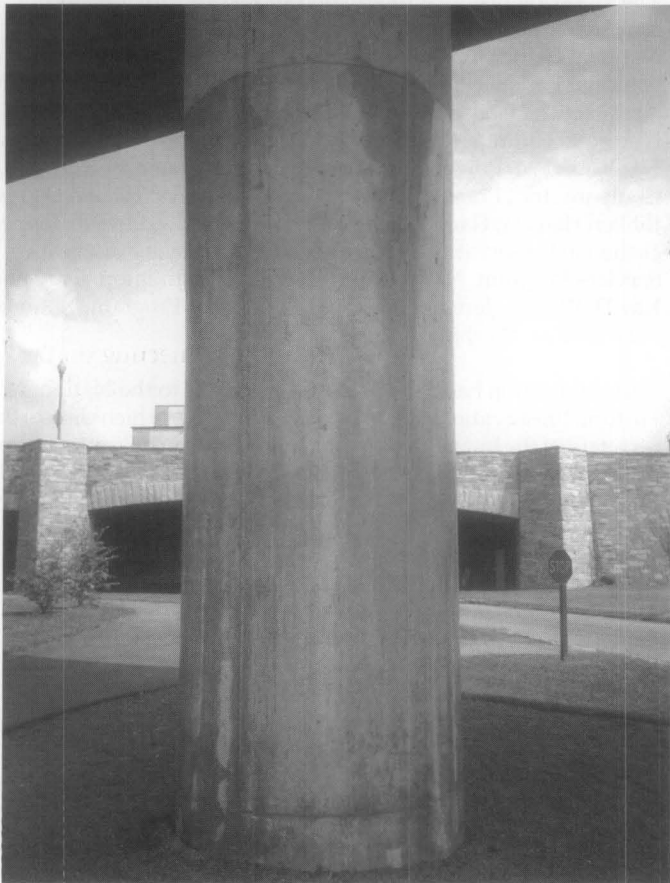


Figure 26. The anti-graffiti or barrier coating on this column is very shiny and would not be appropriate to use on a historic masonry building. The coating has discolored as it has aged and whitish streaks reveal areas of bare concrete where the coating was incompletely applied.

periodically although, if they are truly invisible, it can be difficult to know when they are no longer providing the intended protection.

Testing a water-repellent coating by applying it in one small area may not be helpful in determining its suitability for the building because a limited test area does not allow an adequate evaluation of such a treatment. Since water may enter and leave through the surrounding untreated areas, there is no way to tell if the coated test area is "breathable." But trying a coating in a small area may help to determine whether the coating is visible on the surface or if it will otherwise change the appearance of the masonry.

Waterproof Coatings

In theory, waterproof coatings usually do not cause problems as long as they exclude all water from the masonry. If water does enter the wall from the ground or from the inside of a building, the coating can intensify the damage because the water will not be able to escape. During cold weather this water in the wall can freeze causing serious mechanical disruption, such as spalling.

In addition, the water eventually will get out by the path of least resistance. If this path is toward the interior, damage to interior finishes can result; if it is toward the exterior, it can lead to damage to the masonry caused by built-up water pressure (Fig. 27).

In most instances, waterproof coatings should not be applied to historic masonry. The possible exception to this might be the application of a waterproof coating to below-grade exterior foundation walls as a last resort to stop water infiltration on interior basement walls. **Generally, however, waterproof coatings, which include elastomeric paints, should almost never be applied above grade to historic masonry buildings.**

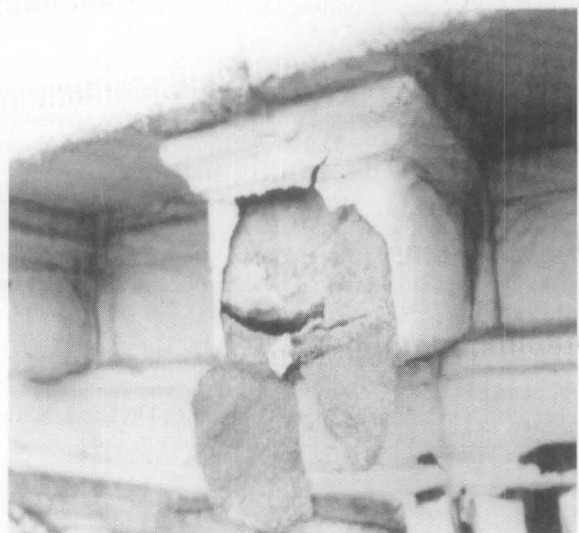


Figure 27. Instead of correcting the roof drainage problems, an elastomeric coating was applied to the already saturated limestone cornice. An elastomeric coating holds moisture in the masonry because it does not "breathe" and does not allow liquid moisture to escape. If the water pressure builds up sufficiently it can cause the coating to break and pop off as shown in this example, often pulling pieces of the masonry with it. Photo: National Park Service Files.

Summary

A well-planned cleaning project is an essential step in preserving, rehabilitating or restoring a historic masonry building. Proper cleaning methods and coating treatments, when determined necessary for the preservation of the masonry, can enhance the aesthetic character as well as the structural stability of a historic building. Removing years of accumulated dirt, pollutant crusts, stains, graffiti or paint, if done with appropriate caution, can extend the life and longevity of the historic resource. Cleaning that is carelessly or insensitively prescribed or carried out by inexperienced workers can have the opposite of the intended effect. It may scar the masonry permanently, and may actually result in hastening deterioration by introducing harmful residual chemicals and salts into the masonry or causing surface loss. Using the wrong cleaning method or using the right method incorrectly, applying the wrong kind of coating or applying a coating that is not needed can result in serious damage, both physically and aesthetically, to a historic masonry building. Cleaning a historic masonry building should always be done using the *gentlest means possible* that will clean, but not damage the building. It should always be taken into consideration before applying a water-repellent coating or a waterproof coating to a historic masonry building whether it is really necessary and whether it is in the best interest of preserving the building.

Selected Reading

Architectural Ceramics: Their History, Manufacture and Conservation. A Joint Symposium of English Heritage and the United Kingdom Institute for Conservation, September 22-25, 1994. London: English Heritage, 1996.

Ashurst, Nicola. *Cleaning Historic Buildings. Volume One: Substrates, Soiling & Investigation. Volume Two: Cleaning Materials & Processes*. London: Donhead Publishing Ltd., 1994.

Association for Preservation Technology. *Special Issue: Preservation of Historic Masonry*. Papers from the Symposium on Preservation Treatments for Historic Masonry: Consolidants, Coatings, and Water Repellents, New York, New York, November 11-12, 1994. *APT Bulletin*. Vol. XXVI, No. 4 (1995).

Grimmer, Anne E. *Preservation Brief 6: Dangers of Abrasive Cleaning to Historic Buildings*. Washington, D.C.: Preservation Assistance Division, National Park Service, U.S. Department of the Interior, 1979.

Grimmer, Anne E. *Keeping it Clean: Removing Exterior Dirt, Paint, Stains and Graffiti from Historic Masonry Buildings*. Washington, D.C.: Preservation Assistance Division, National Park Service, U.S. Department of the Interior, 1988.

Park, Sharon C., AIA. *Preservation Brief 39: Holding the Line: Controlling Unwanted Moisture in Historic Buildings*. Washington, D.C.: Heritage Preservation Services, National Park Service, U.S. Department of the Interior, 1996.

Powers, Robert M. *Preservation Tech Note, Masonry No. 3, "Water Soak Cleaning of Limestone"*. Washington, D.C.: Preservation Assistance Division, National Park Service, U.S. Department of the Interior, 1992.

Sinivinski, Valerie. "Gentle Blasting." *Old-House Journal*. Vol. XXIV, No. 4 (July-August 1996), pp. 46-49.

Weaver, Martin E. *Conserving Buildings: A Guide to Techniques and Materials*. New York: John Wiley & Sons, Inc., 1993.

Weaver, Martin E. *Preservation Brief 38: Removing Graffiti from Historic Masonry*. Washington, D.C.: Preservation Assistance Division, National Park Service, U.S. Department of the Interior, 1995.

Winkler, E.M. *Stone in Architecture: Properties, Durability*. Third, completely revised and extended edition. Berlin, Germany: Springer-Verlag, 1997.

Acknowledgments

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This publication has been prepared pursuant to the National Historic Preservation Act of 1966, as amended, which directs the Secretary of the Interior to develop and make available information concerning historic properties. Comments on the usefulness of this publication may be directed to: Sharon C. Park, FAIA, Chief, Technical Preservation Services Branch, Heritage Preservation Services Program, National Park Service, 1849 C Street, N.W., Suite NC200, Washington, D.C. 20240 (www2.cr.nps.gov/tps). This publication is not copyrighted and can be reproduced without penalty. Normal procedures for credit to the authors and the National Park Service are appreciated.

Front Cover: Chemical cleaning of the brick and architectural terra cotta frieze on the 1880s Pension Building, Washington, D.C. (now the National Building Museum), is shown here in progress. Photo: Christina Henry.

Photographs used to illustrate this Brief were taken by Anne Grimmer unless otherwise credited.

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Exhibit B

Preservation Brief 2 Repointing Mortar Joints in Historic Masonry Buildings

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2 Preservation Briefs

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



Repointing Mortar Joints in Historic Masonry Buildings

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

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» [Identifying the Problem Before Repointing](#)

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

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

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

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

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

Historical Background

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

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

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

Identifying the Problem Before Repointing

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

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

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

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



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

Finding an Appropriate Mortar Match

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



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

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

Although not crucial to a successful repointing project, for projects involving properties of special historic significance, a mortar analysis by a qualified laboratory can be useful by providing information on

the original ingredients. However, there are limitations with such an analysis, and replacement mortar specifications should not be based solely on laboratory analysis. Analysis requires interpretation, and there are important factors which affect the condition and performance of the mortar that cannot be established through laboratory analysis. These may include: the original water content, rate of curing, weather

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

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

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



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

Mortar Analysis

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

Instrumental analysis methods that have been used to evaluate mortars include

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

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

Lorraine Schnabel.

Properties of Mortar

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

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

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



This early 19th century building is being repointed

can cause parts of the outer surface to spall off or delaminate. If the mortar does not permit moisture or moisture vapor to migrate out of the wall and evaporate, the result will be damage to the masonry units.

with lime mortar. Photo: Travis McDonald.

Components of Mortar

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

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

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

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

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

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

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



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

Lime, itself, when mixed with water into a paste is very plastic and creamy. It will remain workable and soft indefinitely, if stored in a sealed container. Lime (calcium hydroxide) hardens by carbonation absorbing carbon dioxide primarily from the air, converting itself to calcium carbonate. Once a lime and sand mortar is mixed and placed in a wall, it begins the process of carbonation. If lime mortar is left to dry too rapidly, carbonation of the mortar will be reduced, resulting in poor adhesion and poor durability. In addition, lime mortar is slightly water soluble and thus is able to re-seal any hairline cracks that may develop during the life of the mortar. Lime mortar is soft, porous, and changes little in

volume during temperature fluctuations thus making it a good choice for historic buildings. *Because of these qualities, high calcium lime mortar may be considered for many repointing projects, not just those involving historic buildings.*

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

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

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

For repointing, portland cement should conform to ASTM C 150. White, non-staining portland cement may provide a better color match for some historic mortars than the more commonly available grey portland cement. But, it should not be assumed, however, that white portland cement is always appropriate for all historic buildings, since the original mortar may have been mixed with grey cement. The cement should not have more than 0.60 per cent alkali to help avoid efflorescence.

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

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

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

Other Components

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

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

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

Modern components. Admixtures are used to create specific characteristics in mortar, and whether they should be used will depend upon the individual project. *Air entraining agents*, for example, help the mortar to resist freeze-thaw damage in northern climates. *Accelerators* are used to reduce mortar freezing prior to setting while *retarders* help to extend the mortar life in hot climates. Selection of admixtures should be made by the architect or architectural conservator as part of the specifications, not something routinely added by the masons.

