MICHIGAN STATE
UNIVERSITY

ELECTRONIC BIDDING

PUBLICLY BID AND ADVERTISED
SPECIFICATION FOR

Human Ecology – Replace Roofs and Complete Masonry Restoration

PROJECT NUMBER

CP24039

Thursday, November 20, 2025

AT

MICHIGAN STATE UNIVERSITY
EAST LANSING, MICHIGAN

Infrastructure Planning and Facilities
Planning, Design and Construction

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

DIVISION 06 - WOODS PLASTICS AND COMPOSITES

- 061000 ROUGH CARPENTRY
- 061600 SHEATHING

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

- 070150.19 PREPARATION FOR REROOFING
- 072100 THERMAL INSULATION
- 073231 SYNTHETIC ROOF TILE
- 075552 MODIFIED BITUMINOUS PROTECTED MEMBRANE ROOFING
- 076200 SHEET METAL FLASHING AND TRIM
- 076221 COPPER GUTTERS AND DOWNSPOUTS
- 077253 SNOW GUARDS
- 079200 JOINT SEALANTS

DIVISION 26 - ELECTRICAL

- 264113 LIGHTNING PROTECTION FOR STRUCTURES

DIVISION 31 - EARTHWORK

- 311400 SITE CLEARING
- 312300 EARTHWORK
- 314100 SHORING AND UNDERPINING

DIVISION 32 - EXTERIOR IMPROVEMENTS

- 321216 BITUMINOUS PAVEMENT
- 321313 CONCRETE PAVEMENT
- 321416 BRICK PAVERS
- 321613 CONCRETE CURBS AND GUTTERS
- 321723 PAVEMENT MARKINGS
- 324000 SITE APPURTENANCES

DIVISION 33 - UTILITIES

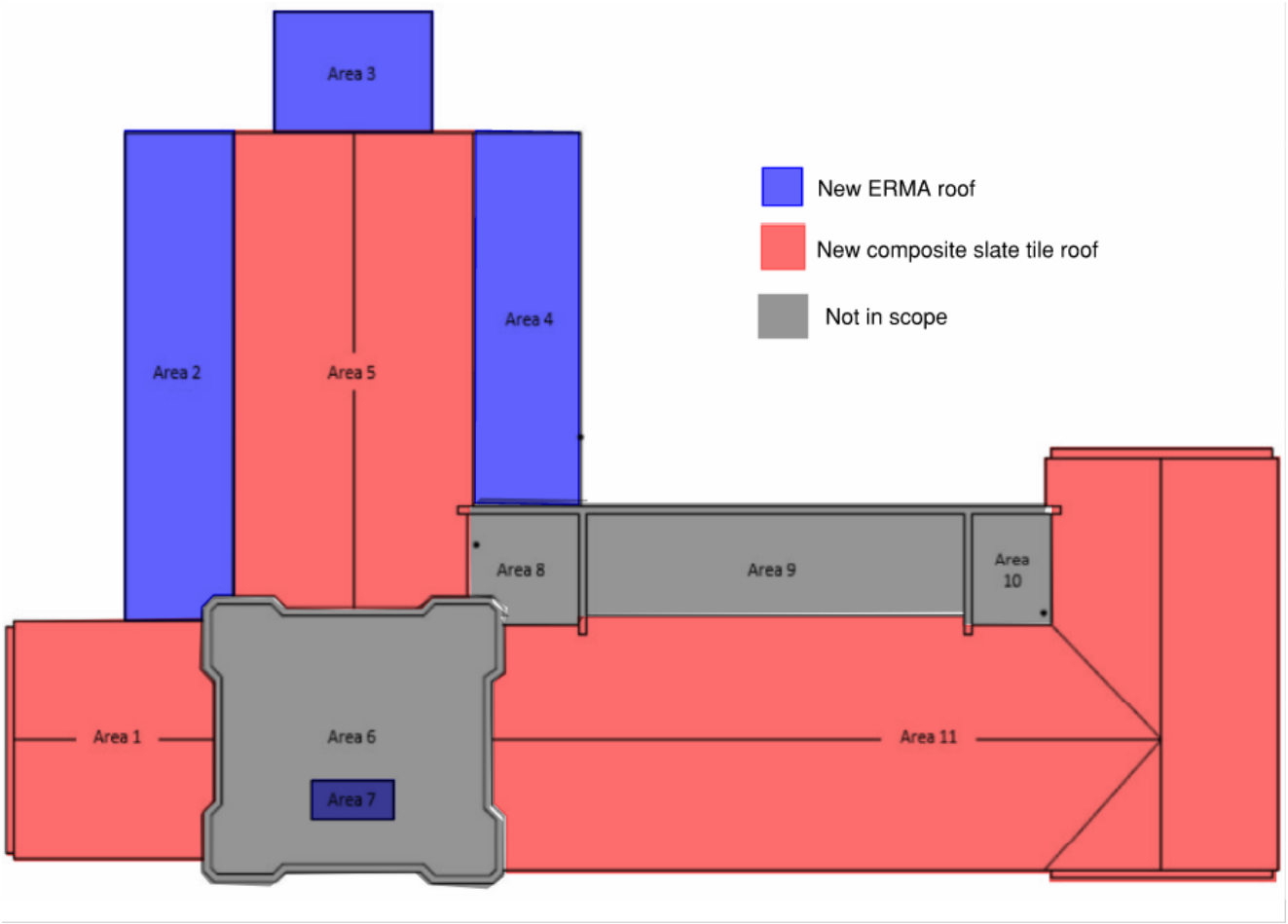
- 334000 STORM DRAINAGE

SCHEDULE OF DRAWINGS

Project Title: **Human Ecology – Replace Roofs and Complete Masonry Restoration**
Capital Project Number: **CP24039**
No. of Sheets: **16**

G-000	GENERAL INFORMATION
C-101	TOPOGRAPHIC SURVEY
C-102	EXISTING UTILITIES
C-103	SOIL EROSION & SEDIMENTATION CONTROLS (SESC) PLAN
C-104	SESC DETAILS
C-105	DEMOLITION PLAN
C-201	SITE LAYOUT
C-301	GRADING PLAN
C-401	UTILITIES PLAN
C-501	DETAILS
A-100	ROOF PLAN
A-200	EXTERIOR ELEVATIONS
A-201	EXTERIOR ELEVATIONS, DOWNSPOUT PROFILES
A-300	ROOF / MASONRY DETAILS
A-301	ROOF / MASONRY DETAILS
A-302	ROOF / MASONRY DETAILS

ROOF AREAS DIAGRAM



ADVERTISEMENT FOR BIDS

DATE: **December 1, 2025**

PROJECT TITLE: **Human Ecology – Replace Roofs and Complete Masonry Restoration**

PROJECT NUMBER: **CP24039**

for

MICHIGAN STATE UNIVERSITY

located at

EAST LANSING, MICHIGAN

OWNER: BOARD OF TRUSTEES
MICHIGAN STATE UNIVERSITY

ENGINEER/ARCHITECT: PLANNING, DESIGN AND CONSTRUCTION
Infrastructure Planning and Facilities
Michigan State University

DESIGN REPRESENTATIVE: **Dan Launstein 517-896-2989**

PROJECT MANAGER: **Matt Cornillie 810-341-4384**

BID DUE DATE: Until **3:00 p.m.** on **Tuesday, January 20, 2026**, the Owner will receive bids for the work as set forth in the Bidding Documents via the Owner's Oracle Primavera Unifier Bid Manager, at which time and place all proposals will be publicly opened. Bidders are responsible for properly registering for this process and familiarizing themselves with the system and its requirements. Registration information can be found at https://ipf.msu.edu/construction/partners/prospective-partners.

Proposals are invited for General Construction Work.

This project involves the removal of existing asbestos-containing slate tile roofing and coal pitch tar roofing; replace with new composite slate tile roofing and ERMA roofing accordingly (refer to above 'Roof Areas Diagram'), removal of existing copper gutters/downspouts and replace with new exterior downspouts, reworking the underground storm drainage system, and various masonry repairs/restoration as indicated on the drawings. **Please provide all Allowances (section 012100), Unit Prices (section 012200), and Alternates (section 012300). Alternates #2 & #3 are especially critical.**

Publicly Bid and Advertised: This project is publicly bid and advertised.

The substantial construction completion date for the project, as set forth in the project manual and drawings is **August 21, 2026**. See applicable start date and interim completion dates in the General Requirements (Division One) – Part 1 Work Sequence section.

LIQUIDATED DAMAGES:
☐ Shall, or ☒ Shall not be assessed for Substantial Completion at:
$_____PER DAY

☐ Shall, or ☒ Shall not be assessed for Final Completion at:
$_____PER DAY

EXCLUSIONS FROM MUTUAL WAIVERS OF CONSEQUENTIAL DAMAGES:
DEFAULT IS NONE. (If exclusions apply, project team to insert applicable exclusions below).

The complete set of documents is also available for viewing through our MSU Plan Room or via the MSU Planning, Design and Construction web page at https://ipf.msu.edu/construction/partners/prospective-partners and then select "dedicated plan room".

PLAN ROOMS

The Bidding documents are on file and may be examined at the following locations during regular business hours, Monday through Friday:

Builders Exchange of Lansing &
Central Michigan
1240 East Saginaw
Lansing, MI 48906

Dodge Data & Analytics
25330 Telegraph Road, Suite 350
Southfield, MI 48009

Dodge Data & Analytics
914 E. Vine Street
Kalamazoo, MI 49001

Dodge Data & Analytics
1311 South Linden Road, Suite B
Flint, MI 48532

Builders Exchange
P.O. Box 2031
Grand Rapids, MI 49501

Tri-City Builders & Traders Exchange
334 South Water
Saginaw, MI 48607

Construction Association of Michigan
43636 Woodward Avenue
P. O. Box 3204
Bloomfield Hills, MI 48302-3204

Builders Exchange
3431 East Kilgore
Kalamazoo, MI 49001

CNS Construction News Service
of West Michigan, Inc.
1793 R. W. Berends Dr. SW.
Wyoming, MI 49509-4993

MMSDC Michigan Minority Supplier
Development Council.
100 River Place STE 300
Detroit, MI 48207

Builders Exchange of NW MI, Inc.
1373 Barlow St. , Suite 4
Traverse City, MI 49686

Capital Imaging
2521 East Michigan Avenue
Lansing, MI 48912

A pre-bid site inspection will be held on **Tuesday, January 6, 2026** at **2:00 p.m.**. All interested Contractors or Bidders are encouraged to attend. Interested parties should meet outside of the main entrance to the Human Ecology building off West Circle Drive. All Contractors submitting bids for the work will be held to have visited the site prior to submitting bids.

Each proposal shall be accompanied by a bid security as set forth in the Instructions to Bidders.

The Owner reserves the right to reject any or all proposals either in whole or in part and to waive any irregularities.

Withdrawal of any proposal is prohibited for a period of 120 days after the actual date of the opening thereof.

Performance and Labor and Material Bonds are required as set forth in the Instructions to Bidders.

All prospective Bidders, their Subcontractors and suppliers must be awardable by and in compliance with the directives and guidelines of the Contract Compliance Division of the Michigan Civil Rights Commission.