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

Mortar Type and Mix

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



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

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

Specifying the proportions for the repointing mortar for a specific job is not as difficult as it might seem. Five mortar types, each with a corresponding recommended mix, have been established by ASTM to distinguish high strength mortar from soft flexible mortars. The ASTM designated them in decreasing order of approximate general strength as Type M (2,500 psi), Type S (1,800 psi), Type N (750 psi), Type O (350 psi) and Type K (75 psi). (The letters identifying the types are from the words MASON WORK using every other letter.) Type K has the highest lime content of the mixes that contain portland cement, although it is seldom used today, except for some historic preservation projects. The designation "L" in the accompanying chart identifies a straight lime and sand mix. Specifying the appropriate ASTM

mortar by proportion of ingredients, will ensure the desired physical properties. Unless specified otherwise, measurements or proportions for mortar mixes are always given in the following order: cement-lime-sand. Thus, a Type K mix, for example, would be referred to as 1-3-10, or 1 part cement to 3 parts lime to 10 parts sand. Other requirements to create the desired visual qualities should be included in the specifications.

The strength of a mortar can vary. If mixed with higher amounts of portland cement, a harder mortar is obtained. The more lime that is added, the softer and more plastic the mortar becomes, increasing its workability. A mortar strong in compressive strength might be desirable for a hard stone (such as granite) pier holding up a bridge deck,

whereas a softer, more permeable lime mortar would be preferable for a historic wall of soft brick. Masonry deterioration caused by salt deposition results when the mortar is less permeable than the masonry unit. A strong mortar is still more permeable than hard, dense stone. However, in a wall constructed of soft bricks where the masonry unit itself has a relatively high permeability or vapor transmission rate, a soft, high lime mortar is necessary to retain sufficient permeability.

Budgeting and Scheduling

Repointing is both expensive and time consuming due to the extent of handwork and special materials required. It is preferable to repoint only those areas that require work rather than an entire wall, as is often specified. But, if 25 to 50 per cent or more of a wall needs to be repointed, repointing the entire wall may be more cost effective than spot repointing.

Total repointing may also be more sensible when access is difficult, requiring the erection of expensive scaffolding (unless the majority of the mortar is sound and unlikely to require replacement in the foreseeable future). Each project requires judgement based on a variety of factors. Recognizing this at the outset will help to prevent many jobs from becoming prohibitively expensive.



When repairing this stone wall, the mason matched the raised profile of the original tuckpointing. Photo: NPS files.

In scheduling, seasonal aspects need to be considered first. Generally speaking, wall temperatures between 40 and 95 degrees F (8 and 38 degrees C) will prevent freezing or excessive evaporation of the water in the mortar. Ideally, repointing should be done in shade, away from strong sunlight in order to slow the drying process, especially during hot weather. If necessary, shade can be provided for large-scale projects with appropriate modifications to scaffolding.

The relationship of repointing to other work proposed on the building must also be recognized. For example, if paint removal or cleaning is anticipated, and if the mortar joints are basically sound and need only selective repointing, it is generally better to postpone repointing until after completion of these activities. However, if the mortar has eroded badly, allowing moisture to penetrate deeply into the wall, repointing should be accomplished before cleaning. Related work, such as structural or roof repairs, should be scheduled so that they do not interfere with repointing and so that all work can take maximum advantage of erected scaffolding.

Building managers also must recognize the difficulties that a repointing project can create.

The process is time consuming, and scaffolding may need to remain in place for an extended period of time. The joint preparation process can be quite noisy and can generate large quantities of dust which must be controlled, especially at air intakes to protect human health, and also where it might damage operating machinery. Entrances may be blocked from time to



A mechanical grinder improperly used to cut out the horizontal joint and incompatible repointing have seriously damaged the 19th century brick. Photo: NPS files.

time making access difficult for both building tenants and visitors. Clearly, building managers will need to coordinate the repointing work with other events at the site.

Contractor Selection

The ideal way to select a contractor is to ask knowledgeable owners of recently repointed historic buildings for recommendations. Qualified contractors then can provide lists of other repointing projects for inspection. More commonly, however, the contractor for a repointing project is selected through a competitive bidding process over which the client or consultant has only limited control. In this situation it is important to ensure that the specifications stipulate that masons must have a minimum of five years' experience with repointing historic masonry buildings to be eligible to bid on the project. Contracts are awarded to the lowest responsible bidder, and bidders who have performed poorly on other projects usually can be eliminated from consideration on this basis, even if they have

the lowest prices.

The contract documents should call for unit prices as well as a base bid. Unit pricing forces the contractor to determine in advance what the cost addition or reduction will be for work which varies from the scope of the base bid. If, for example, the contractor has fifty linear feet less of stone repointing than indicated on the contract documents but thirty linear feet more of brick repointing, it will be easy to determine the final price for the work. Note that each type of work--brick repointing, stone repointing, or similar items--will have its own unit price. The unit price also should reflect quantities; one linear foot of pointing in five different spots will be more expensive than five contiguous linear feet.

Execution of the Work

Test Panels. These panels are prepared by the contractor using the same techniques that will be used on the remainder of the project. Several panel locations--preferably not on the front or other highly visible location of the building--may be necessary to include all types of masonry, joint styles, mortar colors, and other problems likely to be encountered on the job.

If cleaning tests, for example, are also to be undertaken, they should be carried out in the same location. Usually a 3 foot by 3 foot area is sufficient for brickwork, while a somewhat larger area may be required for stonework. These panels establish an acceptable standard of work and serve as a benchmark for evaluating and accepting subsequent work on the building.

Joint Preparation. Old mortar should be removed to a minimum depth of 2 to 2-1/2 times the width of the joint to ensure an adequate bond and to prevent mortar "popouts." For most brick joints, this will require removal of the mortar to a depth of approximately 1/2 to 1 inch; for stone masonry with wide joints, mortar may need to be removed to a depth of several inches. Any loose or disintegrated mortar



Unskilled repointing has

beyond this minimum depth also should be removed.

negatively impacted the character of this late-19th century building. Photo: NPS files.

Although some damage may be inevitable, careful joint preparation can help limit damage to masonry units. The traditional manner of removing old mortar is through the use of hand chisels and mash hammers. Though labor-intensive, in most instances this method poses the least threat for damage to historic masonry units and produces the best final product.

The most common method of removing mortar, however, is through the use of power saws or grinders. The use of power tools by unskilled masons can be disastrous for historic masonry, particularly soft brick. Using power saws on walls with thin joints, such as most brick walls, almost always will result in damage to the masonry units by breaking the edges and by overcutting on the head, or vertical joints.

However, small pneumatically-powered chisels generally can be used safely and effectively to remove mortar on historic buildings as long as the masons maintain appropriate control over the equipment. Under certain circumstances, thin diamond-bladed grinders may be used to cut out *horizontal* joints only on hard portland cement mortar common to most early-20th century masonry buildings. Usually, automatic tools most successfully remove old mortar without damaging the masonry units when they are used in combination with hand tools in preparation for repointing. Where horizontal joints are uniform and fairly wide, it may be possible to use a power masonry saw to assist the removal of mortar, such as by cutting along the middle of the joint; final mortar removal from the sides of the joints still should be done with a hand chisel and hammer. Caulking cutters with diamond blades can sometimes be used successfully to cut out joints without damaging the masonry. Caulking cutters are slow; they do not rotate, but vibrate at very high speeds, thus minimizing the possibility of damage to masonry units. Although mechanical tools may be safely used in limited circumstances to cut out horizontal joints in preparation for repointing, they should never be used on vertical joints because of the danger of slipping and cutting into the brick above or below the vertical joint. Using power tools to remove mortar without damaging the surrounding masonry units also necessitates highly skilled masons experienced in working on historic masonry buildings. Contractors should demonstrate proficiency with power tools before their use is approved.

Using any of these power tools may also be more acceptable on hard stone, such as quartzite or granite, than on terra cotta with its glass-like glaze, or on soft brick or stone. The test panel should determine the acceptability of power tools. If power tools are to be permitted, the contractor should establish a quality control program to account for worker fatigue and similar variables.

Mortar should be removed cleanly from the masonry units, leaving square corners at the back of the cut. Before filling, the joints should be rinsed with a jet of water to remove all loose particles and dust. At the time of filling, the joints should be damp, but with no standing water present. For masonry walls--limestone, sandstone and common brick--that are extremely absorbent, it is recommended that a continual mist of water be applied for a few hours before repointing begins.

Mortar Preparation. Mortar components should be measured and mixed carefully to assure the uniformity of visual and physical characteristics. Dry ingredients are measured by volume and thoroughly mixed before the addition of any water. Sand must be added in a damp, loose condition to avoid over sanding. Repointing mortar is typically pre-hydrated by adding water so it will just hold together, thus allowing it to stand for a period of time before the final water is added. Half the water should be added, followed

by mixing for approximately 5 minutes. The remaining water should then be added in small portions until a mortar of the desired consistency is reached. The total volume of water necessary may vary from batch to batch, depending on weather conditions. It is important to keep the water to a minimum for two reasons: first, a drier mortar is cleaner to work with, and it can be compacted tightly into the joints; second, with no excess water to evaporate, the mortar cures without shrinkage cracks. Mortar should be used within approximately 30 minutes of final mixing, and "retempering," or adding more water, should not be permitted.

Using Lime Putty to Make Mortar. Mortar made with lime putty and sand, sometimes referred to as roughage or course stuff, should be measured by volume, and may require slightly different proportions from those used with hydrated lime. No additional water is usually needed to achieve a workable consistency because enough water is already contained in the putty. Sand is proportioned first, followed by the lime putty, then mixed for five minutes or until all the sand is thoroughly coated with the lime putty. But mixing, in the familiar sense of turning over with a hoe, sometimes may not be sufficient if the best possible performance is to be obtained from a lime putty mortar. Although the old practice of chopping, beating and ramming the mortar has largely been forgotten, recent field work has confirmed that lime putty and sand rammed and beaten with a wooden mallet or ax handle, interspersed by chopping with a hoe, can significantly improve workability and performance. The intensity of this action increases the overall lime/sand contact and removes any surplus water by compacting the other ingredients. It may also be advantageous for larger projects to use a mortar pan mill for mixing. Mortar pan mills which have a long tradition in Europe produce a superior lime putty mortar not attainable with today's modern paddle and drum type mixers.

For larger repointing projects the lime putty and sand can be mixed together ahead of time and stored indefinitely, on or off site, which eliminates the need for piles of sand on the job site. This mixture, which resembles damp brown sugar, must be protected from the air in sealed containers with a wet piece of burlap over the top or sealed in a large plastic bag to prevent evaporation and premature carbonation. The lime putty and sand mixture can be recombined into a workable plastic state months later with no additional water.

If portland cement is specified in a lime putty and sand mortar--Type O (1:2:9) or Type K (1:3:11)--the portland cement should first be mixed into a slurry paste before adding it to the lime putty and sand. Not only will this ensure that the portland cement is evenly distributed throughout the mixture, but if dry portland cement is added to wet ingredients it tends to "ball up," jeopardizing dispersion. (Usually water must be added to the lime putty and sand anyway once the portland cement is introduced.) Any color pigments should be added at this stage and mixed for a full five minutes. The mortar should be used within 30 minutes to 1½ hours and it should not be retempered. Once portland cement has been added the mortar can no longer be stored.

Filling the Joint. Where existing mortar has been removed to a depth of greater than 1 inch, these deeper areas should be filled first, compacting the new mortar in several layers. The back of the entire joint should be filled successively by applying approximately 1/4 inch of mortar, packing it well into the back corners. This application may extend along the wall for several feet. As soon as the mortar has reached thumb-print hardness, another 1/4 inch layer of mortar--approximately the same thickness--may be applied. Several layers will be needed to fill the joint flush with the outer surface of the masonry. It is important to allow each layer time to harden before the next layer is applied; most of the mortar shrinkage occurs during the hardening process and layering thus minimizes overall shrinkage.

When the final layer of mortar is thumb-print hard, the joint should be tooled to match the historic joint. Proper timing of the tooling is important for uniform color and appearance. If tooled when too soft, the color will be lighter than expected, and hairline cracks may occur; if tooled when too hard, there may be dark streaks called "tool burning," and good closure of the mortar against the masonry units will not be achieved.

If the old bricks or stones have worn, rounded edges, it is best to recess the final mortar slightly from the face of the masonry. This treatment will help avoid a joint which is visually wider than the actual joint; it also will avoid creation of a large, thin featheredge which is easily damaged, thus admitting water. After tooling, excess mortar can be removed from the edge of the joint by brushing with a natural bristle or nylon brush. Metal bristle brushes should never be used on historic masonry.

Curing Conditions. The preliminary hardening of high-lime content mortars--those mortars that contain more lime by volume than portland cement, i.e., Type O (1:2:9), Type K (1:3:11), and straight lime/sand, Type "L" (0:1:3)--takes place fairly rapidly as water in the mix is lost to the porous surface of the masonry and through evaporation. A high lime mortar (especially Type "L") left to dry out too rapidly can result in chalking, poor adhesion, and poor durability. Periodic wetting of the repointed area after the mortar joints are thumb-print hard and have been finish tooled may significantly accelerate the carbonation process. When feasible, misting using a hand sprayer with a fine nozzle can be simple to do for a day or two after repointing. Local conditions will dictate the frequency of wetting, but initially it may be as often as every hour and gradually reduced to every three or four hours. Walls should be covered with burlap for the first three days after repointing. (Plastic may be used, but it should be tented out and not placed directly against the wall.) This helps keep the walls damp and protects them from direct sunlight. Once carbonation of the lime has begun, it will continue for many years and the lime will gain strength as it reverts back to calcium carbonate within the wall.

Aging the Mortar. Even with the best efforts at matching the existing mortar color, texture, and materials, there will usually be a visible difference between the old and new work, partly because the new mortar has been matched to the unweathered portions of the historic mortar. Another reason for a slight mismatch may be that the sand is more exposed in old mortar due to the slight erosion of the lime or cement. Although spot repointing is generally preferable and some color difference should be acceptable, if the difference between old and new mortar is too extreme, it may be advisable in some instances to repoint an entire area of a wall, or an entire feature such as a bay, to minimize the difference between the old and the new mortar. If the mortars have been properly matched, usually the best way to deal with surface color differences is to let the mortars age naturally. Other treatments to overcome these differences, including cleaning the non-repointed areas or staining the new mortar, should be carefully tested prior to implementation.



This 18th century pediment and surrounding wall exhibit distinctively different mortar joints. Photo: NPS files.

Staining the new mortar to achieve a better color match is generally not recommended, but it may be appropriate in some instances. Although staining may provide an initial match, the old and new mortars may weather at different rates, leading to visual differences after a few seasons. In addition, the mixtures used to stain the mortar may be harmful to the masonry; for example, they may introduce salts into the masonry

which can lead to efflorescence.

Cleaning the Repointed Masonry. If repointing work is carefully executed, there will be little need for cleaning other than to remove the small amount of mortar from the edge of the joint following tooling. This can be done with a stiff natural bristle or nylon brush after the mortar has dried, but before it is initially set (1-2 hours). Mortar that has hardened can usually be removed with a wooden paddle or, if necessary, a chisel.

Further cleaning is best accomplished with plain water and natural bristle or nylon brushes. If chemicals must be used, they should be selected with extreme caution. Improper cleaning can lead to deterioration of the masonry units, deterioration of the mortar, mortar smear, and efflorescence. New mortar joints are especially susceptible to damage because they do not become fully cured for several months. Chemical cleaners, particularly acids, should never be used on dry masonry. The masonry should always be completely soaked once with water before chemicals are applied. After cleaning, the walls should be flushed again with plain water to remove all traces of the chemicals.

Several precautions should be taken if a freshly repointed masonry wall is to be cleaned. First, the mortar should be fully hardened before cleaning. Thirty days is usually sufficient, depending on weather and exposure; as mentioned previously, the mortar will continue to cure even after it has hardened. Test panels should be prepared to evaluate the effects of different cleaning methods. Generally, on newly repointed masonry walls, only very low pressure (100 psi) water washing supplemented by stiff natural bristle or nylon brushes should be used, except on glazed or polished surfaces, where only soft cloths should be used.**

New construction "bloom" or efflorescence occasionally appears within the first few months of repointing and usually disappears through the normal process of weathering. If the efflorescence is not removed by natural processes, the safest way to remove it is by dry brushing with stiff natural or nylon bristle brushes followed by wet brushing. Hydrochloric (muriatic) acid, is generally ineffective, and it should not be used to remove efflorescence. It may liberate additional salts, which, in turn, can lead to more efflorescence.

Surface Grouting is sometimes suggested as an alternative to repointing brick buildings, in particular. This process involves the application of a thin coat of cement-based grout to the mortar joints and the mortar/brick interface. To be effective, the grout must extend slightly onto the face of the masonry units, thus widening the joint visually. The change in the joint appearance can alter the historic character of the structure to an unacceptable degree. In addition, although masking of the bricks is intended to keep the grout off the remainder of the face of the bricks, some level of residue, called "veiling," will inevitably remain. Surface grouting cannot substitute for the more extensive work of repointing, and it is not a recommended treatment for historic masonry.

***Additional information on masonry cleaning is presented in Preservation Briefs 1: Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings, Robert C. Mack, FAIA, and Anne Grimmer, Washington, D.C.: Technical Preservation Services, National Park Service, U.S. Department of the Interior, 2000; and Keeping it Clean: Removing Exterior Dirt, Paint, Stains & Graffiti from Historic Masonry Buildings, Anne E. Grimmer, Washington, D.C.: Technical Preservation Services, National Park Service, U.S. Department of the Interior, 1988.*

Visually Examining the Mortar and the Masonry Units

A simple *in situ* comparison will help determine the hardness and condition of the mortar and the masonry units. Begin by scraping the mortar with a screwdriver, and gradually tapping harder with a cold chisel and mason's hammer. Masonry units can be tested in the same way beginning, even more gently, by scraping with a fingernail. This relative analysis which is derived from the 10-point hardness scale used to describe minerals, provides a good starting point for selection of an appropriate mortar. It is described more fully in "The Russack System for Brick & Mortar Description" referenced in **Selected Reading** at the end of this Brief.

Mortar samples should be chosen carefully, and picked from a variety of locations on the building to find unweathered mortar, if possible. Portions of the building may have been repointed in the past while other areas may be subject to conditions causing unusual deterioration. There may be several colors of mortar dating from different construction periods or sand used from different sources during the initial construction. Any of these situations can give false readings to the visual or physical characteristics required for the new mortar. Variations should be noted which may require developing more than one mix.

1) Remove with a chisel and hammer three or four unweathered samples of the mortar to be matched from several locations on the building. (Set the largest sample aside--this will be used later for comparison with the repointing mortar). Removing a full representation of samples will allow selection of a "mean" or average mortar sample.

2) Mash the remaining samples with a wooden mallet, or hammer if necessary, until they are separated into their constituent parts. There should be a good handful of the material.

3) Examine the powdered portion--the lime and/or cement matrix of the mortar. Most particularly, note the color. There is a tendency to think of historic mortars as having white binders, but grey portland cement was available by the last quarter of the 19th century, and traditional limes were also sometimes grey. Thus, in some instances, the natural color of the historic binder may be grey, rather than white. The mortar may also have been tinted to create a colored mortar, and this color should be identified at this point.

4) Carefully blow away the powdery material (the lime and/or cement matrix which bound the mortar together).

5) With a low power (10 power) magnifying glass, examine the remaining sand and other materials such as lumps of lime or shell.

6) Note and record the wide range of color as well as the varying sizes of the individual grains of sand, impurities, or other materials.

Other Factors to Consider

Color. Regardless of the color of the binder or colored additives, the sand is the primary material that gives mortar its color. A surprising variety of colors of sand may be found in a single sample of historic mortar, and the different sizes of the grains of sand or other materials, such as incompletely ground lime or cement, play an important role in the texture of the repointing mortar. Therefore, when specifying sand for repointing

mortar, it may be necessary to obtain sand from several sources and to combine or screen them in order to approximate the range of sand colors and grain sizes in the historic mortar sample.

Pointing Style. Close examination of the historic masonry wall and the techniques used in the original construction will assist in maintaining the visual qualities of the building. Pointing styles and the methods of producing them should be examined. It is important to look at both the horizontal and the vertical joints to determine the order in which they were tooled and whether they were the same style. Some late-19th and early-20th century buildings, for example, have horizontal joints that were raked back while the vertical joints were finished flush and stained to match the bricks, thus creating the illusion of horizontal bands. Pointing styles may also differ from one facade to another; front walls often received greater attention to mortar detailing than side and rear walls.

Tuckpointing is not true repointing but the application of a raised joint or lime putty joint on top of flush mortar joints. **Penciling** is a purely decorative, painted surface treatment over a mortar joint, often in a contrasting color.

Masonry Units. The masonry units should also be examined so that any replacement units will match the historic masonry. Within a wall there may be a wide range of colors, textures, and sizes, particularly with hand-made brick or rough-cut, locally-quarried stone. Replacement units should blend in with the full range of masonry units rather than a single brick or stone.

Matching Color and Texture of the Repointing Mortar

New mortar should match the unweathered interior portions of the historic mortar. The simplest way to check the match is to make a small sample of the proposed mix and allow it to cure at a temperature of approximately 70 degrees F for about a week, or it can be baked in an oven to speed up the curing; this sample is then broken open and the surface is compared with the surface of the largest "saved" sample of historic mortar.

If a proper color match cannot be achieved through the use of natural sand or colored aggregates like crushed marble or brick dust, it may be necessary to use a modern mortar pigment.

During the early stages of the project, it should be determined how closely the new mortar should match the historic mortar. Will "quite close" be sufficient, or is "exactly" expected? The specifications should state this clearly so that the contractor has a reasonable idea how much time and expense will be required to develop an acceptable match.

The same judgment will be necessary in matching replacement terra cotta, stone or brick. If there is a known source for replacements, this should be included in the specifications. If a source cannot be determined prior to the bidding process, the specifications should include an estimated price for the replacement materials with the final price based on the actual cost to the contractor.

Mortar Types (Measured by volume)			
Designation	Cement	Hydrated Lime or Lime Putty	Sand
M	1	1/4	3 - 3 3/4

S	1	1/2	4 - 4 1/2
N	1	1	5 - 6
O	1	2	8 - 9
K	1	3	10 - 12
"L"	0	1	2 1/4 - 3

Suggested Mortar Types for Different Exposures			
Masonry Material	Exposure		
	Sheltered	Moderate	Severe
Very durable: granite, hard-cored brick, etc.	O	N	S
Moderately durable: limestone, durable stone, molded brick	K	O	N
Minimally durable: soft hand-made brick	"L"	K	O

Summary

For the Owner/Administrator. The owner or administrator of a historic building should remember that repointing is likely to be a lengthy and expensive process. First, there must be adequate time for evaluation of the building and investigation into the cause of problems. Then, there will be time needed for preparation of the contract documents. The work itself is precise, time-consuming and noisy, and scaffolding may cover the face of the building for some time. Therefore, the owner must carefully plan the work to avoid problems. Schedules for both repointing and other activities will thus require careful coordination to avoid unanticipated conflicts. The owner must avoid the tendency to rush the work or cut corners if the historic building is to retain its visual integrity and the job is to be durable.

For the Architect/Consultant. Because the primary role of the consultant is to ensure the life of the building, a knowledge of historic construction techniques and the special problems found in older buildings is essential. The consultant must assist the owner in planning for logistical problems relating to research and construction. It is the consultant's responsibility to determine the cause of the mortar deterioration and ensure that it is corrected before the masonry is repointed. The consultant must also be prepared to spend more time in project inspections than is customary in modern construction.

For the Masons. Successful repointing depends on the masons themselves. Experienced masons understand the special requirements for work on historic buildings and the added time and expense they require. The entire masonry crew must be willing and able to perform the work in conformance with the specifications, even when the specifications may not be in conformance with standard practice. At the same time, the masons should not hesitate to question the specifications if it appears that the work specified would damage the building.

Conclusion

A good repointing job is meant to last, at least 30 years, and preferably 50- 100 years. Shortcuts and poor craftsmanship result not only in diminishing the historic character of a building, but also in a job that looks bad, and will require future repointing sooner than if the work had been done correctly. The mortar joint in a historic masonry building has often been called a wall's "first line of defense." Good repointing practices guarantee the long life of the mortar joint, the wall, and the historic structure. Although careful maintenance will help preserve the freshly repointed mortar joints, it is important to remember that mortar joints are intended to be sacrificial and will probably require repointing some time in the future. Nevertheless, if the historic mortar joints proved durable for many years, then careful repointing should have an equally long life, ultimately contributing to the preservation of the entire building.

Selected Reading

Ashurst, John & Nicola. *Practical Building Conservation. Vol. 3: Mortars, Plasters and Renders*. New York: Halsted Press, a Division of John Wiley & Sons, Inc., 1988.

Cliver, E. Blaine. "Tests for the Analysis of Mortar Samples." *Bulletin of the Association for Preservation Technology*. Vol. 6, No. 1 (1974), pp. 68-73.