SUBCONTRACTING AND SUPPLIER DIVERSITY

The University makes a continuous effort to broaden its business relationships with Minority Business Enterprise (MBE) contractors, Women Business Enterprise (WBE) contractors, and small business concerns (including veteran-owned small business, service-disabled veteran owned small business, HUB Zone small business, and small disadvantaged business concerns certified by the U.S. Small Business Administration). For the purposes of this provision, suppliers are considered subcontractors. If third parties are needed to fulfill contractual obligations to the University, you are strongly encouraged to consider all qualified sources, including WBE, MBE, and small business subcontractors. For purposes of this paragraph, MBE is defined as a business enterprise of which more than 50% of the voting shares or interest in the business is owned, controlled, and operated by individuals who are members of a minority and with respect to which more than 50% of the net profit or loss attributable to the business accrues to shareholders who are members of a minority. WBE is defined as a business enterprise of which more than 50% of the voting shares or interest in the business is owned, controlled, and operated by women and with respect to which more than 50% of the net profit or loss attributable to the business accrues to the women shareholders.

The apparent Low Bidder shall, within 24 hours, after receipt of bids, provide the names of any MBE/WBE/small business subcontractors, description of work to be done by each, dollar value of work, and percentage of contract price. This information shall be included with the contract breakdown specified in Section 012000.1.4 of the specifications.

The Michigan State University Purchasing Department maintains a list of known Minority and Women Business Enterprises in the region for informational purposes. Bidders can obtain a copy of this list by calling (517) 355-0357. This list is not intended to be comprehensive. Similarly, it does not constitute an endorsement or certification of acceptability of the contractors and vendors included.

INSTRUCTION TO BIDDERS

ARTICLE 1

DEFINITIONS

1.1 Bidding Documents include the Advertisement or Invitation to Bid, Instruction to Bidders, and the proposed Contract Documents including any Addenda issued prior to receipt of Bids.

1.2 All definitions set forth in Consensus Docs 200- Standard Agreement and General Conditions Between Owner and Constructor (as modified by MSU) and in other Contract Documents are applicable to the Bidding Documents.

1.3 **Addenda** are written or graphic instruments, issued by the Architect prior to the receipt of Bids, which modify or interpret the Bidding Documents by addition, deletions, clarifications or corrections.

1.4 A **Bid** is a complete and properly signed proposal to do the Work or designated portion thereof, for the sums stipulated therein, supported by data called for by the Bidding Documents.

1.5 **Base Bid** is the sum stated in the Bid for which the Bidder offers to perform the Work described as the base, to which Work may be added or deducted for sums stated in Alternate Bids.

1.6 An **Alternate Bid** (or Alternate) is an amount stated in the Proposal to be added to or deducted from the amount of the Base Bid if the corresponding change in project scope or materials or methods of construction described in the Bidding Documents is accepted.

1.7 A **Unit Price** is an amount stated in the Bid as a price per unit of measurement for materials or services as described in the Contract Documents.

1.8 A **Bidder** is one who submits a Bid for a prime Contract with the Owner for the Work described in the proposed Contract Documents.

1.9 A **Sub-bidder** is one who submits a Bid to a Bidder for materials or labor for a portion of the Work.

1.10 **Bid Manager** is the Oracle Primavera Unifier Bid Manager application used by the Owner to receive competitive bids for this project. The Bid Manager is an electronic platform.

ARTICLE 2

BIDDER'S REPRESENTATION

2.1 Each Bidder, by making his/her Bid, represents that:

2.1.1 They have read and understand the Bidding Documents and their Bid is made in accordance therewith.

2.1.2 They have visited the site and are familiar with the local conditions under which the Work is to be performed.

2.1.3 Their Bid is based upon the materials, systems and equipment described in the Bidding Documents, without exceptions.

ARTICLE 3

BIDDING DOCUMENTS

3.1 COPIES

3.1.1 Bidders may obtain complete sets of the Bidding Documents via the MSU Planning, Design and Construction web page at https://ipf.msu.edu/construction/partners/prospective-partners, or as outlined in the Advertisement for Bids, page AB-2.

3.1.2 Complete sets of Bidding Documents shall be used in preparing Bids; neither the Owner nor the Architect assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

3.1.3 The Owner or Architect, in making copies of the Bidding Documents available on the above terms, does so only for the purpose of obtaining Bids on the Work and does not confer a license or grant for any other use.

3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

3.2.1 Bidders shall promptly notify the Architect of any ambiguity, inconsistency or error which they may discover upon examination of the Bidding Documents or of the site and local conditions.

3.2.2 Bidders requiring clarification or interpretation of the Bidding Documents shall make a written request to be received by the Architect at least fourteen days prior to the date for receipt of Bids.

3.2.3 Any interpretation, correction or change of the Bidding Documents will be made by Addendum. Interpretations, corrections or changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon such interpretations, corrections and changes.

3.3 SUBSTITUTIONS

3.3.1 The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.

3.3.2 No substitution will be considered unless written request for approval has been submitted by the Bidder and has been received by the Architect at least fourteen days prior to the date for receipt of Bids. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cuts, performance and test data, and any other information necessary for an evaluation. A statement setting forth any changes in other materials, equipment or work that incorporation of the substitute would require shall be included. It is the burden of the bidder proposing the substitution to establish its merits. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

3.3.3 If the Architect approves any proposed substitution, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

3.4 ADDENDA

3.4.1 The Architect and Owner will endeavor to notify all known plan holders of addenda issued, but it is the Bidder's responsibility to verify receipt of all addenda.

3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

3.4.3 Normally Addenda will not be issued later than five days prior to the date for receipt of Bids except an Addendum, if necessary, postponing the date for receipt of Bids or withdrawing the request for Bids.

3.4.4 Each Bidder shall ascertain prior to submitting their Bid that they have received all Addenda issued, and receipt of all Addenda shall be acknowledged on their bid.

ARTICLE 4

BIDDING PROCEDURE

4.1 FORM AND STYLE OF BIDS

4.1.1 Bidders will receive an invitation from Oracle Primavera Unifier to the Bid Manager.

4.1.2 Bids shall be submitted via the Bid Manager on the form specified.

4.1.3 All fields on the Bid Form shall be completed.

4.1.4 All requested Alternates shall be listed and quoted in the Bid Manager. Failure to quote a requested Alternate will be cause to reject the Bid.

4.1.4.1 If an alternate is added via Addendum, bidders will include by [adding new line to bid form, clearly labeling ALTERNATE X (x being the number)] or [providing pricing on an attachment, also clearly labeling pricing for Alternate.]

4.1.5 All requested Unit Prices shall be listed and quoted via attachment in the Bid Manager. Failure to quote a requested Unit Price will be cause to reject the Bid.

4.1.6 Acknowledge the receipt of the last Addendum on the Bid Form. By acknowledging this addendum, Bidder also acknowledges receipt of all prior consecutive addenda (e.g., acknowledging Addendum 3 also acknowledges Addendum 1 and 2).

4.1.7 Bidder shall make no additional stipulations on the Bid Form nor qualify its Bid in any manner.

4.1.8 By submitting a Bid via the Bid Manager, the Bidder has committed the offer to perform the Work. The Owner will rely on this document as properly signed by the Bidder. The Owner may rely on this commitment, including submitting a claim on the Bidder's Bid Bond if they fail to enter into a contract per the project manual.

4.2 BID SECURITY

4.2.1 Any base bid greater than $50,000 shall be accompanied by a Bid Security in the form of a bid bond made payable to the Board of Trustees, Michigan State University, in the amount of not less than five percent (5%) of the Base Bid, as a proposal guarantee, pledging that the Bidder will enter into a Contract with the Owner on the terms stated in its Bid, and will furnish bonds as described hereunder in Article 8 covering the faithful performance of the Contract and the payment of all obligations arising thereunder. Bidder shall attach a scanned copy of the bid bond to the bid in Unifier Bid Manager.

As an alternative to a bid bond, Bidders may provide certified check, cashiers' check, or money order made payable to the Board of Trustees, Michigan State University, in the amount of not less than five percent (5%) of the Base Bid, to be delivered to MSU Infrastructure Planning and Facilities, 1147 Chestnut Road, Room 101, East Lansing, MI 48824. The proposal guarantee of Bidders under consideration will be returned immediately after approval of contracts by the Owner; those of all others will normally be returned upon request within 48 hours after bid opening.

Should the Bidder refuse to enter into a Contract or fail to furnish such bonds within 30 days of notification of intent to award, the amount of the Bid Security shall be forfeited to the Owner as liquidated damages, not as penalty.

4.2.2 The bonding firm must be listed on the current U.S. Department of Treasury Circular 570, rated A- or better by Best, and be licensed to do business in the State of Michigan. The bonds are to be made out to "Michigan State University, Board of Trustees."

4.2.3 The Owner will have the right to retain the Bid Security of Bidders under consideration until either (a) the Contract has been executed and bonds have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn, or (c) all Bids have been rejected.

4.3 SUBMISSION OF BIDS

4.3.1 Bids shall be completed prior to the time and date for receipt of Bids indicated in the Advertisement or Invitation to Bid, or any extension thereof made by Addendum. Bids received after the time and date for receipt of Bids will not be considered.

4.3.2 Bidder shall assume full responsibility for timely delivery at location designated for receipt of Bids.

4.3.3 Oral, telephone, paper, or faxed Bids are invalid and will not receive consideration.

4.4 MODIFICATION OR WITHDRAWAL OF BID

4.4.1 A Bid may not be modified, withdrawn, or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and Bidder so agrees in submitting his/her Bid.

4.4.2 Prior to the time and date designated for receipt of Bids, Bids submitted early may be modified or withdrawn only by withdrawing current Bid, and resubmitting within the Bid Manager.

4.4.3 Bid security shall be in an amount sufficient for the Bid as modified or resubmitted.

4.5 BIDDER REGISTRATION

4.5.1 The Owner will only receive Bids via the Bid Manager, which requires prior registration and invitation. The Bidder is responsible to familiarize itself with this system and request access in a timely manner.

4.5.2 The Owner will endeavor to maintain a list of all interested bidders and invite to all public bids. Bidders interested in being added to this list must register. Registration information can be found at https://ipf.msu.edu/construction/partners/prospective-partners.

4.5.3 Bidders are encouraged to continue to monitor projects via plan rooms and other advertising venues. They must express interest to bid on MSU projects by request at least 7 days prior to a bid opening. Owner takes no responsibility for inviting a bidder after that date.

ARTICLE 5

CONSIDERATION OF BIDS

5.1 OPENING OF BIDS

5.1.1 Unless stated otherwise in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be opened publicly and will be read aloud virtually via Zoom. A Zoom meeting link will be listed in the Bid Manager.

5.1.1.1 Unless stated otherwise in the Advertisement or Invitation to Bid, the Owner will endeavor to share bid results within 24 hours of opening.

5.1.1.2 The Owner will endeavor to stream the bid opening, and will share details in the bid invitation

5.2 REJECTION OF BIDS

5.2.1 The Owner shall have the right to reject any or all Bids.

5.3 ACCEPTANCE OF BID (AWARD)

5.3.1 The Owner shall have the right to waive any informality or irregularity in any Bid received.

5.3.2 If the University accepts any alternates, it will do so in the order representing the Owner's opinion of the best value to Michigan State University. The Owner shall be the sole judge of value. The low bidder will be determined on the basis of the sum of the base bid and the alternates accepted.