Coney, William B., AIA. *Masonry Repointing of Twentieth-Century Buildings*. Illinois Preservation Series. Number 10. Springfield, IL: Division of Preservation Services, Illinois Historic Preservation Agency, 1989.

Davidson, J.I. "Masonry Mortar." *Canadian Building Digest*. CBD 163. Ottawa, ONT: Division of Building Research, National Research Council of Canada, 1974.

Ferro, Maximillian L., AIA, RIBA. "The Russack System for Brick and Mortar Description: A Field Method for Assessing Masonry Hardness." *Technology and Conservation*. Vol. 5, No. 2 (Summer 1980), pp. 32-35.

Hooker, Kenneth A. "Field Notes on Repointing." *Aberdeen's Magazine of Masonry Construction*. Vol. 4, No. 8 (August 1991), pp. 326-328.

Jedrzejewska, H. "Old Mortars in Poland: A New Method of Investigation." *Studies in Conservation*. Vol. 5, No. 4 (1960), pp. 132-138.

"Lime's Role in Mortar." *Aberdeen's Magazine of Masonry Construction*. Vol. 9, No. 8 (August 1996), pp. 364-368.

Phillips, Morgan W. "Brief Notes on the Subjects of Analyzing Paints and Mortars and the Recording of Moulding Profiles: The Trouble with Paint and Mortar Analysis." *Bulletin of the Association for Preservation Technology*. Vol. 10, No. 2 (1978), pp. 77-89.

Preparation and Use of Lime Mortars: An Introduction to the Principles of Using Lime Mortars. Scottish Lime Centre for Historic Scotland. Edinburgh: Historic Scotland, 1995.

Schierhorn, Carolyn. "Ensuring Mortar Color Consistency." *Aberdeen's Magazine of Masonry Construction*. Vol. 9, No. 1 (January 1996), pp. 33-35.

"Should Air-Entrained Mortars Be Used?" *Aberdeen's Magazine of Masonry Construction*. Vol. 7, No. 9 (September 1994), pp. 419-422.

Sickels-Taves, Lauren B. "Creep, Shrinkage, and Mortars in Historic Preservation." *Journal of Testing and Evaluation, JTEVA*. Vol. 23, No. 6 (November 1995), pp. 447-452.

Speweik, John P. *The History of Masonry Mortar in America, 1720-1995*. Arlington, VA: National Lime Association, 1995.

Speweik, John P. "Repointing Right: Why Using Modern Mortar Can Damage a Historic House." *Old-House Journal*. Vol. XXV, No. 4 (July-August 1997), pp. 46-51.

Technical Notes on Brick Construction. Brick Institute of America, Reston, VA.

"Moisture Resistance of Brick Masonry: Maintenance." 7F. February 1986.

"Mortars for Brick Masonry." 8 Revised II. November 1989.

"Standard Specification for Portland Cement-Lime Mortar for Brick Masonry." 8A Revised. September 1988.

"Mortar for Brick Masonry-Selection and Controls." 8B Reissued. September 1988. (July/August 1976).

"Guide Specifications for Brick Masonry, Part V Mortar and Grout." 11E Revised. September 1991.

"Bonds and Patterns in Brickwork." 30 Reissued. September 1988.

Useful Addresses

Brick Institute of America
11490 Commerce Park Drive
Reston, VA 22091

National Lime Association
200 N. Glebe Road, Suite 800
Arlington, VA 22203

Portland Cement Association
5420 Old Orchard Road
Skokie, IL 60077

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Washington, D.C. October, 1998

Home page logo: Soft mortar for repointing. Photo: John P. Speweik.

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[Questions](#)

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Exhibit C

Preservation Brief 6 Dangers of Abrasive Cleaning to Historic Buildings

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PRESERVATION BRIEFS

6

Dangers of Abrasive Cleaning to Historic Buildings

Anne E. Grimmer

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Undamaged historic brick (above).
Sandblasted brick (below). Photo:
Courtesy, Illinois Historic Preservation
Agency.

“Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible.” —**The Secretary of the Interior's Standards for Rehabilitation.**

Abrasive cleaning methods are responsible for causing a great deal of damage to historic building materials. To prevent indiscriminate use of these potentially harmful techniques, this brief has been prepared to explain abrasive cleaning methods, how they can be physically and aesthetically destructive to historic building materials, and why they generally are not acceptable preservation treatments for historic structures. There are alternative, less harsh means of cleaning and removing paint and stains from historic buildings. However, careful testing should precede general cleaning to assure that the method selected will not have an adverse effect on the building materials. A historic building is irreplaceable, and should be cleaned using only the "gentlest means possible" to best preserve it.

What is Abrasive Cleaning?

Abrasive cleaning methods include all techniques that physically abrade the building surface to remove soils, discolorations or coatings. Such techniques involve the use of certain *materials* which impact or abrade the surface under pressure, or *abrasive tools and equipment*. Sand, because it is readily available, is probably the most commonly used type of grit material. However, any of the following materials may be substituted for sand, and all can be classified as abrasive substances: ground slag or volcanic ash, crushed (pulverized) walnut or almond shells, rice husks, ground corncobs, ground coconut shells, crushed eggshells, silica flour, synthetic particles, glass beads and micro-balloons. Even *water* under pressure can be an abrasive substance. Tools and equipment that are abrasive to historic building materials include wire

brushes, rotary wheels, power sanding disks and belt sanders.

The use of water in combination with grit may also be classified as an abrasive cleaning method. Depending on the manner in which it is applied, water may soften the impact of the grit, but water that is too highly pressurized can be very abrasive. There are basically two different methods which can be referred to as "wet grit," and it is important to differentiate between the two. One technique involves the addition of a stream of water to a regular sandblasting nozzle. This is done primarily to cut down dust, and has very little, if any, effect on reducing the aggressiveness, or cutting action of the grit particles. With the second technique, a very small amount of grit is added to a pressurized water stream. This method may be controlled by regulating the amount of grit fed into the water stream, as well as the pressure of the water.



Abrasive cleaning can cause permanent damage to historic fabric, such as this brick wall. Photo: NPS files.

Why Are Abrasive Cleaning Methods Used?

Usually, an abrasive cleaning method is selected as an expeditious means of quickly removing years of dirt accumulation, unsightly stains, or deteriorating building fabric or finishes, such as stucco or paint.



Brick molding next to the window has been severely abraded by sandblasting to remove paint. Photo: NPS files.

The fact that sandblasting is one of the best known and most readily available building cleaning treatments is probably the major reason for its frequent use.

Many mid-19th century brick buildings were painted immediately or soon after completion to protect poor quality brick or to imitate another material, such as stone. Sometimes brick buildings were painted in an effort to produce what was considered a more harmonious relationship between a building and its natural surroundings. By the 1870s, brick buildings were often left unpainted as mechanization in the brick industry brought a cheaper pressed brick and fashion decreed a sudden preference for dark colors. However, it was still customary to paint brick of poorer quality for the additional protection the paint afforded.

It is a common 20th century misconception that all historic masonry buildings were initially unpainted. If the intent of a modern restoration is to return a building to its original appearance, removal of the paint not only may be historically inaccurate, but also harmful. Many older buildings were painted or stuccoed at some point to correct recurring maintenance problems caused by faulty construction techniques, to hide alterations, or in an attempt to solve moisture problems. If this is the case, removal of paint or stucco may cause these problems to reoccur.

Another reason for paint removal, particularly in rehabilitation projects, is to give the building a "new image" in response to contemporary design trends and to attract investors or tenants. Thus, it is necessary to consider the purpose of the intended cleaning. While it is clearly important to remove unsightly stains, heavy encrustations of dirt, peeling paint or other surface coatings, it may not be equally desirable to remove paint from a building which originally was painted. Many historic buildings which show only a slight amount of soil or discoloration are much better left as they are.

A thin layer of soil is more often protective of the building fabric than it is harmful, and seldom detracts from the building's architectural and/or historic character. Too thorough cleaning of a historic building may not only sacrifice some of the building's character, but also, misguided cleaning efforts can cause a great deal of damage to historic building fabric. Unless there are stains, graffiti or dirt and pollution deposits which are destroying the building fabric, it is generally preferable to do as little cleaning as possible, or to repaint where necessary. It is important to remember that a historic building does not have to look as if it were newly constructed to be an attractive or successful restoration or rehabilitation project.

Problems of Abrasive Cleaning

The crux of the problem is that abrasive cleaning is just that--abrasive. An abrasively cleaned historic structure may be physically as well as aesthetically damaged. Abrasive methods "clean" by eroding dirt or paint, but at the same time they also tend to erode the surface of the building material. In this way, abrasive cleaning is destructive and causes irreversible harm to the historic building fabric. If the fabric is brick, abrasive methods remove the hard, outer protective surface, and therefore make the brick more susceptible to rapid weathering and deterioration.

Grit blasting may also increase the water permeability of a brick wall. The impact of the grit particles tends to erode the bond between the mortar and the brick, leaving cracks or enlarging existing cracks where water can enter. Some types of stone develop a protective patina or "quarry crust" parallel to the worked surface (created by the movement of moisture towards the outer edge), which also may be damaged by abrasive cleaning. The rate at which the material subsequently weathers depends on the quality of the inner surface that is exposed.

Abrasive cleaning can destroy, or substantially diminish, decorative detailing on buildings such as a molded brickwork or architectural terra-cotta, ornamental carving on wood or stone, and evidence of historic craft techniques, such as tool marks and other surface textures.

In addition, perfectly sound and/or "tooled" mortar joints can be worn away by abrasive techniques. This not only results in the loss of historic craft detailing but also requires repointing, a step involving considerable time, skill and expense, and which might not have been necessary had a gentler method been chosen. Erosion and pitting of the building material by abrasive cleaning creates a greater surface area on which dirt and pollutants collect. In this sense, the building fabric "attracts" more dirt, and will require more frequent cleaning in the future.

In addition to causing physical and aesthetic harm to the historic fabric, there are several adverse environmental effects of dry abrasive cleaning methods. Because of the friction caused by the abrasive medium hitting the building fabric, these techniques usually create a considerable amount of dust, which is unhealthy, particularly to the operators of the abrasive equipment. It further pollutes the environment around the job site, and deposits dust on neighboring buildings, parked vehicles and nearby trees and shrubbery. Some adjacent materials not intended for abrasive treatment such as wood or glass, may also be damaged because the equipment may be difficult to regulate.

Wet grit methods, while eliminating dust, deposit a messy slurry on the ground or other objects surrounding the base of the building. In colder climates where there is the threat of frost, any wet cleaning process applied to historic masonry structures must be done in warm weather, allowing ample time for the wall to dry out thoroughly before cold weather sets in. Water which remains and freezes in cracks and openings of the masonry surface eventually may lead to spalling. High-pressure wet cleaning may force an inordinate amount of water into the walls, affecting interior materials such as plaster or joist ends, as well as metal building components within the walls.

Variable Factors

The greatest problem in developing practical guidelines for cleaning any historic building is the large number of variable and unpredictable factors involved. Because these variables make each cleaning project unique, it is difficult to establish specific standards at this time. This is particularly true of abrasive cleaning methods because their inherent potential for causing damage is multiplied by the following factors:

- the type and condition of the material being cleaned
- the size and sharpness of the grit particles or the mechanical equipment
- the pressure with which the abrasive grit or equipment is applied to the building surface
- the skill and care of the operator, and
- the constancy of the pressure on all surfaces during the cleaning process.

Pressure: The damaging effects of most of the variable factors involved in abrasive cleaning are self evident. However, the matter of pressure requires further explanation. In cleaning specifications, pressure is generally abbreviated as "psi" (pounds per square inch), which technically refers to the "tip" pressure, or the amount of pressure at the nozzle of the blasting apparatus. Sometimes "psig," or pressure at the gauge (which may be many feet away, at the other end of the hose), is used in place of "psi." These terms are often incorrectly used interchangeably.

Despite the apparent care taken by most architects and building cleaning contractors to prepare specifications for pressure cleaning which will not cause harm to the delicate fabric of a historic building, it is very difficult to ensure that the same amount of pressure is applied to all parts of the building. For example, if the operator of the pressure equipment stands on the ground while cleaning a two-story structure, the amount of force reaching the first story will be greater than that hitting the second story, even if the operator stands on scaffolding or in a cherry picker, because of the "line drop" in the distance from the pressure source to the nozzle. Although technically it may be possible to prepare cleaning specifications with tight controls that would eliminate all but a small margin of error, it may not be easy to find professional cleaning firms willing to work under such restrictive conditions. The fact is that many professional building cleaning firms do not really understand the extreme delicacy of historic building fabric, and how it differs from modern construction materials. Consequently, they may accept building cleaning projects for which they have no experience.