5.4 ACCEPTANCE OF CONTRACTOR AND SUBCONTRACTORS

5.4.1 Each portion of the Work shall be performed by an organization equipped and experienced to do the Work in each particular field, and no portion shall be reserved by the Contractor unless they are so equipped and experienced. Within 24 hours after the receipt of Bids, the successful Contractor shall submit a list of each Subcontractor proposed for each section of the Work. Subcontractors shall be satisfactory to the Owner. Unless authorized to the contrary in writing from the Owner, Subcontracts shall be awarded to the firms named in this list. Acceptance of the Bid does not imply approval of the Subcontractors subsequently named, but each Subcontractor shall be approved individually.

ARTICLE 6

QUALIFICATION OF CONTRACTORS

6.1 SUBMISSION OF QUALIFICATION STATEMENT

6.1.1 Bidders to whom award of a Contract is under consideration shall submit to the Architect upon his/her request, a properly executed Contractor's Qualification Statement, Consensus Docs 221 – Constructor's Statement of Qualifications for a Specific Project, unless such a Statement has been previously required and submitted as a prerequisite to the issuance of Bidding Documents.

6.2 NONDISCRIMINATION

6.2.1 In performing under this Contract, the Contractor agrees not to discriminate against any employee, or applicant for employment, with respect to hire, tenure, terms, conditions or privileges of employment, or any matter directly or indirectly related to employment, because of race, color, religion, national origin, age, sex, height or weight, marital status or handicap. Subcontracts with each Subcontractor will contain a provision requiring nondiscrimination in employment, as herein specified. Any breach of this covenant may be regarded as a material breach of this Contract. The foregoing is included as a part of the University's institutional Affirmative Action/Equal Opportunity commitment.

6.3 APPROVED ASBESTOS ABATEMENT CONTRACTORS

6.3.1 The Department of Environmental Health and Safety (EHS) annually prequalifies asbestos abatement contractors to perform asbestos abatement work on Campus. Asbestos abatement work shall only be performed by one of the asbestos abatement contractors on the approved list. The current list is available from the PDC Project Representative, the Environmental Coordinator for EHS, and at https://ehs.msu.edu/enviro/asbestos/index.html.

ARTICLE 7

POST-BID INFORMATION

7.1 SUBMISSIONS

7.1.1 Unless waived by the Architect, the apparent low Bidder shall, within 24 hours after receiving bids, submit the following information to the Architect:

7.1.1.1 A designation of the Work to be performed by the Bidder with their own forces.

7.1.1.2 The proprietary names and the suppliers of principal items or systems of material and equipment proposed for the Work.

7.1.1.3 A list of names of the Subcontractors or other persons or organizations (including those who are to furnish materials or equipment fabricated to a special design) proposed for each division and/or major subdivision, for the Owner’s approval.

7.1.1.4 The names of the MBE/WBE and a description of work to be done by each, dollar value of Work and percentage of contract price.

7.1.1.5 List of representatives authorized to perform Unifier functions on behalf of the contractor using the Unifier New Company Request, available at Unifier System Vendor Information Form.

7.1.1.6 Certificate of Insurance demonstrating compliance with project requirements.

7.1.1.7 Criminal Background Check (CBC) demonstrating compliance with university requirements.

7.1.2 At the option of the Owner, the Bidder may be required to establish to the satisfaction of the Architect and the Owner the capability, reliability, and responsibility of the proposed Contractor and Subcontractors to furnish and perform the Work.

7.1.3 Subcontractors and other persons and organizations proposed by the Bidder and accepted by the Owner and the Architect must be used on the Work for which they were proposed and accepted and shall not be changed except with the written approval of the Owner and the Architect.

ARTICLE 8

PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

8.1 OWNER'S RIGHT TO REQUIRE BONDS

8.1.1 Each Bidder under a proposal in which the base bid exceeds $50,000, shall include the premiums for furnishing a Performance Bond and also Labor Material Bond, each in the full amount of the proposal sum as specified in the Owner / Constructor Agreement.

8.1.2 The bonding firm must be listed on the current U.S. Department of Treasury Circular 570, rated A- or better by Best, and be licensed to do business in the State of Michigan. The bonds are to be made out to "Michigan State University, Board of Trustees."

8.1.3 In assuming assigned Subcontractor by the successful Bidder for general building work as specified, each assigned Subcontractor for each Subcontract shall reimburse the General Contractor his/her proportionate share of the premiums for bonds.

8.2 TIME OF DELIVERY AND FORM OF BONDS AND INSURANCE

8.2.1 The Bidder shall deliver two (2) copies of the required bonds and insurance to the Owner not later than the date of execution of the Contract.

8.2.2 The Bidder shall require the Attorney-In-Fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of his/her Power of Attorney.

ARTICLE 9

FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

9.1 FORM TO BE USED

9.1.1 The Agreement for the Work will be governed by the project manual, and by the terms and conditions of ConsensusDocs 200- Standard Agreement and General Conditions Between Owner and Constructor (as modified by MSU).

9.1.2 If the project is under $250,000, an MSU Purchase Order will be used and the terms and conditions of ConsensusDocs 200- Standard Agreement and General Conditions Between Owner and Constructor (as modified by MSU), will serve as the applicable General Conditions for administration of the Work.

9.1.3 If the project is over $250,000, the ConsensusDocs 200- Standard Agreement and General Conditions Between Owner and Constructor will be used and the terms and conditions of that Agreement will be formalized through the execution of a Contract Finalization Form.

ARTICLE 10

APPLICATION FOR PAYMENT

10.1 FORM TO BE USED

10.1.1 Applications for Payment shall be submitted in Unifier in accordance with the Pay Apps (Pay Applications) business process. Refer to the MSU IPF website for more information.

ARTICLE 11

ELECTRONIC TRANSACTIONS

11.1 UNIFIER

11.1.1 The Owner reserves the right to require that any or all transactions and submissions be conducted and delivered electronically through Unifier, a web-based project management software system. Unifier functions on most popular web browsers. If the owner requires the use of Unifier, the owner will provide the necessary licenses for access to Unifier. The Owner requires new vendors and users to complete the initial Unifier Vendor Training program on how to use Unifier. To request access to the Unifier Vendor Training program, send an email to Unifier Support at ipf.sa.cpmshelp@msu.edu. Access to Unifier will be password restricted, and any proposal, acceptance, quote or other information submitted through Unifier through the use of a party's password shall be deemed to be the submission of such party and any proposal, acceptance, quote or other information in the submission shall be binding on such party as if such proposal, acceptance, quote or other information was in a writing signed by such party. Owner shall not be required to verify the validity of any such submission or inquire as to the authority of the user gaining access to Unifier through the use of a party's password. It is the responsibility of the vendor to verify compatibility of their systems with Unifier. For more information, see Unifier System Vendor Information Form.

11.2 CONTRACT EXECUTION

11.2.1 The Owner may choose to accept a scanned signed contract, provided through Unifier, as acceptance of the agreement. The Owner will rely on this document as properly signed by the Constructor.

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY OF WORK

A. Work Under This Contract

1. This Contract encompasses the furnishing of all labor, materials, services, equipment, and insurance to complete the following as shown on drawing and specified herein:
   - Removal of existing asbestos-containing slate tile roofing and coal pitch tar roofing; replace with new composite slate tile roofing and ERMA roofing accordingly.
   - Removal of existing copper gutters/downspouts and replace with new exterior downspouts.
   - Rework underground storm drainage system.
   - Various masonry repairs/restoration as indicated on the drawings.

2. Please provide all Allowances (section 012100), Unit Prices (section 012200), and Alternates (section 012300). **Alternates #2 & #3 are especially critical. Due to project budget limitations, it is unlikely that the full scope of masonry repairs and downspouts/underground drainage will be able to be funded as part of this Capital Project. It is MSU's goal to address the remainder of masonry repairs and downspouts/underground drainage via a separate future Capital Project, so having these alternates will help MSU to adequately budget for the future project. Therefore, it is key that contractors provide these alternates exactly as listed in Section 012300, Part 3.**

3. Any premium time necessary to complete this project as scheduled, shall be included in the Base Bid.

4. All pertinent requirements of the Invitation to Bidders, Instructions to Bidders, and General Conditions shall form a part of these specifications and the Contractor shall consult them in detail for instructions pertaining to the work in the following divisions.

B. Work Performed Under Separate Contracts

1. The following will be provided by the Owner or by others under separate contracts:

   a. Tie-back, pruning, removal and/or transplanting of existing plantings.

   b. Tree protection fencing.

   c. Parking gate equipment and parking booth installation and wiring. Conduit installed by Contractor.

d. Departmental possessions - furniture, books, personal items, etc., shall be relocated by the Department or University as required.

e. Smart Ball utility locators

f. As-built Site Survey

1) The Contractor shall notify the Project Representative when new underground utility installation starts, or when existing utilities are exposed, to allow the Project Representative to coordinate with IPF Facility Information Services for documentation.

2) The Project Representative shall coordinate with IPF Facility Information Services for an As-built Survey upon completion of exterior improvements and utilities.

2. Coordinate pickup of the following site-related, owner-provided materials from Beaumont Supply at 4080 Beaumont Rd., Lansing, MI 48910, phone: (517) 643-6253 (Hours of operation are May 1st – October 31st 6am-4pm Monday – Friday excluding university holidays. November 1st – up until the Thanksgiving Holiday 6am-230pm Monday -Friday and following Thanksgiving Holiday – April 30th 5am-130pm to accommodate for snow) Extended hours are available with a minimum 24-hour notice. Contractor is responsible for transporting materials to the jobsite.

a. Soil Erosion and Sedimentation Control (SESC) materials: (removed and retained by Owner at end of permit)

1) Erosion eels

b. Recycled concrete aggregate for parking bituminous pavement base (see section 321216)

c. Topsoil, final grading, fertilizing, mulching, and seeding of construction site. (see Section 312300).

d. Site Appurtenances (see Section 324000):

1) Barrier-free parking bollards, removable bollards, guard post bollards, Post and chain fence

2) Parking meters and parking meter posts

3) Parking and regulatory U-channel posts and signs

4) Building address and wayfinding signs

5) Benches, tables, litter receptacles and other site furniture

6) Bike loops and bike loop regulatory signs

C. Pre-Ordered Products

1. The Contractor shall assume full responsibility for all pre-ordered products after their arrival at MSU. This includes transportation, handling, storage, start-up, warranty services, and installation in accordance with the General Conditions unless otherwise specified.

D. Work Sequence

1. The Substantial construction completion date for this project is as specified in the Advertisement for Bids.

1.2 WORK RESTRICTIONS

A. Access Routes

1. All materials and equipment (new and demolition), including mechanical and electrical, shall be transported through a building via the designated building receiving area (usually the loading dock), and through main corridor to rooms or areas. Alternate routes may be used only with the approval of the Project Representative.

B. Owner Occupancy

1. Unless otherwise stated, University buildings will continue to function and remain occupied during the construction process.

2. On every project involving new construction, additions or alterations to existing facilities, M.S.U. requires the ability of a person with physical disabilities to independently get to, enter, and use the site, facility, building or element. In no way shall a site, building or facility be restricted to individuals with disabilities, due to alterations or construction, which would normally be made accessible to individuals with no disabilities. Alternate routes for all new and alterations of existing facilities shall incorporate the latest federal, state and local barrier free standards and include temporary access accommodations for individuals with disabilities.

C. Use of Site

1. There shall be a pre-construction site walk-thru with the Project Representative to clarify and discuss limitations and concerns prior to construction.