The amount of pressure used in any kind of cleaning treatment which involves pressure, whether it is dry or wet grit, chemicals or just plain water, is crucial to the outcome of the cleaning project. Unfortunately, no standards have been established for determining the correct pressure for cleaning each of the many historic building materials which would not



On the left, grit blasting has obliterated the vertical tooling marks from granite, a very dense stone. Photo: NPS files.



Bronze statuary may be cleaned gently using crushed walnut shells.
Photo: NPS files.

cause harm. The considerable discrepancy between the way the building cleaning industry and architectural conservators define "high" and "low" pressure cleaning plays a significant role in the difficulty of creating standards.

Non-historic/Industrial: A representative of the building cleaning industry might consider "high" pressure water cleaning to be anything over 5,000 psi, or even as high as 10,000 to 15,000 psi! Water under this much pressure may be necessary to clean industrial structures or machinery, but would destroy most historic building materials. Industrial chemical cleaning commonly utilizes pressures between 1,000 and 2,500 psi.

Historic: By contrast, conscientious dry or wet abrasive cleaning of a historic structure would be conducted within the range of 20 to 100 psi at a range of 3 to 12 inches. Cleaning at this low pressure requires the use of a very fine 00 or 0 mesh grit forced through a nozzle with a 1/4-inch opening. A similar, even more delicate method being adopted by architectural conservators uses a micro-abrasive grit on small, hard-to-clean areas of carved, cut or molded ornament on a building facade. Originally developed by museum conservators for cleaning sculpture, this technique may employ glass beads, micro-balloons, or another type of micro-abrasive gently powered at

approximately 40 psi by a very small, almost pencil-like pressure instrument. Although a slightly larger pressure instrument may be used on historic buildings, this technique still has limited practical applicability on a large scale building cleaning project because of the cost and the relatively few technicians competent to handle the task. In general, architectural conservators have determined that only through very controlled conditions can most historic building material be abrasively cleaned of soil or paint without measurable damage to the surface or profile of the substrate.

Yet some professional cleaning companies which specialize in cleaning historic masonry buildings use chemicals and water at a pressure of approximately 1,500 psi, while other cleaning firms recommend lower pressures ranging from 200 to 800 psi for a similar project. An architectural conservator might decide, after testing, that some historic structures could be cleaned properly using a moderate pressure (200-600 psi), or even a high pressure (600-1800 psi) water rinse. However, cleaning historic buildings under such high pressure should be considered an exception rather than the rule, and would require *very careful* testing and supervision to assure that the historic surface materials could withstand the pressure without gouging, pitting or loosening.

These differences in the amount of pressure used by commercial or industrial building cleaners and architectural conservators point to one of the main problems in using abrasive means to clean historic buildings: misunderstanding of the potentially fragile nature of historic building materials. There is no one cleaning formula or pressure suitable for all situations. Decisions regarding the proper cleaning process for historic structures can be made only after careful analysis of the building fabric, and testing.

How Building Materials React to Abrasive Cleaning

Brick and Architectural Terra-cotta: Abrasive blasting does not affect all building materials to the same degree. Such techniques quite logically cause greater damage to softer and more porous materials, such as brick or architectural terra-cotta. When these materials are cleaned abrasively, the hard, outer layer (closest to the heat of the kiln) is eroded, leaving the soft, inner core exposed and susceptible to accelerated weathering. Glazed architectural terra-cotta and ceramic veneer have a baked on glaze which is also easily damaged by abrasive cleaning. Glazed architectural terra-cotta was designed for easy maintenance, and generally can be cleaned using detergent and water; but chemicals or steam may be needed to remove more persistent stains. Large areas of brick or architectural terra-cotta which have been painted are best left painted, or repainted if necessary.

Plaster and Stucco: Plaster and stucco are types of masonry finish materials that are softer than brick or terra-cotta; if treated abrasively these materials will simply disintegrate. Indeed, when plaster or stucco is treated abrasively it is usually with the intention of removing the plaster or stucco from whatever base material or substrate it is covering. Obviously, such abrasive techniques should not be applied to clean sound plaster or stuccoed walls, or decorative plaster wall surfaces.

Building Stones: Building stones are cut from the three main categories of natural rock: dense, igneous rock such as granite; sandy, sedimentary rock such as limestone or sandstone; and crystalline, metamorphic rock such as marble. As opposed to kiln-dried masonry materials such as brick and architectural terra-cotta, building stones are generally homogeneous in character at the time of a building's construction. However, as the stone is exposed to weathering and environmental pollutants, the surface may become friable, or may develop a protective skin or patina. These outer surfaces are very susceptible to damage by abrasive or improper chemical cleaning.

Building stones are frequently cut into ashlar blocks or "dressed" with tool marks that give the building surface a specific texture and contribute to its historic character as much as ornately carved decorative stonework. Such detailing is easily

damaged by abrasive cleaning techniques; the pattern of tooling or cutting is erased, and the crisp lines of moldings or carving are worn or pitted.

Occasionally, it may be possible to clean small areas of rough-cut granite, limestone or sandstone having a heavy dirt encrustation by using the "wet grit" method, whereby a small amount of abrasive material is injected into a controlled, pressurized water stream. However, this technique requires very careful supervision in order to prevent damage to the stone. Polished or honed marble or granite should never be treated abrasively, as the abrasion would remove the finish in much the way glass would be etched or "frosted" by such a process. It is generally preferable to underclean, as too strong a cleaning procedure will erode the stone, exposing a new and increased surface area to collect atmospheric moisture and dirt. Removing paint, stains or graffiti from most types of stone may be accomplished by a chemical treatment carefully selected to best handle the removal of the particular type of paint or stain without damaging the stone. (See section on the "Gentlest Means Possible.")



Very high-pressure water has scarred this granite.
Photo: NPS files.

Wood: Most types of wood used for buildings are soft, fibrous and porous, and are particularly susceptible to damage by abrasive cleaning. Because the summer wood between the lines of the grain is softer than the grain itself, it will be worn away by abrasive blasting or power tools, leaving an uneven surface with the grain raised and often frayed or "fuzzy." Once this has occurred, it is almost impossible to achieve a smooth surface again except by extensive hand sanding, which is expensive and will quickly negate any costs saved earlier by sandblasting. Such harsh cleaning treatment also obliterates historic tool marks, fine carving and detailing, which precludes its use on any interior or exterior woodwork which has been hand planed, milled or carved.

Metals: Like stone, metals are another group of building materials which vary considerably in hardness and durability. Softer metals which are used architecturally, such as tin, zinc, lead, copper or aluminum, generally should not be cleaned abrasively as the process deforms and destroys the original surface texture and appearance, as well as the acquired patina.



Decorative pressed metal interior or exterior features should not be cleaned abrasively. Photo: NPS files.

Much applied architectural metal work used on historic buildings--tin, zinc, lead and copper--is often quite thin and soft, and therefore susceptible to denting and pitting. Galvanized sheet metal is especially vulnerable, as abrasive treatment would wear away the protective galvanized layer.

In the late 19th and early 20th centuries, these metals were often cut, pressed or otherwise shaped from sheets of metal into a wide variety of practical uses such as roofs, gutters and flashing, and facade ornamentation such as cornices, friezes, dormers, panels, cupolas, oriel windows, etc. The architecture of the 1920s and 1930s made use of metals such as chrome, nickel alloys, aluminum and stainless steel in decorative exterior panels, window frames, and doorways. Harsh abrasive blasting would destroy the original surface finish of most of these metals, and would increase the possibility of corrosion.

However, conservation specialists are now employing a sensitive technique of glass bead peening to clean some of the harder metals, in particular large bronze outdoor sculpture. Very fine (75125 micron) glass beads are used at a low pressure of 60 to 80 psi. Because these glass beads are completely spherical, there are no sharp edges to cut the surface of the metal. After cleaning, these

statues undergo a lengthy process of polishing. Coatings are applied which protect the surface from corrosion, but they must be renewed every 3 to 5 years. A similarly delicate cleaning technique employing glass beads has been used in Europe to clean historic masonry structures without causing damage. But at this time the process has not been tested sufficiently in the United States to recommend it as a building conservation measure.

Sometimes a very fine smooth sand is used at a low pressure to clean or remove paint and corrosion from copper flashing and other metal building components. Restoration architects recently found that a mixture of crushed walnut shells and copper slag at a pressure of approximately 200 psi was the only way to remove corrosion successfully from a mid-19th century terne-coated iron roof. Metal cleaned in this manner must be painted immediately to prevent rapid recurrence of corrosion. It is thought that these methods "work harden" the surface by compressing the outer layer, and actually may be good for the surface of the metal. But the extremely complex nature and the time required by such processes make it very expensive and impractical for large-scale use at this time.

Cast and wrought iron architectural elements may be gently sandblasted or abrasively cleaned using a wire brush to remove layers of paint, rust and corrosion. Sandblasting was, in fact, developed originally as an efficient maintenance procedure for engineering and industrial structures and heavy machinery--iron and steel bridges, machine tool frames, engine frames, and railroad rolling stock--in order to clean and prepare them for repainting. Because iron is hard, its surface, which is naturally somewhat uneven, will not be noticeably damaged by controlled abrasion. Such treatment will,

however, result in a small amount of pitting. But this slight abrasion creates a good surface for paint, since the iron must be repainted immediately to prevent corrosion. Any abrasive cleaning of metal building components will also remove the caulking from joints and around other openings. Such areas must be recaulked quickly to prevent moisture from entering and rusting the metal, or causing deterioration of other building fabric inside the structure.

When is Abrasive Cleaning Permissible?

For the most part, abrasive cleaning is destructive to historic building materials. A limited number of special cases have been explained when it may be appropriate, if supervised by a skilled conservator, to use a delicate abrasive technique on some historic building materials. The type of "wet grit" cleaning which involves a small amount of grit injected into a stream of low pressure water may be used on small areas of stone masonry (i.e., rough cut limestone, sandstone or unpolished granite), where milder cleaning methods have not been totally successful in removing harmful deposits of dirt and pollutants. Such areas may include stone window sills, the tops of cornices or column capitals, or other detailed areas of the facade.

This is still an abrasive technique, and without proper caution in handling, it can be *just as harmful to the building surface as any other abrasive cleaning method*. Thus, the decision to use this type of "wet grit" process should be made only after consultation with an experienced building conservator. *Remember that it is very time consuming and expensive to use any abrasive technique on a historic building in such a manner that it does not cause harm to the often fragile and friable building materials.*

At this time, and only under certain circumstances, abrasive cleaning methods may be used in the rehabilitation of interior spaces of warehouse or industrial buildings for contemporary uses.

Interior spaces of factories or warehouse structures in which the masonry or plaster surfaces do not have significant design, detailing, tooling or finish, and in which wooden architectural features are not finished, molded, beaded or worked by hand, may be cleaned abrasively in order to remove layers of paint and industrial discolorations such as smoke, soot, etc. It is expected after such treatment that brick surfaces will be rough and pitted, and wood will be somewhat frayed or "fuzzy" with raised wood grain. These nonsignificant surfaces will be damaged and have a roughened texture, but because they are interior elements, they will not be subject to further deterioration caused by weathering.

Historic Interiors That Should Not Be Cleaned Abrasively

Those instances (generally industrial and some commercial properties), when it may be acceptable to use an abrasive treatment on the interior of historic structures have been described. But for the majority of historic buildings, the Secretary of the Interior's *Guidelines for Rehabilitation* do not recommend "changing the texture of exposed wooden architectural features (including structural members) and masonry surfaces through sandblasting or use of other abrasive techniques to remove paint, discolorations and plaster.

Thus, it is not acceptable to clean abrasively interiors of historic residential and commercial properties which have *finished* interior spaces featuring milled woodwork such as doors, window and door moldings, wainscoting, stair balustrades and mantelpieces. Even the most modest historic house interior, although it may not feature elaborate detailing, contains plaster and woodwork that is architecturally significant to the original design and function of the house. Abrasive cleaning of such an interior would be destructive to the historic integrity of the building.

Abrasive cleaning is also impractical. Rough surfaces of abrasively cleaned wooden elements are hard to keep clean. It is also difficult to seal, paint or maintain these surfaces which can be splintery and a problem to the building's occupants. The force of abrasive blasting may cause grit particles to lodge in cracks of wooden elements, which will be a nuisance as the grit is loosened by vibrations and gradually sifts out. Removal of plaster will reduce the thermal and insulating value of the



Cast iron may be abrasively cleaned, but must be painted immediately to prevent rust. Photo: NPS files.



Industrial interiors that are not finely milled may be abrasively cleaned, in some instances. Photo: NPS files.



Decorative wood exterior or interior features should not be cleaned abrasively. Photo: NPS files.

walls. Interior brick is usually softer than exterior brick, and generally of a poorer quality. Removing surface plaster from such brick by abrasive means often exposes gaping mortar joints and mismatched or repaired brickwork which was never intended to show. The resulting bare brick wall may require repointing, often difficult to match. It also may be necessary to apply a transparent surface coating (or sealer) in order to prevent the mortar and brick from "dusting." However, a sealer may not only change the color of the brick, but may also compound any existing moisture problems by restricting the normal evaporation of water vapor from the masonry surface.

"Gentlest Means Possible"

There are alternative means of removing dirt, stains and paint from historic building surfaces that can be recommended as more efficient and less destructive than abrasive techniques. The "gentlest means possible" of removing dirt from a building surface can be achieved by using a low-pressure water wash, scrubbing areas of more persistent grime with a natural bristle (never metal) brush. Steam cleaning can also be used effectively to clean some historic building fabric. Low-pressure water or steam will soften the dirt and cause the deposits to rise to the surface, where they can be washed away.

A third cleaning technique which may be recommended to remove dirt, as well as stains, graffiti or paint, involves the use of commercially available chemical cleaners or paint removers, which, when applied to masonry, loosen or dissolve the dirt or stains. These cleaning agents may be used in combination with water or steam, followed by a clear water wash to remove the residue of dirt and the chemical cleaners from the masonry. A natural bristle brush may also facilitate this type of chemically assisted cleaning, particularly in areas of heavy dirt deposits or stains, and a wooden scraper can be useful in removing thick encrustations of soot. A limewash or absorbent talc, whitening or clay poultice with a solvent can be used effectively to draw out salts or stains from the surface of the selected areas of a building facade. It is almost impossible to remove paint from masonry surfaces without causing some damage to the masonry, and it is best to leave the surfaces as they are or repaint them if necessary.

Some physicists are experimenting with the use of pulsed laser beams and xenon flash lamps for cleaning historic masonry surfaces. At this time it is a slow, expensive cleaning method, but its initial success indicates that it may have an increasingly important role in the future.

There are many chemical paint removers which, when applied to painted wood, soften and dissolve the paint so that it can be scraped off by hand. Peeling paint can be removed from wood by hand scraping and sanding. Particularly thick layers of paint may be softened with a heat gun or heat plate, providing appropriate precautions are taken, and the paint film scraped off by hand. Too much heat applied to the same spot can burn the wood, and the fumes caused by burning paint are dangerous to inhale, and can be explosive. Furthermore, the hot air from heat guns can start fires in the building cavity. Thus, adequate ventilation is important when using a heat gun or heat plate, as well as when using a chemical stripper. A torch or open flame should never be used.

Preparations for Cleaning: It cannot be overemphasized that all of these cleaning methods must be approached with caution. When using any of these procedures which involve water or other liquid cleaning agents on masonry, it is imperative that all openings be tightly covered, and all cracks or joints be well pointed in order to avoid the danger of water penetrating the building's facade, a circumstance which might result in serious moisture related problems such as efflorescence and/or subflorescence. Any time water is used on masonry as a cleaning agent, either in its pure state or in combination with chemical cleaners, it is very important that the work be done in warm weather when there is no danger of frost for several months. Otherwise water which has penetrated the masonry may freeze, eventually causing the surface of the building to crack and spall, which may create another conservation problem more serious to the health of the building than dirt.

Each kind of masonry has a unique composition and reacts differently with various chemical cleaning substances. Water and/or chemicals may interact with minerals in stone and cause new types of stains to leach out to the surface immediately, or more gradually in a delayed reaction. What may be a safe and effective cleaner for certain stain on one type of stone, may leave unattractive discolorations on another stone, or totally dissolve a third type.

Testing: Cleaning historic building materials, particularly masonry, is a technically complex subject, and thus, should never be done without expert consultation and testing. No cleaning project should be undertaken without first applying the intended cleaning agent to a representative test patch area in an inconspicuous location on the building surface. The test patch or patches should be allowed to weather for a period of time, preferably through a complete seasonal cycle, in order to determine that the cleaned area will not be adversely affected by wet or freezing weather or any by-products of the cleaning process.

Mitigating the Effects of Abrasive Cleaning

There are certain restoration measures which can be adopted to help preserve a historic building exterior which has been damaged by abrasive methods. Wood that has been sandblasted will exhibit a frayed or "fuzzed" surface, or a harder wood

will have an exaggerated raised grain. The only way to remove this rough surface or to smooth the grain is by laborious sanding. Sandblasted wood, unless it has been extensively sanded, serves as a dustcatcher, will weather faster, and will present a continuing and ever worsening maintenance problem. Such wood, after sanding, should be painted or given a clear surface coating to protect the wood, and allow for somewhat easier maintenance.

There are few successful preservative treatments that may be applied to grit-blasted exterior masonry. Harder, denser stone may have suffered only a loss of crisp edges or tool marks, or other indications of craft technique. If the stone has a compact and uniform composition, it should continue to weather with little additional deterioration. But some types of sandstone, marble and limestone will weather at an accelerated rate once their protective "quarry crust" or patina has been removed.

Softer types of masonry, particularly brick and architectural terra-cotta, are the most likely to require some remedial treatment if they have been abrasively cleaned. Old brick, being essentially a soft, baked clay product, is greatly susceptible to increased deterioration when its hard, outer skin is removed through abrasive techniques. This problem can be minimized by painting the brick. An alternative is to treat it with a clear sealer or surface coating but this will give the masonry a glossy, or shiny look. It is usually preferable to paint the brick rather than to apply a transparent sealer since sealers reduce the transpiration of moisture, allowing salts to crystallize as subflorescence that eventually spalls the brick. If a brick surface has been so extensively damaged by abrasive cleaning and weathering that spalling has already begun, it may be necessary to cover the walls with stucco, if it will adhere.

Of course, the application of paint, a clear surface coating (sealer), or stucco to deteriorating masonry means that the historical appearance will be sacrificed in an attempt to conserve the historic building materials. However, the original color and texture will have been changed already by the abrasive treatment. At this point it is more important to try to preserve the brick, and there is little choice but to protect it from "dusting" or spalling too rapidly. As a last resort, in the case of severely spalling brick, there may be no option but to replace the brick--a difficult, expensive (particularly if custom-made reproduction brick is used), and lengthy process. As described earlier, sandblasted interior brick work, while not subject to change of weather, may require the application of a transparent surface coating or painting as a maintenance procedure to contain loose mortar and brick dust. (See [Preservation Briefs No. 1](#) for a more thorough discussion of coatings.)

Metals, other than cast or wrought iron, that have been pitted and dented by harsh abrasive blasting usually cannot be smoothed out. Although fillers may be satisfactory for smoothing a painted surface, exposed metal that has been damaged usually will have to be replaced.

Summary and References

Sandblasting or other abrasive methods of cleaning or paint removal are by their nature destructive to historic building materials and should not be used on historic buildings except in a few well-monitored instances. There are exceptions when certain types of abrasive cleaning may be permissible, but only if conducted by a trained conservator, and if cleaning is necessary for the preservation of the historic structure.

There is no one formula that will be suitable for cleaning all historic building surfaces. Although there are many commercial cleaning products and methods available, it is impossible to state definitively which of these will be the most effective without causing harm to the building fabric. It is often difficult to identify ingredients or their proportions contained in cleaning products; consequently it is hard to predict how a product will react to the building materials to be cleaned. Similar uncertainties affect the outcome of other cleaning methods as they are applied to historic building materials. Further advances in understanding the complex nature of the many variables of the cleaning techniques may someday provide a better and simpler solution to the problems. But until that time, the process of cleaning historic buildings must be approached with caution through trial and error.

It is important to remember that historic building materials are neither indestructible, nor are they renewable. They must be treated in a responsible manner, which may mean little or no cleaning at all if they are to be preserved for future generations to enjoy. If it is in the best interest of the building to clean it, then it should be done "using the gentlest means possible."

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June 1979

Reading List

Ashurst, John. *Cleaning Stone and Brick*. Technical Pamphlet 4. London: Society for the Protection of Ancient Buildings. 1977.

Asmus, John F. "Light Cleaning: Laser Technology for Surface Preparation in the Arts." *Technology and Conservation*. 3:3 (Fall 1978), pp. 14-18.

"The Bare-Brick Mistake." *The Old House Journal*. I:2 (November 1973). p 2.

Brick Institute of America. Colorless Coatings for Brick Masonry. *Technical Notes on Brick Construction*. Number 7E (September/October 1976).

Gilder, Cornelia Brooke. *Property Owner's Guide to the Maintenance and Repair of Stone Buildings*. Technical Series/ No. 5. Albany, New York: The Preservation League of New York State, 1977.

Prudon, Theodore H.M. "The Case Against Removing Paint from Brick Masonry." *The Old House Journal*, III:2 (February 1975). pp. 6-7.

_____. "Removing Stains from Masonry." *The Old House Journal*. V:5 (May 1977), pp. 58-59.

Stambolov, T. and J.R.J. Van Asperen de Boer. *The Deterioration and Conservation of Porous Building Material in Monuments: A Review of the Literature*. Second enlarged edition. Rome: International Centre for Conservation, 1976.

Weiss, Norman R. "Cleaning of Building Exteriors: Problems and Procedures of Dirt Removal." *Technology and Conservation*, 2/76 (Fall 1976), pp. 8-13.

_____. *Exterior Cleaning of Historic Masonry Buildings*. Draft. Washington, D.C.: Office of Archeology and Historic Preservation, Heritage Conservation and Recreation Service, U.S. Department of the Interior, 1976.

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Exhibit D

Preservation Brief 32

Assessing Cleaning and Water Repellent Treatments for historic Masonry Buildings

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Technical Preservation Services



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Some of the web versions of the Preservation Briefs differ somewhat from the printed versions. Many illustrations are new and in color; Captions are simplified and some complex charts are omitted. To order hard copies of the Briefs, see [Printed Publications](#).

PRESERVATION BRIEFS

32

Making Historic Properties Accessible

Thomas C. Jester and Sharon C. Park, AIA

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[Making Historic Landscapes Accessible](#)

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Accessible historic building.
Photo: NPS files.

Historically, most buildings and landscapes were not designed to be readily accessible for people with disabilities. In recent years, however, emphasis has been placed on preserving historically significant properties, and on making these properties-and the activities within them-more accessible to people with disabilities. With the passage of the Americans with Disabilities Act in 1990, access to properties open to the public is now a civil right.



A significant entrance may be difficult to modify. Although a special challenge, sensitive changes can almost always be made to provide access while preserving the unique historic character. Photo: NPS files.

This Preservation Brief introduces the complex issue of providing accessibility at historic properties, and underscores the need to balance accessibility and historic preservation. It provides guidance on making historic properties accessible while preserving their historic character; the Brief also provides examples to show that independent physical accessibility at historic properties can be achieved with careful planning, consultation, and sensitive design. While the Brief focuses primarily on making buildings and their sites accessible, it also includes a section on historic landscapes. The Brief will assist historic property owners, design professionals, and administrators in evaluating their historic properties so that the highest level of accessibility can be provided while minimizing changes to historic materials and features. Because many projects encompassing accessibility work are complex, it is advisable to consult with experts in the fields of historic preservation and accessibility before proceeding with permanent physical changes to historic properties.

Modifications to historic properties to increase accessibility may be as simple as a small, inexpensive ramp to overcome one entrance step, or may involve changes to exterior and interior features. The Brief does not provide a detailed explanation of local or State accessibility laws as they vary from jurisdiction to jurisdiction. A concise explanation of several federal accessibility laws is included below.