2. Construction fence

a. A construction fence shall be placed around the construction site as

shown on the drawings and as approved by the Project Representative.

b. The Contractor is responsible for installing and maintaining the construction fence and gates to restrict access by the public to the area under construction. The Contractor may be required to reposition the fence and/or gate(s) during the course of construction to accommodate the construction activities in order to minimize the inconvenience to the public.

c. The fence shall be constructed of chain link fabric with a minimum height of 6', with metal or wood posts at not to exceed 8' spacing. Fence fabric shall be supported by either a top bar or tension cable. Gates (where specified) will be constructed of a suitable metal frame with chain link fabric with a height of not less than 6'. This fence shall be installed before work commences.

d. Metal signs reading "Construction Area - Keep Out" must be attached to the fence at not more than 20' spacing and to the gate(s).

e. Where any fence crosses an existing walk, drive, or road, a lighted MDOT Type 1 barricade or larger shall be attached to the inside of the fence facing on-coming pedestrian and/or vehicular traffic.

f. No construction work, parking, storage of materials or related activities shall occur beyond this boundary fencing.

PART 2 - PRODUCTS
Not Used

PART 3 - EXECUTION
Not Used

END OF SECTION

SECTION 012000 - PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 PROPOSAL QUOTATION REQUIREMENTS

A. Projects to be bid will be quoted as required by the front-end documents on the specification. **Please provide all Allowances (section 012100), Unit Prices (section 012200), and Alternates (section 012300).**

1.2 CONTRACT BREAKDOWNS

A. Within twenty-four (24) hours after receipt of Bids, the apparent Low Bidder shall submit to the Architect/Engineer, the following:

1. A Schedule of Values (SOV), indicating the cost of each specified Division and/or Major Subdivision of the Bid. The approved SOV will be used as the basis for estimating partial payments to the Contractor when allowed per the front-end documents.

a. All contracts shall assign a minimum of 1% of the contract value for final completion and project closeout. This item must be identified as a separate line item labeled *Closeout* on the SOV. Exceptions must be approved by the Construction Superintendent.

b. Due to changes to Generally Accepted Accounting Practices, environmental remediation must be separately reported in the Owner's financial statements. Accordingly, all contracts shall carry remediation costs in separate lines clearly marked *remediation*. These titles should not be used in other line descriptions.

c. Construction Management contracts shall carry separate detail lines for at least the following lines:

i. Preconstruction Services
ii. Construction phase staffing
iii. General conditions
iv. Bonds and Insurance. Note that subcontractor bonds are not required to be separately listed.
v. Fee
vi. Closeout

2. Identify a Subcontractor for each Division and/or Major Subdivision for the Owner's approval. Once approved, no Subcontractors will be changed without the Owner's written consent. The List of Subcontractors will have indicated the MBE/WBE Contractors and their percentages of the Contract Price as specified in the "Cover Letter" or "Advertisement for Bids" of this project.

3. A list of representatives authorized to perform Unifier functions on behalf of the Contractor using the Unifier System - Vendor Information available at http://ipf.msu.edu/index.cfm/capital-project-procedures/documents/unifier-system-vendor-information/.

1.5 CONTRACT MODIFICATION PROCEDURES

A. Change Management Quotation Requirements

1. Quotations for changes in the Contract will be submitted via Unifier when requested, as outlined in Section 012000-1.5.B, Change Management Procedures. This section will not prohibit the Project Representative from requesting and receiving verbal quotations. It is intended that mutual cooperation will keep any changes to an absolute minimum. The Contractor shall promptly document any verbal request by initiating a Change Management or Change Request record in Unifier. The Contractor shall not engage in added work without proper authorization by the Owner. Any added work the Contractor engages in without authorization shall be at the Contractor's risk. In no event shall the failure of the Construction Representative to initiate a change constitute authorization for the Contractor to proceed with work.

2. The Change Order Quotation Format Form is available on the MSU Capital Project Delivery Procedures website (http://procedures.ipf.msu.edu/index.cfm/capital-project-delivery-procedures/). This Form shall be forwarded to each required Subcontractor, and is recommended as an outline of the information required by this Contract.

3. The Contractor will submit quotations through Unifier, including detailed breakdowns. Upon request, originals of any documents shall be provided to the Owner. The Project Representative will receive quotations from the Contractor only. Subcontractors will submit quotations through the Contractor. All Contractors will submit quotations with information and back-up data as indicated on the quotation form.

B. Change Management Procedures

1. Change Orders shall be issued as required to alter the Contract, (i.e. change the work scope, materials, dates, etc.), in accordance with the General Conditions of the Contract, and the following procedure:

   a. The Contractor or the Project Representative shall initiate a Change Request in the Unifier Project Management System. Each Change Request will consist of only one change item of work.

   b. Items brought up by the Department or Contractor shall be reviewed first with the Project Representative.

   c. The Architect/Engineer will review the Change Request, and with the Project Representative, will determine the need for an item to be changed in the Contract by Change Order.

d. If the Change Request is approved, the Contractor will receive a request through Unifier to proceed with the work and/or provide pricing, as applicable. Provide a quotation for the item requiring change, unless the Change Request is submitted as a lump sum with a quotation attached

e. The Contractor will submit a quotation for each Change Request item in accordance with the applicable Unifier business process. Overhead and profit shall be applied consistent with the General Conditions.

f. The Project Representative and Architect/Engineer will evaluate the quotations and accept or reject each item quoted. A Change Order will be created within the Unifier system and will be issued through the MSU Purchasing Department to change the contract amount if required.

g. The Construction Supervisor or Director of Planning, Design and Construction has approval authority for the Contract Change.

1.6 CONTRACT PAYMENT PROCEDURES

A. Payment application requirements
1. Payment applications shall be submitted in Unifier, consistent with the contract documents.

PART 2 - PRODUCTS
Not Used

PART 3 - EXECUTION
Not Used

END OF SECTION

SECTION 013000 - ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.1 PROJECT MANAGEMENT AND COORDINATION

A. Project Meetings

1. Project meetings may be called as deemed necessary by the Project Manager.

B. Project Scope Documentation

1. The Contractor shall use PlanGrid for coordination of changes in the field, punch list items, and potential use for plan review comments.

C. Project Coordination

1. The Contractor is ultimately responsible for coordination to complete all work shown on drawings and specified herein independent of the location of the work on drawings and within the specifications. The arrangement of work within the specification into Divisions and Sections shall be considered as given for convenience of reference only and shall not be held to conform to jurisdictional rules which may prevail in any particular trade. It shall be the responsibility of the Contractor to so arrange or group items of work under a particular trade to conform to the prevailing customs of that trade and best interest of the Owner. Specific items of work will be performed by specific subcontractors or workmen when so specified herein or subsequently deemed necessary by the Project Representative to produce competent results.

2. The Contractor shall lay out the work and be responsible for all lines and measurements of the work. Before ordering material or executing work the Contractor shall obtain field measurements and prepare the work to fit conditions properly.

3. The Contractor will be held responsible for any error resulting from his/her failure to verify the figures shown on the drawing before laying out the work.

4. No extra charge will be allowed on account of slight variations between field dimensions and dimensions given on the drawings.

D. Mechanical and Electrical Coordination

1. Connection to Existing Equipment

a. The Contractor shall make arrangements with Planning, Design and Construction, through the Project Representative, before connecting to existing facilities. Unless otherwise noted, if interruption of service is required it shall be done at the convenience of the Owner.

1.2 CONSTRUCTION PROGRESS DOCUMENTATION

A. Construction Schedule Development/Coordination Responsibilities.

1. The Critical Path Method (CPM) will be used to plan, schedule, execute and report status of work under this contract. It shall include and properly coordinate dates for performance of all divisions for each major portion of the Work, and including completion of off-site requirements and tasks if request by Project Representative.

a. Within fourteen (14) calendar days of the Letter of Intent or contract award, the Contractor shall develop a proposed Baseline schedule for the Work, and submit it to each subcontractor to incorporate their own work.

b. All subcontractors, both direct and indirect, shall, within seven (7) calendar days of receipt of the Contractor's Schedule, submit revisions, comments and feedback to the Contractors, which shall be incorporated into the proposed schedule.

c. Upon receipt of the schedule from the Subcontractors, the Contractor will incorporate Subcontractors information into the Baseline Construction Schedule with appropriate logic ties and Contract Milestones, and distribute to the Architect/Engineer and Owner within seven (7) calendar days. Thus the Contractor Schedule development will be completed within twenty-eight (28) calendar days from Letter of Intent or Contract, awaiting Owner approval.

d. After project schedule has been accepted by the Owner the Contractor within five days (5 days) schedule a meeting with all subcontractors to review and encourage schedule compliance.

2. **All Subcontractors shall cooperate with the General Contractor to prepare and maintain the Construction Schedule, which shall include, without limitation, the following information at the General Contractor request.**

a. Shop Drawing review and approval, product procurement, fabrication, shop inspection, and delivery dates including lead times. Note: A/E shall be given 14 days upon receipt of submittal to review and return submittal.

b. Each phase of the Work, including the Punch List, Project Closeout requirements, Contract Completion and Occupancy;

c. Milestone dates that are required by the Contract Documents and Progress Milestones. Milestones should typically be based on the critical path and not exceed one (1) month between milestones.

d. The critical path of the Work

e. Planned disruptions and shutdowns due to other operations, facilities and functions, if any.

3. Upon receipt of the proposed Construction Schedule, the Architect/Engineer (A/E) and Owner (or other designee of the Owner), shall review the Construction Schedule and submit a copy of the Construction Schedule with comments to the Contractor within seven (7) calendar days. Within five (5) calendar days of review of comments from the Owner, all requested changes shall be incorporated in to the baseline Construction Schedule and a printout and electronic copy shall be provided to the Owner. Thus, the Contractor Schedule development with Owner review and Contractor modifications/changes shall not exceed forty (40) calendar days from the Letter of Intent.

4. **No progress payments will be made to the Contractor without a Baseline Construction Schedule approved by the Owner (or other designee of the Owner).**

5. Unless otherwise specified in the Contract Documents or waived in writing by the Owner, the Contractor shall provide **monthly progress reports, at a minimum,** to the Architect/Engineer and the Owner, which shall include recommendations for adjusting the construction schedule to meet Milestone Completion dates and contract completion dates.

6. An updated construction schedule shall be submitted each month to the Project Rep. The Project Rep shall review the submittal, provide comments as necessary. No **payment will be made without an updated construction schedule approved by the Project Representative.**

7. When it is apparent to the contractor and A/E that critical path activities, scheduled Milestone completion dates, or contract completion dates will not be met, the Contractor shall submit to the Owner for review and approval, a plan to avoid or minimize any delay. Such a plan may include, without limitation, increasing the Contractor's workforce; increasing the number of working hours per shift, shifts per workday, workdays per week, the amount of construction equipment, and rescheduling of activities, or any combination thereof; to achieve maximum practical concurrency of work efforts and eliminate the cause of such delay. The Contractor agrees that such actions as described in this paragraph or other action deemed necessary by the Contractor will be taken promptly and without additional cost to the Owner.

8. Any request for time extensions or damages due to delay will only be considered where it is proven by the Contractor, using acceptable scheduling techniques, that the project's contractual intermediate milestones or contract completion dates have been directly impacted by the alleged issue causing the delay. This does not preclude the Contractor's right to finish the Project early. It does explicitly establish the condition upon which the Contractor shall be entitled to request time extensions or delay damages.

B. Construction Schedule Technical Requirements

1. The Critical Path Method (CPM) shall be used to plan, schedule, execute and report the status of work under this contract. The CPM Construction Schedule shall be developed

utilizing a Scheduling Software approved by Owner. It shall include and properly coordinate dates for performance of all divisions for each major portions of the work, including completion of off-site requirements and tasks.

2. The objective of the CPM Construction Schedule is to define and plan the reasonable timing and sequencing of all work, from Letter of Intent or Notice to Proceed to Final Contract Completion (along with interim Milestone Completion dates required by the contract) without exceeding the Contract Time limits. At a minimum, CPM activities shall be used for defining the following:

   a. Permitting
   b. Submittal/procurement/approval process (including shop drawing preparation)
   c. Material and equipment fabrication and delivery
   d. Construction/Installation
   e. Trade coordination
   f. Shutdowns
   g. Owner performed work and Owner-provided items
   h. Work of Other Contractors (indirect) hired by the Owner
   i. Governing Agencies inspections
   j. Punch list
   k. Commissioning
   l. Clean-up and project close-out
   m. Contract Completion/Occupancy

3. The Construction Schedule level of detail shall be broken down to the extent individual activities do not combine (a) Subcontractor work; (b) distinct divisions of work; (c) work in separate facilities or areas; or (d) rough-in and finish items of work. Construction/Installation activities shall not exceed duration of fifteen (15) workdays and Owner review/approval activities are to include a reasonable time for review depending on the size and complexity of the submittal.

4. Preparation of the "Baseline" Construction Schedule shall commence following the issuance of a Letter of Intent, and shall be submitted to the Architect/Engineer and Owner (or other designee of the Owner) within twenty-eight (28) calendar days of issuance of the Letter of Intent. The Architect/Engineer and Owner will review and provide comments as it relates to the schedule. The Construction Schedule must involve input from all major subcontractors and be signed by the Contractor and all Primes/Subcontractors indicating their approval in the accuracy of the Baseline Construction Schedule and/or Schedule Updates. Submittal and approval of the Baseline Construction Schedule and/or Monthly Schedule Updates are required prior to the corresponding progress payment being released.

5. The Contractor will utilize "Retained Logic" as the method of calculating the Construction Schedule and Updated Schedules, which will be computer generated and computer drawn.

6. The Construction Schedule requirement shall include but not be limited to (a) Baseline

Schedule; (b) Monthly schedule updates, (c) Weekly 2 week look-ahead schedules.

7. The Contractor shall provide the current updated Construction Schedule for review and discussion at each regular progress meeting. In addition, the Contractor shall prepare a two-week look-ahead schedule for distribution at the progress meetings. This information shall be derived directly from the current Construction Schedule. The two-week look-ahead schedule shall include all activities scheduled to commence, continue or complete in the upcoming two weeks.

8. Each monthly schedule submittal will consist of one electronic file containing current schedule files or back-up, narrative, reports and plots discussed later in this section. Each monthly schedule shall be submitted using the Unifier Transmittal process. Each schedule submittal shall be uniquely identified as to which revision and/or update and will incorporate any Owner schedule review comments from previous schedule submissions. The date of the data shall be within two (2) calendar days of the Schedule submittal date.

9. The Construction Schedule shall meet the following criteria:

   a. Activity descriptions shall be clear and concise

   b. Activities shall be coded with sufficient detail to identify the activity as to phase, type of work, responsibilities, area of work, interface with other contracts, and any other coding necessary to accurately describe or sort the work activity.

   c. Activity durations shall be sufficiently short to accurately disseminate an item of work with the maximum installation activity not to exceed fifteen (15) workdays.

   d. Architect/Engineer and Owner review and approval activities will allow for sufficient time depending on the size, quantity of and complexity of the submission(s) (14 calendar days minimum).

   e. Logic ties shall be shown on graphics at the discretion of the Owner. Logic ties shall be accurate and reasonable with no regard to preferential logic that would sequester float for any one party. Logic ties will be reasonable to the point that a true critical path is identifiable from the beginning of the project (Letter of Intent) to the Final Completion milestone. Constraint dates are to be used at a minimum with a description for their basis if used. No open-ended activities shall be allowed.

   f. The Construction Schedule shall allow for and depict: recognized national holidays, proposed number of workdays per week for each activity (calendar), adherence to specific restrictions, constraints and contract completion milestones (interim and final) stipulated in the contract documents and work of separate Contractors.

   g. Contractually specified interim Completion Milestone dates shall be constrained to show negative float, if the early finish date of the last activity in that phase

falls after the interim Milestone Completion date.

10. For all major equipment and materials fabricated or supplied for this project, the Construction Schedule shall show a sequence of activities including:

    a. Preparation of submittal shop drawings, samples and O&M instructions.
    b. Review of shop drawings, samples and O&M instructions by the Architect/Engineer (allow reasonable time for review depending on size and complexity of the submittal, minimum 14 calendar days).
    c. Shop fabrication and delivery
    d. Erection or installation
    e. Testing of equipment and materials
    f. Required dates of completion
    g. Instruction of operating personnel

11. Baseline Construction Schedule and Periodic Schedule Monthly Update submittals shall include the following information:

    a. Report content:
        1) Activity number
        2) Activity description
        3) Activity durations in work days (not to exceed 15 workdays)
        4) Remaining durations in work days
        5) Early and late start dates (Actual dates when progressed)
        6) Early and late finish dates (Actual dates when progressed)
        7) Percent complete
        8) Total float
        9) Free float
    b. An electronic file of the schedule files with all current schedule information.

12. If a Construction Schedule revision is required as determined by the Owner, Contractor or Architect/Engineer, the Contractor must include a complete schedule submittal with reports accompanied with a detailed narrative report describing the basis for any and all changes proposed by the Contractor. The Contractor cannot make significant revision(s) to the schedule without written approval by the Owner.

13. Schedule float is not for the exclusive use of any one party and should be shared for the projects benefit. The Contractor's work shall proceed to the early start dates and the Owner shall have the right to reserve and apportion float time according to the needs of the project.

14. If any of the Project Contract Milestones fall behind more than five (5) workdays, the Contractor is required to develop a Time Recovery Plan and Schedule, which shall be monitored weekly by the Contractor. The Contractor shall detail within the next Construction Schedule submittal narrative, the reorganization means and methods instituted in the schedule recovery plan to get back to the contract completion date(s). The recovery period should be achieved within the shortest reasonable time.

a. If the recovery plan does not achieve its goal by the next pay request period, the Contractor will be required to develop another recovery plan until the Contract Completion Milestones are back on schedule.

b. If the recovery plan has sufficient regained compliance with the Project Milestone Dates, use of the Baseline Construction Schedule will be resumed.

15. Time Extensions/Adjustments will only be granted when the Contractor can accurately demonstrate through the use of the Construction Schedule and accepted scheduling techniques, the need for a time extension due to delays, change orders or impacts by others. Schedule fragments and/or critical path schedule analysis shall be developed and submitted with each change order or other request for time adjustment. Time extension requests shall be submitted within ten (10) days of the onset of the occurrence impacting the Construction Schedule. Failure to submit this information by the time stated above shall result in rejection of the request. Based primarily on information provided by the Contractor, the Owner will decide the extent of impact and respond within a reasonable time depending on the complexity of the analysis required.

a. If the time extension request is approved, the impact period will then be incorporated into the Construction Schedule.

b. If the time extension request is rejected, no change to the project schedule will be permitted.

16. The Contractor shall coordinate its work with the Owner and other Subcontractors and shall cooperate with other Subcontractors by utilizing orderly progress toward completion in accordance with the work scheduled.

17. The Construction Schedule shall include without limitation, milestones, shop drawing submittals with time allowed for Owner approval, procurement and construction of all major items of work, depicted in weekly increments.

18. The Contractor shall submit updates to the Construction Schedule on no less than a monthly basis and shall submit updates with each Application for Payment, as required by paragraph 3.10 of the Conditions of the Contract.

19. The Contractor shall coordinate its work with the Owner and other Subcontractors and shall cooperate with other Subcontractors by utilizing orderly progress toward completion in accordance with the work scheduled.

1.4 SUBMITTALS

A. Submittal Schedule

1. Concurrently with the development of the Contractor’s Construction Schedule, the Contractor shall prepare a complete schedule of submittals. Submit the initial Submittal Schedule along with the Construction Schedule, at, or prior to, the Pre-Construction Conference.

a. Coordinate the Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products, as well as the Contractor's Construction Schedule.

b. Prepare the schedule in chronological order. Provide the following information:
- Scheduled date for the first submittal
- Related section number or specification number
- Submittal category (Shop Drawing, Product Data, Calculations, Test Results or Samples.
- Name of the subcontractor
- Scheduled date for resubmittal
- Scheduled date for completion of the A/E's review

2. Distribution: Following the Owner's response to the initial submittal, print and distribute copies to the Project representative, A/E, Owner, subcontractors, suppliers and other parties required to comply with the submittal dates indicated. Keep copies at the Project Site at all times.

a. When revisions are made, distribute to the same parties and post at the same locations. Delete parties for distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

3. 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, or as requested by the Project Representative.

A. Submittals are required for, but are not limited to, each of the following. The Contractor should refer to each of the following referenced sections for additional requirements of each submittal. All submittals are to be processed electronically using Unifier.

1. GENERAL SUBMITTALS
Section 012000 for Contract Breakdowns
Section 013000 for Safety Documentation
Section 017000 for FADE Log

2. AS-BUILT DRAWINGS
As-built Drawings are required as specified in Section 017000.

3. CERTIFICATES OF INSPECTION
Certificates of Inspection are required as specified in Section 017000.

4. OPERATION AND MAINTENANCE DATA
Operation and maintenance data is required as specified in Section 017000.

5. GUARANTEES
Guarantees are required as specified in Section 017000.

B. Shop Drawings and Samples

1. The Contractor shall review, stamp with their approval, and submit via the Unifier Submittal process to the Project Representative all Shop Drawings and Samples asked for in these specifications, or deemed necessary by the Architect/Engineer.

2. Work will not begin on any item requiring Shop Drawings or samples until the Contractor receives approval in writing from the Architect/Engineer. Any material or item, ordered or fabricated prior to final approval shall be at the Contractors' risk. No changes shall be made on the approved drawings or samples without the written consent of the Architect/Engineer. Each Shop Drawing or Sample shall be properly identified as to MSU project title and number, Contractor, item, etc., with cover sheet, stamp, tag, etc., so as not to be confused with any other. The Contractor shall direct specific attention with written explanation to any deviation from what is specified or shown on the drawing.

C. Shop Drawings

1. The Shop Drawing will be identified by job name, date, Contractor name and name of person reviewing for compliance with Contract Documents. Shop Drawings are drawings, diagrams, schedules and other data specifically prepared by the Contractor to illustrate some portion of the Work for which submittals are required by the Contract Documents. The purpose of their submittal is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.

2. The Contractor shall review for compliance with the Contract Documents, approve and submit to the Owner all Shop Drawings required by the Contract Documents. Submittal shall be with reasonable promptness and in such sequence as to cause no delay in the Work or in activities of the Owner or their separate Contractors. Submittals which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor may be returned by the Owner without action.

3. By approving and submitting Shop Drawings the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

4. The Owner will review and approve or take other appropriate action on the Shop Drawings submitted by the Contractor only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. Review of Shop Drawings 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 Owner's review shall not constitute approval of safety precautions or, unless otherwise stated by the Owner, of any construction means, methods, techniques, sequences or procedures. The Owner's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

E. Samples

1. Samples shall be submitted as directed to provide a representative sample. Samples shall be physical examples, from the actual materials, to be used whenever practical. All packing and transportation charges on samples shall be paid by the Contractor.