Planning Accessibility Modifications

Historic properties are distinguished by features, materials, spaces, and spatial relationships that contribute to their historic character. Often these elements, such as steep terrain, monumental steps, narrow or heavy doors, decorative ornamental hardware, and narrow pathways and corridors, pose barriers to persons with disabilities, particularly to wheelchair users.

A three-step approach is recommended to identify and implement accessibility modifications that will protect the integrity and historic character of historic properties:

1. Review the historical significance of the property and identify character-defining features;
2. Assess the property's existing and required level of accessibility; and
3. Evaluate accessibility options within a preservation context.

1. Review the Historical Significance

If the property has been designated as historic (properties that are listed in, or eligible for listing in the National Register of Historic Places, or designated under State or local law), the property's nomination file should be reviewed to learn about its significance. Local preservation commissions and State Historic Preservation Offices can usually provide copies of the nomination file and are also resources for additional information and assistance. Review of the written documentation should always be supplemented with a physical investigation to identify which character defining features and spaces must be protected whenever any changes are anticipated. If the level of documentation for a property's significance is limited, it may be necessary to have a preservation professional identify specific historic features, materials, and spaces that should be protected.

For most historic properties, the construction materials, the form and style of the property, the principal elevations, the major architectural or landscape features, and the principal public spaces constitute some of the elements that should be preserved. Every effort should be made to minimize damage to the materials and features that convey a property's historical significance when making modifications for accessibility. Very small or highly significant properties that have never been altered may be extremely difficult to modify.

Secondary spaces and finishes and features that may be less important to the historic character should also be identified; these may generally be altered without jeopardizing the historical significance of a property. Nonsignificant spaces, secondary pathways, later additions, previously altered areas, utilitarian spaces, and service areas can usually be modified without threatening or destroying a property's historical significance.

2. Assess the Property's Existing and Required Level of Accessibility

A building survey or assessment will provide a thorough evaluation of a property's accessibility. Most surveys identify accessibility barriers in the following areas: building and site entrances; surface textures, widths and slopes of walkways; parking; grade changes; size, weight and configuration of doorways; interior corridors and path of travel restrictions; elevators; and public toilets and amenities. Simple audits can be completed by property owners using readily available checklists (See Further Reading). Accessibility specialists can be hired to assess barriers in more complex properties, especially those with multiple buildings, steep terrain, or interpretive programs. Persons with disabilities can be particularly helpful in assessing specific barriers.

All applicable accessibility requirements—local codes, State codes and federal laws—should be reviewed carefully before undertaking any accessibility modification. Since many States and localities have their own accessibility regulations and codes (each with their own requirements for dimensions and technical requirements), owners should use the most stringent accessibility requirements when implementing modifications. The Americans with Disability Act Accessibility Guidelines (ADAAG) is the document that should be consulted when complying with the Americans with Disabilities Act (ADA) requirements.

3. Identify and Evaluate Accessibility Options within a Preservation Context

Once a property's significant materials and features have been identified, and existing and required levels of accessibility have been established, solutions can be developed. Solutions should provide the greatest amount of accessibility without threatening or destroying those materials and features that make a property significant. Modifications may usually be phased over time as funds are available, and interim solutions can be considered until more permanent solutions are implemented. A team comprised of persons with disabilities, accessibility and historic preservation professionals, and building inspectors should be consulted as accessibility solutions are developed.

Modifications to improve accessibility should generally be based on the following priorities:



This accessibility ramp is compatible with the historic building in scale and materials. Photo: William Smith.

1. Making the main or a prominent public entrance and primary public spaces accessible, including a path to the entrance;
2. Providing access to goods, services, and programs;
3. Providing accessible restroom facilities; and,
4. Creating access to amenities and secondary spaces.



The ramp's scale and materials are inconsistent with the historic character of the building. Photo: NPS files.

All proposed changes should be evaluated for conformance with the Secretary of the Interior's "Standards for the Treatment of Historic Properties," which were created for property owners to guide preservation work. These Standards stress the importance of retaining and protecting the materials and features that convey a property's historical significance. Thus, when new features are incorporated for accessibility, historic materials and features should be retained whenever possible. Accessibility modifications should be in scale with the historic property, visually compatible, and, whenever possible, reversible. Reversible means that if the new feature were removed at a later date, the essential form and integrity of the property would be unimpaired. The design of new features should also be differentiated from the design of the historic property so that the evolution of the property is evident.

In general, when historic properties are altered, they should be made as accessible as possible. However, if an owner or a project team believes that certain modifications would threaten or destroy the significance of the property, the State Historic Preservation Officer should be consulted to determine whether or not any special accessibility provisions may be used. Special accessibility provisions for historic properties will vary depending on the

applicable accessibility requirements.

In some cases, programmatic access may be the only option for extremely small or unaltered historic properties, such as a two-story house museum with no internal elevator. Programmatic access for historic properties refers to alternative methods of providing services, information, and experiences when physical access cannot be provided. It may mean offering an audio-visual program showing an inaccessible upper floor of a historic house museum, providing interpretive panels from a vista at an inaccessible terraced garden, or creating a tactile model of a historic monument for people with visual impairments.

Accessibility Solutions

The goal in selecting appropriate solutions for specific historic properties is to provide a high level of accessibility without compromising significant features or the overall character of the property. The following sections describe accessibility solutions and offer guidance on specific historic property components, namely the building site, entrances, interiors, landscapes, amenities, and new additions. Several solutions are discussed in each section, referencing dimensions and technical requirements from the ADA's accessibility guidelines, ADAAG. State and local requirements, however, may differ from the ADA requirements. Before making any modification owners should be aware of all applicable accessibility requirements.

The Building Site

An accessible route from a parking lot, sidewalk, and public street to the entrance of a historic building or facility is essential. An accessible route, to the maximum extent possible, should be the circulation route used by the general public. Critical elements of accessible routes are their widths, slopes, cross slopes, and surface texture. Each of these route elements must be appropriately designed so that the route can be used by everyone, including people with disabilities.



The significant building site is now accessible to people with disabilities (note steps in front of ramp). Photo: NPS files.

The distance between the arrival and destination points should also be as short as possible. Sites containing designed landscapes should be carefully evaluated before making accessibility modifications. Historic landscapes are described in greater detail below.

Providing Convenient Parking

If parking is provided, it should be as convenient as possible for people with disabilities. Specially designated parking can often be created to improve accessibility. Modifications to parking configurations and pathways should not alter significant landscape features.

Creating an Accessible Route

The route or path through a site to a historic building's entrance should be wide enough, generally at least 3 feet (91 cm), to accommodate visitors with disabilities and must be appropriately graded with a stable, firm, and slip-resistant surface. Existing paths should be modified to meet these requirements whenever possible as long as doing so would not threaten or destroy significant materials and features.

Existing surfaces can often be stabilized by providing a new base and resetting the paving materials, or by modifying the path surface. In some situations it may be appropriate to create a new path through an inaccessible area. At large properties, it may be possible to regrade a slope to less than 1:20 (5%), or to introduce one or more carefully planned ramps. Clear directional signs should mark the path from arrival to destination.

Entrances



The historic threshold was made accessible with a 1/2" wood bevel. Photo: NPS files.

Whenever possible, access to historic buildings should be through a primary public entrance. In historic buildings, if this cannot be achieved without permanent damage to character-defining features, at least one entrance used by the public should be made accessible. If the accessible entrance is not the primary public entrance, directional signs should direct visitors to the accessible entrance. A rear or service entrance should be avoided as the only mean of entering a building.

Creating an accessible entrance usually involves overcoming a change in elevation. Steps, landings, doors, and thresholds, all part of the entrance, often pose barriers for persons with disabilities. To preserve the integrity of these features, a number of solutions are available to increase accessibility. Typical solutions include regrading, incorporating ramps, installing wheelchair lifts, creating new entrances, and modifying doors, hardware, and thresholds.

Regrading an Entrance

In some cases, when the entrance steps and landscape features are not highly significant, it may be possible to regrade to provide a smooth entrance into a building. If the existing steps are historic masonry, they should be buried, whenever possible, and not removed.

Incorporating Ramps

Permanent ramps are perhaps the most common means to make an entrance accessible. As a new feature, ramps should be carefully designed and appropriately located to preserve a property's historic character.

Ramps should be located at public entrances used by everyone whenever possible, preferably where there is minimal change in grade. Ramps should also be located to minimize the loss of historic features at the connection points-porch railings, steps, and windows-and should preserve the overall historic setting and character of the property. Larger buildings may have below grade areas that can accommodate a ramp down to an entrance. Below grade entrances can be considered if the ramp leads to a publicly used interior, such as an auditorium, or if the building is serviced by a public elevator. Ramps can often be incorporated behind historic features, such as cheek-walls or railings, to minimize the visual effect.

The steepest allowable slope for a ramp is usually 1:12 (8%), but gentler slopes should be used whenever possible to accommodate people with limited strength. Greater changes in elevation require larger and longer ramps to meet accessibility scoping provisions and may require an intermediate landing. Most codes allow a slightly steeper ramp for historic buildings to overcome one step.

Ramps can be faced with a variety of materials, including wood, brick, and stone. Often the type and quality of the materials determines how compatible a ramp design will be with a historic property. Unpainted pressure-treated wood should not be used to construct ramps because it usually appears temporary and is not visually compatible with most historic properties.

Railings should be simple in design, distinguishable from other historic features, and should extend one foot beyond the sloped area.

Ramp landings must be large enough for wheelchair users, usually at least 5 feet by 5 feet (152.5 cm by 152.5 cm), and the top landing must be at the level of the door threshold. It may be possible to reset steps by creating a ramp to accommodate minor level changes and to meet the threshold without significantly altering a property's historic character. If a building's existing landing is not wide or deep enough to accommodate a ramp, it may be necessary to modify the entry to create a wider landing. Long ramps, such as switchbacks, require intermediate landings, and all ramps should be detailed with an appropriate edge and railing for wheelchair users and visually impaired individuals.



A new elevator entrance was provided next to the stairs to provide universal access to the services inside. Photo: Courtesy, GSA.

Temporary or portable ramps are usually constructed of light-weight materials and, thus, are rarely safe or visually compatible with historic properties. Moreover, portable ramps are often stored until needed and, therefore, do not meet accessibility requirements for independent access. Temporary and portable ramps, however, may be an acceptable interim solution to improve accessibility until a permanent solution can be implemented.

Installing Wheelchair Lifts

Platform lifts and inclined stair lifts, both of which accommodate only one person, can be used to overcome changes of elevation ranging from three to 10 feet (.9 m-3 m) in height. However, many States have restrictions on the use of wheelchair lifts, so all applicable codes should be reviewed carefully before installing one. Inclined stair lifts, which carry a wheelchair on a platform up a flight of stairs, may be employed selectively. They tend to be visually intrusive, although they are relatively reversible. Platform lifts can be used when there is inadequate space for a ramp. However, such lifts should be installed in unobtrusive locations and under cover to minimize maintenance if at all possible. A similar, but more expensive platform lift has a retracting railing that lowers into the ground, minimizing the visual effect to historic properties. Mechanical lifts have drawbacks at historic properties with high public visitation because their capacity is limited, they sometimes cannot be operated independently, and they require frequent maintenance.

Considering a New Entrance

When it is not possible to modify an existing entrance, it may be possible to develop a new entrance by creating an entirely new opening in an appropriate location, or by using a secondary window for an opening. This solution should only be considered after exhausting all possibilities for modifying existing entrances.

Retrofitting Doors

Historic doors generally should not be replaced, nor should door frames on the primary elevation be widened, as this may alter an important feature of a historic design. However, if a building's historic doors have been removed, there may be greater latitude in designing a compatible new entrance. Most accessibility standards require at least a 32" (82 cm) clear opening with manageable door opening pressures. The most desirable preservation solution to improve accessibility is retaining historic doors and upgrading the door pressure with one of several devices. Automatic door openers (operated by push buttons, mats, or electronic eyes) and power-assisted door openers can eliminate or reduce door pressures that are accessibility barriers, and make single or double-leaf doors fully operational.

Adapting Door Hardware

If a door opening is within an inch or two of meeting the 32" (81 cm) clear opening requirement, it may be possible to replace the standard hinges with off-set hinges to increase the size of the door opening as much as 1 Ω" (3.8 cm). Historic hardware can be retained in place, or adapted with the addition of an automatic opener, of which there are several types. Door hardware can also be retrofitted to reduce door pressures. For example, friction hinges can be retrofitted with ball-bearing inserts, and door closers can be rethreaded to reduce the door pressure.