2. A Submittal record shall be created in Unifier for each sample, indicating the manufacturer and specifications, and informing the Owner of the status of delivery of the physical sample. The physical sample will be retained by the Owner. The Submittal record will be returned to the Contractor with a review status by the Owner.

3. Approval of Samples shall be generally for quality, color, and finish, and shall not modify the requirements of any of the Contract Documents as to dimensions or design.

1.5 SPECIAL PROCEDURES

A. Constructor Safety Requirements

1. MIOSHA regulations apply to all university projects. Each constructor is responsible for ensuring compliance with "all applicable requirements" that govern their work, including any additional regulations, interpretations, clarifications, and consensus standards incorporated therein by reference.

2. MSU-specific safety requirements are published in the Constructor Safety Requirements Manual. The most current version of this manual is available at http://www.ehs.msu.edu/contractors. Constructors will be held to the version of the manual in effect at the time of contract execution.

3. Requirements specific to work at Michigan State University generally fall into one of two categories:

    a. Administrative Requirements, such as but not limited to communication, planning, documentation, submittals, notifications, reporting, and inspections.

    b. Safety Requirements unique to work at MSU, such as but not limited to Control of Hazardous Energy/Lock Out Tag Out, Confined Space, Electrical, Excavations, Fall Protection, Hot Work, etc.

4. Constructor shall submit a Site-Specific Safety Plan or work under an existing Area-Specific Safety Plan where allowed, as described in the MSU Contractor Safety Requirements Manual.

B. Hazardous Materials

1. If the Contractor suspects a material, preexisting or newly discovered, within the scope of this project to be a hazardous material such as, asbestos, lead, polychlorinated biphenyl or any other potentially hazardous material, that has not already been identified and/or in the scope of work for the Contractor to abate, notify the Project Representative immediately. Do not impact or disturb the material in question until it has been determined to either be non-hazardous, included in the original scope of work, or until other arrangements can be made with the project representative and the MSU Department of Environmental Health and Safety (EHS).

2. Due to the age of buildings on the Michigan State University campus, all coated surfaces shall be assumed to contain lead-based paint. This includes but is not limited to any type of paint, primer, coating, lacquer, or varnish on any building component. Proper precautions must be taken to ensure that workers and building occupants are not exposed to airborne lead concentrations at or above the OSHA Action Level (AL) of 30 ug/m3.

3. If work will be conducted on any coated surface at MSU, the contractor must submit to the Department of Environmental Health and Safety (EHS) and Infrastructure Planning and Facilities Project Representative current proof of appropriate detailed written lead work plan in accordance with 29 CFR § 1926.62 (Michigan Part 603). This submittal will include proof of training, written respirator program, and negative exposure assessments from projects with similar conditions at a minimum. Contractors performing work on campus must follow the provisions of the MSU Lead Management Program from EHS.

4. Any work that impacts Lead shall comply with the provisions of the MSU EHS Lead Management Plan.

5. Any work that impacts Asbestos shall comply with the provisions of the MSU EHS Asbestos Management Plan.

1.6 Requests for Information

A. Requests for Information (RFI's) shall be processed within PlanGrid, using the RFI business process in the IPF PlanGrid Standardization Guide. Failure to complete the tasks within the Plangrid time frames shall not be a basis for a delay claim.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION
Not Used

END OF SECTION

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1- GENERAL

1.1 TEMPORARY UTILITIES

A. General

1. The Contractor for the general construction work shall be responsible for all items specified in Section 015000. The Contractor shall install and maintain all items until project is finished and shall remove same and restore areas to their original conditions.

B. Temporary Electricity

1. The Contractor may use any permanent electrical outlets in the construction area.

2. Construction lighting shall be turned off during unoccupied periods, with the exception of lighting required for safety reasons such as path of egress.

3. Temporary service for heavy loads, or where no other service is available, will be provided by the general Contractor at the Contractor's expense. Power for temporary service connected to public utility company lines, (before an MSU service meter) will be paid for by the Contractor. Power for temporary service connected to the MSU power system, or after an MSU service meter, will be furnished by the Owner at no charge.

4. The contractor shall install temporary lighting within the construction area consistent with MIOSHA requirements.

C. Temporary Heat

1. All equipment and labor for temporary heat shall be furnished by the Contractor. Use of University utilities for temporary heat will be at the discretion of the Owner. The cost of natural gas or steam for heating new structures or other applications requiring temporary heat will be paid by the Contractor.

D. Temporary Telephone Service

1. If there is no University phone at the immediate work site, the Contractor shall provide a temporary job site telephone and/or provide the Job Superintendent with a phone activated paging device or cell phone.

E. Temporary Water

1. Each Contractor may use water for construction purposes from the nearest University source.

F. Temporary Sanitary Facilities

1. A toilet in the work area may be used by the Contractor's employees.

2. Where there is no toilet in the work area, an approved chemical type portable toilet will be provided by the Contractor.

1.2 VEHICULAR ACCESS AND PARKING

A. Parking Regulations

1. Unless otherwise directed, all non-University personnel working on the Campus of Michigan State University are required to park as Visitors. Between 7:00 a.m. and 6:00 p.m., Monday through Friday, Visitors may park only in metered parking spaces or gate controlled parking lots.

2. Commercial permits are available from the Department of Police and Public Safety (355-8440), which will allow parking in specific areas. The cost of a commercial permit is the responsibility of the Contractor.

3. Permits for one day parking in areas reserved for university employees are available to Contractors or their personnel from the Department of Police and Public Safety at the current rate, with a signed note from the Project Representative.

4. Parking permits are not required for vehicles south of Mount Hope Road.

1.3 TEMPORARY BARRIERS AND ENCLOSURES

A. General

1. The Contractor shall provide, install, and maintain necessary temporary barrier warning signs, and other safety measures to protect the public, property, and plant growth.
2. The Contractor will be required to work within limitations imposed by the University Police and Public Safety Department with respect to vehicular and pedestrian traffic. When approved by the Owner, if it becomes necessary to occupy a traffic lane for **ANY** length of time, proper directional signs, flashers and barricades shall be provided at the Contractor's expense in accordance with the most recent edition of the Michigan Manual of Uniform Traffic Control Devices. The Contractor will replace if damaged or stolen, all barricades, flares, and night protection at Contractor’s expense, all being considered as incidental to the work.

B. Dust Control

1. Temporary Partitions

a. The Contractor shall construct necessary temporary partitions to isolate the new work from the existing building.

b. Unless noted otherwise, construct partitions of 2” x 4” wood studs, 16” on center and heavy mil, fire retardant plastic sheeting securely attached so as to keep dust, dirt, and debris from spreading beyond the work area.

2. Return Air Openings

a. The Contractor shall block all return air openings in the work area so that dust will not carry into other areas of the building.

3. Site Dust

a. The General Contractor shall be responsible for eliminating airborne dust in the work area and staging area by application of appropriate mitigation measures, as approved by the Owner.

C. Security Measures

1. Temporary & Access Keying

a. The MSU Infrastructure Planning and Facilities Key Shop will furnish construction keys, and furnish and install construction cores for use during construction as deemed necessary by the Project Representative. The Contractor may pick up the construction keys at the Key Shop with the form, "Authorization for Construction Cores and Keys," completed and authorized by the Project Representative.

b. All construction keys and facility keys issued to a Contractor for a particular project will be returned to the Project Representative before final payment will be processed. If keys are not returned, the Contractor may be held responsible to pay for re-keying any and all affected facilities.

2. Campus Security and Access Control System

a. When deemed necessary by the Project Representative, temporary security access cards will be issued to the Contractor for building exterior doors, rooms, and/or spaces that are secured by the Campus Security and Access Control System.

b. On construction projects where the security system is active and armed during construction the Contractor will be assessed a false alarm fee for any unauthorized entry of a secure space and/or setting off an alarm by propping open secured doors/windows, cutting into the security wiring, removing security devices, or any other action causing an alarm.

c. The false alarm fees shall be as follows:

First occurrence	No assessed fee
Second occurrence	$500
Third and subsequent occurrences	$1,000 each

d. The breaches of security and associated fees shall be assessed by project to the Contractor, not by sub-contractor, vendor, supplier, etc.

1.4 TEMPORARY CONTROLS

A. Soil Erosion and Sediment Control (SESC)

1. The Contractor shall comply with all Contract Documents, approved SESC plans, permit conditions and with Parts 31 and 91 of Public Act 451 of 1994. The Owner shall obtain a Soil Erosion and Sedimentation Control (SESC) permit from the appropriate Municipal (MEA) or County (CEA) Enforcing Agency. Permit Fees and MEA/CEA routine inspections will be paid for by the Owner.

2. Prior to beginning any earth change, the Contractor shall retain a DEQ Certified Storm Water Operator (CSWO) to provide the required SESC reports (which include the weekly and storm event reports as well as all follow up reports for both violations and storm event corrections) on the standard DEQ form. The Contractor shall provide the reports to the Owner on a weekly basis, and retain those reports for 3 years.

3. Prior to beginning any earth change, and during the life of the contract, the Contractor shall install and maintain all temporary SESC measures as shown on the Contract Documents, SESC plans, and as directed by the Owner, CSWO, DEQ, or MEA/CEA, until MSU officially takes over responsibility for the site.

4. Immediately prior to MSU taking responsibility for the site, the Contractor:
   a. Will be required to clean all catch basins affected by the construction, both within the Contract Limits and all surrounding roads and lawn areas when soil may have spread as the result of construction activities.
   b. Shall put all temporary SESC measures in satisfactory condition as determined by the CSWO.

5. All temporary SESC measures will remain in place and will become the property of the Owner when responsibility for maintaining the SESC measures becomes the Owner's responsibility.

6. The Contractor shall conduct all excavation, filling, grading and clean-up operations in a manner such that sediment generated by wind or water is not discharged off site or into any storm sewer, drainage ditch, river, lake, air or underground utility system. Stage the work per plan to minimize the area of exposed soil, thereby reducing the opportunity for soil erosion.

7. Water from trenches and other excavation shall be passed through an approved filtration bag to remove sediments from the water before it is released into the storm water drainage system.

8. If sediment extends beyond the project limits, the Contractor shall be responsible for cleanup and restoration of all surfaces and utility systems to the condition that existed prior to the Contract award.

9. All SESC measures shall be maintained daily.

10. Should violations (irrespective of a fine being assessed) be identified by the Owner, CSWO, MEA/CEA or DEQ, they shall be corrected within 24 hours of notification. The correction(s) shall be approved by the Owner, CSWO, MEA/CEA or DEQ. All subsequent inspections performed by the Owner, CSWO, MEA/CEA or DEQ as a result of the violation (and any other associated costs) will be paid by the Contractor. If identified violations are not corrected within 24 hours of written notice, the Owner shall have the right to make necessary repairs at the Contractor's expense, without being required to provide further notice to Contractor.

11. Fines assessed as a result of the violation for non-compliance of the SESC provisions, will be paid by the Contractor. If a "Stop Work" order for non-compliance is issued, a time extension request for that time period will **not** be granted. (Fines could be assessed up to and including $25,000/DAY for each violation.)

12. Only one Seven Day Notice will be issued for violations of the SESC provisions. Should subsequent violations be identified, the contractor will be expected to make the satisfactory correction within 24 hours of notification. Should the corrections not be made, the Owner, without further notice to the Contractor, will correct the violation. The cost of the corrective action will be charged to the Contractor.