Altering Door Thresholds

A door threshold that exceeds the allowable height, generally 1/2" (1.3 cm), can be altered or removed with one that meets applicable accessibility requirements. If the threshold is deemed to be significant, a bevel can be added on each side to reduce its height. Another solution is to replace the threshold with one that meets applicable accessibility requirements and is visually compatible with the historic entrance.

Readily Achievable Accessibility Options

Many accessibility solutions can be implemented easily and inexpensively without destroying the significance of historic properties. While it may not be possible to undertake all of the modifications listed below, each change will improve accessibility.

Sites and Entrances

- Creating a designated parking space.
- Installing ramps.
- Making curb cuts.

Interiors

- Repositioning shelves.
- Rearranging tables, displays, and furniture.



This door handle has been retrofitted to meet ADA requirements. Photo: NPS files.

- Repositioning telephones.
- Adding raised markings on elevator control buttons.
- Installing flashing alarm lights.
- Installing offset hinges to widen doorways.
- Installing or adding accessible door hardware.
- Adding an accessible water fountain, or providing a paper cup dispenser at an inaccessible water fountain.

Restrooms

- Installing grab bars in toilet stalls.
- Rearranging toilet partitions to increase maneuvering space.
- Insulating lavatory pipes under sinks to prevent burns.
- Installing a higher toilet seat.
- Installing a full-length bathroom mirror.
- Repositioning the paper towel dispenser.



A retractable lift for this historic building foyer was created using "like" materials. Photo: NPS files.

Moving Through Historic Interiors

Persons with disabilities should have independent access to all public areas and facilities inside historic buildings. The extent to which a historic interior can be modified depends on the significance of its materials, plan, spaces, features, and finishes. Primary spaces are often more difficult to modify without changing their character. Secondary spaces may generally be changed without compromising a building's historic character. Signs should clearly mark the route to accessible restrooms, telephones, and other accessible areas.

Installing Ramps and Wheelchair Lifts

If space permits, ramps and wheelchair lifts can also be used to increase accessibility inside buildings. However, some States and localities restrict interior uses of wheelchair lifts for life-safety reasons. Care should be taken to install these new features where they can be readily accessed. Ramps and wheelchair lifts are described below.

Upgrading Elevators

Elevators are an efficient means of providing accessibility between floors. Some buildings have existing historic elevators that are not adequately accessible for persons with disabilities because of their size, location, or detailing, but they may also contribute to the historical significance of a building. Significant historic elevators can usually be upgraded to improve accessibility. Control panels can be modified with a "wand" on a cord to make the control panel accessible, and timing devices can usually be adjusted.

Retrofitting Door Knobs

Historic door knobs and other hardware may be difficult to grip and turn. In recent years, lever-handles have been developed to replace door knobs. Other lever-handle devices can be added to existing hardware. If it is not possible or appropriate to retrofit existing door knobs, doors can be left open during operating hours (unless doing so would violate life safety codes), and power-assisted door openers can be installed. It may only be necessary to retrofit specific doorknobs to create an accessible path of travel and accessible restrooms.

Modifying Interior Stairs

Stairs are the primary barriers for many people with disabilities. However, there are some ways to modify stairs to assist people who are able to navigate them. It may be appropriate to add hand railings if none exist. Railings should be 1 ½" (3.8 cm) in diameter and return to the wall so straps and bags do not catch. Color-contrasting, slip-resistant strips will help people with visual impairments. Finally, beveled or closed risers are recommended unless the stairs are highly significant, because open risers catch feet.

Building Amenities

Some amenities in historic buildings, such as restrooms, seating, telephones, drinking fountains, counters, may contribute to a building's historic character. They will often require modification to improve their use by persons with disabilities. In many cases, supplementing existing amenities, rather than changing or removing them, will increase access and minimize changes to historic features and materials.

Upgrading Restrooms

Restrooms may have historic fixtures such as sinks, urinals, or marble partitions that can be retained in the process of making modifications. For example, larger restrooms can sometimes be reconfigured by relocating or combining partitions to create an accessible toilet stall. Other changes to consider are adding grab bars around toilets, covering hot water pipes under sinks with insulation to prevent burns, and providing a sink, mirror, and paper dispenser at a height suitable for wheelchair users. A unisex restroom may be created if it is technically infeasible to create two fully accessible restrooms, or if doing so would threaten or destroy the significance of the building. It is important to remember that restroom fixtures, such as sinks, urinals, and partitions, may be historic, and therefore, should be preserved whenever possible.

Modifying Other Amenities

Other amenities inside historic buildings may require modification. Seating in a theater, for example, can be made accessible by removing some seats in several areas. New seating that is accessible can also be added at the end of existing rows, either with or without a level floor surface. Readily removable seats may be installed in wheelchair spaces when the spaces are not required to accommodate wheelchair users. Historic water fountains can be retained and new, two-tiered fountains installed if space permits. If public telephones are provided, it may be necessary to install at least a Text Telephone (TT), also known as a Telecommunication Device for the Deaf (TDD). Historic service counters commonly found in banks, theaters, and hotels generally should not be altered. It is preferable to add an accessible counter on the end of a historic counter if feasible. Modified or new counters should not exceed 36" (91.5 cm) in height.

Considering a New Addition as an Accessibility Solution

Many new additions are constructed specifically to incorporate modern amenities such as elevators, restrooms, fire stairs, and new mechanical equipment. These new additions often create opportunities to incorporate access for people with disabilities. It may be possible, for example, to create an accessible entrance, path to public levels via a ramp, lift, or elevator. However, a new addition has the potential to change a historic property's appearance and destroy significant building and landscape features. Thus, all new additions should be compatible with the size, scale, and proportions of historic features and materials that characterize a property.

New additions should be carefully located to minimize connection points with the historic building, such that if the addition were to be removed in the future, the essential form and integrity of the building would remain intact. On the other hand, new additions should also be conveniently located near parking that is connected to an accessible route for people with disabilities. As new additions are incorporated, care should be taken to protect significant landscape features and archeological resources. Finally, the design for any new addition should be differentiated from the historic design so that the property's evolution over time is clear. New additions frequently make it possible to increase accessibility, while simultaneously reducing the level of change to historic features, materials, and spaces.

Making Historic Landscapes Accessible

To successfully incorporate access into historic landscapes, the planning process is similar to that of other historic properties. Careful research and inventory should be undertaken to determine which materials and features convey the landscape's historical significance. As part of this evaluation, those features that are character-defining (topographical variation, vegetation, circulation, structures, furnishings, objects) should be identified. Historic finishes, details, and materials that also contribute to a landscape's significance should also be documented and evaluated prior to determining an approach to landscape accessibility. For example, aspects of the pedestrian circulation system that need to be understood include walk width, aggregate size, pavement pattern, texture, relief, and joint details. The context of the walk should be understood including its edges and surrounding area. Modifications to surface textures or widths of pathways can often be made with minimal effect on significant landscape features.

Additionally, areas of secondary importance such as altered paths should be identified-especially those where the accessibility modifications will not destroy a landscape's significance. By identifying those features that are contributing or non-contributing, a sympathetic circulation experience can then be developed.

After assessing a landscape's integrity, accessibility solutions can be considered. Full access throughout a historic landscape may not always be possible. Generally, it is easier to provide accessibility to larger, more open sites where there is a greater variety of public experiences. However, when a landscape is uniformly steep, it may only be possible to make discrete portions of a historic landscape accessible, and viewers may only be able to experience the landscape from selected vantage points along a prescribed pedestrian or vehicular access route. When defining such a route, the interpretive value of the user experience should be considered; in other words, does the route provide physical or visual access to those areas that are critical to understand the meaning of the landscape?

Federal Accessibility Laws



The automatic door to this museum building is a practical solution for universal entry. Photo: NPS files.

Today, few building owners are exempt from providing accessibility for people with disabilities. Before making any accessibility modification, it is imperative to determine which laws and codes are applicable. In addition to local and State accessibility codes, the following federal accessibility laws are currently in effect:

Architectural Barriers Act (1968)

The Architectural Barriers Act stipulates that all buildings designed, constructed, and altered by the Federal Government, or with federal assistance, must be accessible. Changes made to federal buildings must meet the Uniform Federal Accessibility Standards (UFAS). Special provisions are included in UFAS for historic buildings that would be threatened or destroyed by meeting full accessibility requirements.

Rehabilitation Act (1973)

The Rehabilitation Act requires recipients of federal financial assistance to make their programs and activities accessible to everyone. Recipients are allowed to make their properties accessible by altering their building, by moving programs and activities to accessible spaces, or by making other accommodations.

Americans with Disabilities Act (1990)

Historic properties are not exempt from the Americans with Disabilities Act (ADA) requirements. To the greatest extent possible, historic buildings must be as accessible as non-historic buildings. However, it may not be possible for some historic properties to meet the general accessibility requirements.

Under Title II of the ADA, State and local governments must remove accessibility barriers either by shifting services and programs to accessible buildings, or by making alterations to existing buildings. For instance, a licensing office may be moved from a second floor to an accessible first floor space, or if this is not feasible, a mail service might be provided. However, State and local government facilities that have historic preservation as their main purpose-State-owned historic museums, historic State capitols that offer tours-must give priority to physical accessibility.

Under Title III of the ADA, owners of "public accommodations" (theaters, restaurants, retail shops, private museums) must make "readily achievable" changes; that is, changes that can be easily accomplished without much expense. This might mean installing a ramp, creating accessible parking, adding grab bars in bathrooms, or modifying door hardware. The requirement to remove barriers when it is "readily achievable" is an ongoing responsibility. When alterations, including restoration and rehabilitation work, are made, specific accessibility requirements are triggered.

Recognizing the national interest in preserving historic properties, Congress established alternative requirements for properties that cannot be made accessible without "threatening or destroying" their significance. A consultation process is outlined in the ADA's Accessibility Guidelines for owners of historic properties who believe that making specific accessibility modifications would "threaten or destroy" the significance of their property. In these situations, after consulting with persons with disabilities and disability organizations, building owners should contact the State Historic Preservation Officer (SHPO) to determine if the special accessibility provisions for historic properties may be used. Further, if it is determined in consultation with the SHPO that compliance with the minimum requirements would also "threaten or destroy" the significance of the property, alternative methods of access, such as home delivery and audio-visual programs, may be used.

Summary and References

Historic properties are irreplaceable and require special care to ensure their preservation for future generations. With the passage of the Americans with Disabilities Act, access to historic properties open to the public is a now civil right, and owners of historic properties must evaluate existing buildings and determine how they can be made more accessible. It is a challenge to evaluate properties thoroughly, to identify the applicable accessibility requirements, to explore alternatives and to implement solutions that provide independent access and are consistent with accepted historic preservation standards. Solutions for accessibility should not destroy a property's significant materials, features and spaces, but should increase accessibility as much as possible. Most historic buildings are not exempt from providing accessibility, and with careful planning, historic properties can be made more accessible, so that all citizens can enjoy our Nation's diverse heritage.

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Reading List

Ballantyne, Duncan S. and Harold Russell Associates, Inc. *Accommodation of Disabled Visitors at Historic Sites in the National Park System*. Washington, D.C.: Park Historic Architecture Division, National Park Service, U.S. Department of the Interior, 1983.

Goldman, Nancy. Ed. *Readily Achievable Checklist: A Survey for Accessibility*. Boston: Adaptive Environments Center, 1993.

Hayward, Judith L. and Thomas C. Jester, compilers. *Accessibility and Historic Preservation Resource Guide*. Windsor, Vermont: Historic Windsor, Inc., 1992, revised 1993.

Jester, Thomas C. *Preserving the Past and Making it Accessible for People with Disabilities*. Washington, D.C.: Preservation Assistance Division, National Park Service, U.S. Department of the Interior, 1992.

Parrott, Charles. *Access to Historic Buildings for the Disabled*. Washington, D.C.: U.S. Department of the Interior, 1980.

Secretary of the Interior's Standards for the Treatment of Historic Properties. Washington, D.C.: Preservation Assistance Division, National Park Service, U.S. Department of the Interior, 1993.

Smith, William D. and Tara Goodwin Frier. *Access to History: A Guide to Providing Access to Historic Buildings for People with Disabilities*. Boston: Massachusetts Historical Commission, 1989.

Standards for Accessible Design: ADA Accessibility Guidelines (ADAAG). Washington, D.C.: U.S. Department of Justice, 1991.



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