1.5 CONSTRUCTION DEBRIS CONTROL

A. The Contractor shall provide and administer a system for disposal of construction debris, and shall be responsible for seeing that the site and the new building are at all times free of accumulated debris caused by the construction. For purposes of this paragraph, debris shall include ALL materials used in construction including construction roads and pads. Special attention should be given to materials that could leach into the ground, including but not limited to lime based materials, all chemicals, and any liquids except clean water.

B. The Contractor shall comply with LEED Materials & Resources Credit 2, including documentation of the Construction Waste materials recycled, reused and sent to the landfill, using the Construction Waste Management form and process provided by the Owner in Unifier. This form shall be submitted monthly, and will be generated from completed payment applications. Negative reports are required.

C. This shall include, but not be limited to, rubbish containers conveniently located throughout the site for the daily disposal of debris directly into them from each work location. Debris shall not be allowed to accumulate on the ground through-out the site overnight.

D. All combustible debris shall be removed to a solid waste disposal site properly licensed under Act 87 of the Public Acts of 1965 of the State of Michigan.

E. No burning of debris will be permitted on the Project site or elsewhere on the Owner's property.

F. Should the Contractor not execute the work required in this section, the Owner reserves the right to perform the work by other forces and deduct the cost from the contract price.

1.6 CONFINED SPACES

A. The workplace may contain permit confined spaces and entry is allowed only through compliance with a confined space program as defined by 29 CFR 1910.146. The contractor is responsible for assessing real or potential atmospheric hazards and other serious safety and health hazards in the confined space. MSU will make available records of known confined space hazards. The contractor shall provide all necessary equipment for confined space entry. If MSU personnel will be working in or near confined spaces occupied by the contractor, the contractor is required to coordinate activities with the Project Representative. The contractor will inform the Project Representative of procedures followed and hazards confronted or created during entry operations.

1.7 LOCK-OUT/TAG-OUT PROCEDURE

A. The Contractor shall conform to Michigan State University Infrastructure Planning and Facilities lock-out/tag-out procedure. Copies are available from Planning, Design and Construction, Infrastructure Planning and Facilities Building, Michigan State University.

1.8 FM RED TAG PERMIT MONITORING SYSTEM

A. When working on fire protection sprinkler systems the Contractor shall conform to the Factory Mutual Red Tag Permit Monitoring System modified by notifying the Project Representative in lieu of the Emergency Organization, Public Fire Department, and Factory Mutual. Documentation is available from Factory Mutual, (781) 255-4359.

1.9 FM HOT WORK PERMIT SYSTEM

A. For all hot work operations, the Contractor shall conform to the Factory Mutual Hot Work Permit System modified by notifying the Project Representative in lieu of the Fire Safety Supervisor and Factory Mutual. Documentation is available from Factory Mutual, (781) 255-4359.

1.10 HAZARDOUS SUBSTANCE SPILLS

A. Releases of hazardous substances that pose a significant threat to health and safety, or that, by their very nature, require more than a routine response, are emergency situations. If a release of an emergency nature occurs, call 911 immediately. Provide all applicable information and stay on the phone until told to hang up. If a non-emergency release of a hazardous substance occurs, contact the MSU Infrastructure Planning and Facilities Project Representative immediately.

1.11 ROOF PROTECTION

A. In the event a roof has to be used as a storage, work and/or walkway area, the following protective measures shall be employed.

1. The size and location of the storage, work or walkway areas shall be approved by the MSU Infrastructure Planning and Facilities Project Representative.

2. The storage, work or walkway area protection shall consist of a 1-inch layer of water resistant insulation such as EPS, and a layer of ½ inch plywood. Stagger the seams of the insulation and plywood; use plywood clips to prevent cupping.

3. The perimeter of the area shall be lined with barricades and warning tape to ensure that all traffic will stay on the protected areas.

1.12 CRANE HOISTING

A. Crane hoisting of equipment or materials over occupied spaces shall be performed at the convenience of the Owner, with arrangements made by the Project Representative.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Storage and Protection

1. The Contractor shall be responsible for work, material, and equipment until finally inspected, tested, and accepted. The project shall be protected against theft, injury, and damage. Material and equipment received on the site shall be carefully stored until installation.

B. Staging Area

1. Should the Contractor require exterior staging or on-site storage of materials - the location of this area must be agreed upon prior to actual use of the space by the Project Representative and the Contractor. The area will not be within the drip-line of any tree or in plant beds, as per Section 015000.1.3.D.3.

2. If this exterior area is outside the fenced project site, the area shall be enclosed with a minimum 4' high welded wire fence, with metal fence T-posts not exceeding 8' on center. Fence fabric shall be supported by either a top bar or a tension cable.

3. The Contractor shall be responsible for the cost of placing and removing the fence.

4. Each designated area shall have only one access route from the road or drive.

5. The area is not to be used for employee parking, but may be utilized by the Contractors' vehicles and equipment necessary to service the project.

6. Any areas damaged as a result of the staging operation shall be repaired by the Contractor, at no additional cost to the Owner.

PART 2 - PRODUCTS
Not Used

PART 3 - EXECUTION
Not Used

END OF SECTION

SECTION 017000 - EXECUTION REQUIREMENTS

PART 1- GENERAL

1.1 EXAMINATION

A. Pre-Bid Site Inspection

1. Each Bidder shall be held to have visited the site of the proposed work before submitting their proposal and to have familiarized themselves with all existing conditions affecting the execution of the work in this project. No allowance or extra consideration on behalf of the Contractor or Subcontractor will subsequently be made by reason of failure to observe the site conditions.

1.2 PREPARATION

A. Protection of Work and Property

1. Contractor shall protect existing and new work as required by this construction or as requested by the Project Representative.

2. Interior Protection

a. This will include, but not be limited to the wall, floor, and ceiling finishes to remain at the construction site, along the access route to the site, existing elevators, and other areas such as roofs and mechanical rooms where related work is specified or required.

3. Exterior Protection

a. The Contractor shall be responsible for any damage to existing facilities, including but not limited to the following: buildings, trees and shrubs, walks, roads, utility systems, terraces and steps, lights, and unreasonable turf damage as determined by the Project Representative. Damage shall be repaired by the Contractor in accordance with MSU's Construction Standards at no cost to the Owner.

b. No crawler cranes, bulldozers, or other equipment, fitted and running on steel treads, shall be permitted to traverse any walk, road, street, or other thoroughfare on the Campus of Michigan State University. Where it is necessary to unload such equipment on these thoroughfares, and when approved by the Project Representative, planking shall be provided to protect same. If this is not done, and damage is observed, the cost of replacing shall be the burden of the Contractor causing such damage.

c. Staging zones for materials and equipment shall be coordinated with Project Representative. They are to be placed on paved areas where possible. Set-up and storage areas shall be fenced with minimum 6-foot high pedestal-type chain link

fencing. Locations shall be reviewed with the Department of Police and Public Safety and approved by the Project Representative.

d. Crane hoist dates shall be coordinated with Project Representative for sufficient notice to building users. Project Representative shall direct the notice to the building users and coordinate with DPPS.

e. Owner may provide temporary access-ways in turf or root zone areas, as determined in pre-construction walk-through. For heavy equipment on turf areas, Alturna mats or approved equal, must be utilized for travel and set-up zones.

f. All electric, telephone, and steam vaults and water valves shall be protected and remain accessible at all times. Heavy equipment shall not be run over the top of vaults or valve boxes, nor shall materials be stored over them.

g. Contractor shall provide lighted barricades if building entrances or pedestrian walks are closed after work hours or on the weekends.

h. Tree pruning, plant tie-back, and vine removal shall be done by the Owner, as coordinated with the Project Representative, and as noted in Section 015000.1.3.D.2.a. Trees or other plant material shall not be used as anchor points for any lines or equipment.

i. Plant protection as directed by the Project representative:

   a. Minor work: Plants adjacent to, or below work zones are to be washed off daily. In no case shall masonry dust or other construction debris remain on plants for more than 24 hours.
   b. Major work: Plants adjacent to, or below work zones are to be covered with breathable woven mesh tarp. Tarp shall be removed at the end of each day and debris disposed of. Debris and dust shall not be absorbed into soil.

B. Field Engineering

1. Existing Utilities

   a. Furnish information necessary to adjust, move or relocate existing structures, utility poles, lines, services or other appurtenances located in or affected by construction.

2. Site Improvements

   a. Locate and layout all site improvements including, but not limited to, pavements, structures, earthwork and utility locations and grades.

3. Structure Lines and Levels

   a. Locate and layout batter boards for structures, building foundations, column grids

and locations, floor levels and control lines and levels required for mechanical and electrical Work.

1.3 EXECUTION

A. Cutting and Patching – Concrete and Masonry

1. The Contractor shall be responsible for any cutting, fitting, and patching that may be required to complete this project, except for core drilling required for mechanical and electrical installations, which shall be the responsibility of the Mechanical or Electrical Contractor.

2. The Contractor shall not endanger any work of any other Contractors by cutting, excavating, or otherwise altering any other work and shall not cut or alter the work of any other Contractor except with the written consent of the Architect/Engineer.

3. No cutting of structural members of the building, likely to impair its strength, shall be done without written approval from the Architect/Engineer.

4. To avoid damage to hidden utilities and structural re-enforcement any cutting or core drilling over one inch in diameter, through concrete floors and slabs will be x-rayed/scanned by the contractor prior to cutting.

a. A qualified engineer will conduct an on-site assessment before any cutting or drilling of a pre-tensioned or post-tensioned component or other structural component of a building or structure commences. The assessment will be documented and provided to the person contracted to carry out the work.

b. If any load bearing member is cut, cored or removed all the requirements of 29 CFR 1926 Subpart T (LARA Part 20) shall apply. This will require notifications to the DEQ 10 working days before cutting begins. Emergency notifications are possible under specific conditions.

c. The responsible person for the project shall ensure substantial compliance with the requirements for exposure to Silica Dust. Substantial compliance will also be required for all other construction safety standards and published by the State of Michigan or Federal OSHA.

d. Work shall be conducted outside of the regular hours to avoid disturbing the building occupants. An exception to this rule will be granted only by the project manager and shall be in writing.

e. The MSU project representative or employee shall be responsible for locating all utilities in the area to be cut. This part of the job is mandatory and shall be given appropriate attention. Minimally the responsible person shall review all available prints and consider structural scanning. The MSU representative or employee shall take necessary steps to isolate and lock out any energy sources that may be jeopardized by the cut to protect worker safety and avoid equipment damage. In

some cases, utilities will need to be cut and relocated to conduct the work. The responsible person shall take steps to notify repair persons in advance of the anticipated timing and scope of the repair project or the need for temporary services.

f. Responsible person shall inspect the area to ensure that no damage has occurred and that the area is cleaned to an acceptable level.

5. Cutting and Patching for Mechanical Work

a. The Mechanical Contractor shall be responsible for any core drilling required to complete their work.

b. The Mechanical Contractor shall be responsible for the accurate location of all openings necessary for the installation of the mechanical work. Any additional openings required to move their work due to an error in the initial layout and the repair of inaccurate openings, shall be made at the expense of the Mechanical Contractor.

6. Cutting and Patching for Electrical Work

a. The Electrical Contractor shall be responsible for any core drilling required to complete their work.

b. The Electrical Contractor shall be responsible for the accurate location of all openings necessary for the installation of the electrical work. Any additional openings required to move their work due to an error in the initial layout and the repair of inaccurate openings, shall be done at the expense of the Electrical Contractor.

B. Salvaging of Materials

1. Materials or equipment shown on drawing or specified herein to be removed, which are not to be reused or salvaged, shall become the property of the Contractor and will be removed from University property and disposed of legally.

2. Salvage the following items to the locations as directed:
   c. Bike racks and loops
   f. Face brick for repair
   h. Limestone cap

3. Deliver all fire alarm equipment removed from the job to the IPF Storage Building 210, 1457 Recycling Drive, East Lansing, MI.

4. Deliver all Best key cylinders to be removed from the job to the Key Shop in the Infrastructure Planning and Facilities Building, 1147 Chestnut Road, East Lansing, MI.

5. Salvage of Brick and Stone

a. Salvage brick and stone for patching areas shown on the drawings. All materials shall be carefully palletized and stored at the site. The Contractor shall take special care in handling stone to avoid chipping corners and scarring faces.

1.4 CLEANING UP

A. Cleaning up shall be in accordance with the General Conditions of the Contract.

B. No rubble, dust, or debris shall be allowed to accumulate or be transported throughout the building.

C. A thorough final cleaning of all of the adjacent streets, as specified by the Project Representative, will be required before final payment is made.

D. If the Contractor fails to clean up, the Owner may do so and the cost thereof shall be charged to the Contractor.

1.5 STARTING AND ADJUSTING

A. Refer to each Division for requirements.

1.6 CLOSEOUT PROCEDURES

A. In general, one or more walk-throughs will be performed with the Contractor and punch lists developed of items to be completed before the project can be closed out.

1.7 CLOSEOUT SUBMITTALS AND PROJECT DELIVERABLES

A. Operation and Maintenance Data

1. The Contractor shall provide operation and maintenance data as required in this specification, and submit the required information through use of the Unifier and PlanGrid systems.

2. Submittals for equipment and systems shall contain the manufacturer's information on installation, balancing, operating, maintenance, lubrication, and repair instructions and parts list for each component.

3. Please refer to MSU Document Submittal Standards and PlanGrid Standardization Guide.

B. As-Built Drawings

1. Submission of all As-built Drawings called for in this specification shall precede request for final payment.

2. The Contractor shall submit As-built Drawings in electronic (.pdf) format, that is not

password protected, indicating any deviations from the Contract Drawings, including contract Change Orders. Upon request of the Owner, printed copies of the As-Built drawings shall be provided as well.

3. Provide any Building Information Model (BIM) data developed for this Project to the Project Representative.
4. Please refer to MSU Document Submittal Standards

C. Facility Asset Data Exchange (FADE) Log

3. The Constructor shall furnish all information as indicated on the FADE log spreadsheet. The University's FADE procedure and requirements for asset tracking and populating the log can be found at the following web addresses:

FADE process during design phase:
https://us.promapp.com/msu/Process/Minimode/Permalink/BrVwOrmhTRjBaJ5QaaOZKI

FADE process during construction:
https://us.promapp.com/msu/Process/Minimode/Permalink/BDKsT36upoGpxJeNiakDkW

Should the Owner change the FADE process change in form or content, the Constructor is not relieved of fully executing the work required to compile the information and complete the Log.

D. Construction Safety Documentation

1. The Contractor shall provide written documentation of the following site safety information, as it pertains to the project only:

a. List of all lost time accidents.
b. Reportable incident rate (total hours worked).
c. Details of many MIOSHA site visits, including resulting citations, violations, or actions.

E. Certificates of Inspection

1. The Contractor shall provide a copy of all Certificates of Inspection called for in this specification. Refer to Section 013000 Part 1.4.B.

F. Construction Waste Management – LEED Documentation

1. The Contractor shall provide written documentation of the Construction Waste Management program, as required for LEED Materials & Resources Credit 2. A form for this purpose is provided within this specification. Refer to Section 024200, Construction Waste Management.

G. Warranty

A. The Contractor shall provide a written guarantee stating that all work performed and material furnished is free from all defects in workmanship, and material for a period of one year, unless noted otherwise, after the equipment has been accepted by the Owner. Final payment or Certificate of Substantial Completion, whichever is issued first, shall constitute Owner acceptance.

B. Additional warranties are required for site concrete pavement (Section 321313), curb/gutter (Section 321613), bituminous pavement (Section 321216), and specific mechanical equipment (Division 23)

H. Final payment

A. The contractor shall provide a sworn statement with final payment. The statement shall detail all subcontractors paid on the project and other information detailed in the link below:

https://api.gis.msu.edu/edms/file/{C500C6DD-E852-11ED-0000-76DDD13A85C5}

PART 2 - PRODUCTS
Not Used

PART 3 - EXECUTION
Not Used

END OF SECTION

SECTION 024113– SITE DEMOLITION

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. Provide labor, materials and equipment as necessary to complete work as indicated on the Drawings and specified herein.

B. This section includes the removal of existing structures, fences, pavements, and other items indicated on the Drawings or specified, or both.

C. Related sections include the following:
1. Division 01 Section “General Requirements – Temporary Facilities and Controls.”
2. Division 31 Section “Site Clearing.”
3. Division 31 Section “Earthwork.”

1.3 PROJECT CONDITIONS

A. Do not close or obstruct streets, walks or other occupied or used facilities without permission from the Project Representative. Provide alternate routes around closed or obstructed traffic ways if required.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 DEMOLITION OPERATIONS

A. At the direction of the Project Representative, certain items within the Project limits may be salvaged by the Contractor to the Owner. Salvaged materials or equipment will be indicated on the Drawings or specified. Salvaged items not indicated or noted to be reinstalled shall be delivered to designated location(s) on campus as directed by Project Representative.

B. Materials to be recycled shall be hauled from the project to Beaumont Landscape Supply, 4080 Beaumont Road, East Lansing MI 48824. Call (517) 884-4880 to coordinate drop-off time and location.

1. Items to be salvaged include, but are not limited to:
a. Post and chain fencing
b. Ornamental fencing and gates

c. Chain link fence
d. Catch basins and manhole frames and covers
e. Bike racks
f. Litter receptacles and ash urns
g. Light fixtures and poles
h. Face brick
i. Paver brick
j. Limestone cap
k. Steel and concrete bollards
l. Irrigation system components, including but not limited to valves, heads, and vacuum breakers

2. Materials to be recycled include, but are not limited to:
   a. Concrete material (pavement, curb and gutter, walls and footings)
   b. Bituminous pavement millings
   c. Topsoil
   d. Clean pavement base aggregate

C. The use of explosives is not permitted.

D. Conduct demolition operations and the removal of debris to ensure minimum interference with adjacent roads, streets, walks, and other facilities, operations and people.

E. Conduct operations to prevent damage by falling debris or other cause to adjacent buildings, structures, vegetation to be retained, and other facilities as well as persons.

F. Promptly repair damages caused to adjacent facilities by demolition operations, as directed by the Project Representative. Repairs shall be made at no cost to the Owner.

3.2 REMOVAL OF PAVEMENTS

A. Saw cut concrete curb and gutter and flatwork on nearest existing joint beyond area required to be removed as shown on the Drawings.

B. Provide a minimum of 18 inches between the new gutter pan edge and the bituminous paving edge.

3.3 CLEANUP

A. Contractor shall be responsible for disposing debris from demolition and salvage operations. Disposal of debris shall be done legally off the Owner's property, except that specifically requested for salvage by the Project Representative. Burning of debris is not permitted.

B. During demolition operations, keep dust to a minimum using appropriate methods.

C. During demolition operations, access roads and adjacent concrete pathways shall be maintained broom clean. Roads shall be cleaned by using a pick-up type sweeper. A front-end tractor mounted sweeper is not permitted.

D. The site shall be graded to provide surface drainage and shall be left in a clean condition.

END OF SECTION 024113

SECTION 024200– CONSTRUCTION WASTE MANAGEMENT

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. This 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 sections include the following:

   1. Division 01 Section "General Requirements – Temporary Facilities and Controls."

1.3 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 and clearing debris including soil, vegetation, and rocks are not to be included.

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: Collect, reprocess and reuse of materials diverted or recovered from solid waste stream.

E. Salvage: Recovery of demolition or construction materials from existing buildings or construction sites and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction materials from existing buildings or construction sites and subsequent incorporation into the Work.

1.4 PERFORMANCE GOALS

A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of 50 (75) percent by weight of total waste generated by the Work.

1.5 SUBMITTALS

A. Waste Management Plan: Submit 3 copies of plan within 14 days of date established for commencement of the Work

B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit 2 copies of report. Include separate reports for demolition and construction waste. 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 or cubic yards.
5. Quantity of waste recycled, both estimated and actual in tons or cubic yards.
6. Total quantity of waste recovered (salvaged plus recycled) in tons or cubic yards.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

C. Waste Reduction Calculations: Before request for Substantial Completion, submit 2 copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

F. 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.

G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licenses to accept them. Include manifests, weight tickets, receipts, and invoices.

H. LEED Submittal: LEED letter template for Credit 2, signed by Contractor, tabulating total waste material, quantities and weight (tons) diverted and means by which it is diverted, and statement that requirements for the credit have been met.

1.6 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: LEED Accredited Professional by U.S. Green Building Council, or person familiar and experienced with LEED construction waste management requirements.

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section. Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

A. General: Develop plan consisting of waste identification, waste reduction plan, and cost/revenue analysis. Include separate sections in plan for 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 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 for 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 on Project site where materials separation will be located.

D. Plan for and describe the means for securing waste containers from unauthorized users.

E. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:

1. Total quantity of waste.

2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
6. Savings in hauling and tipping fees by donating materials.
7. Savings in hauling and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement waste management plan as approved by Owner. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.
2. Observe and follow site measures that prevent cross-contamination of waste. Cross-contamination could render some portion of waste to be non-recyclable, thereby disqualifying the Project from earning LEED Credit MR 2, and the exemplary performance credit of diverting 95% of waste from landfill.

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. The Construction Superintendent may perform the role of the Waste Management Coordinator.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at the Project site.

a. Distribute waste management plan to everyone concerned within three days of submittal return.
b. Distribute waste management plan to entities upon execution of their contracts. 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.

a. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
b. Comply with Division 01 Section "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:

a. Clean salvaged items.
b. Pack or crate items after cleaning. Identify contents of containers.
c. Store items in a secure area until delivery to Owner.
d. Transport items to Owner's storage area off-site designated by Owner.
e. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closes, leave door hardware attached to doors.

3.3 RECYCLING DEMOLITION AND CONTRUCTION WASTE, GENERAL

A. General:

a. Recycle paper and beverage containers used by on-site workers.
b. Concrete, masonry, or asphalt crushed and reused are to be identified and include in calculations.
c. Exclude hazardous waste from calculations.

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.

a. 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.

i. Inspect containers and bins for contamination and remove contaminated materials if found.

b. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

c. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
d. Store components off the ground and protect from the weather.
e. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING CONSTRUCTION WASTE

A. Packaging:

a. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
b. Polystyrene Packaging: Separate and bag materials.
c. 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.
d. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

a. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
b. Clean Sawdust; Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.

a. Clean Gypsum board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

D. Metals: Separate metal by type or to meet requirements of recycling receiver or processor.

3.5 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.

a. Except as otherwise specified, do not allow excessive on-site accumulation of waste materials.
b. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
c. Coordinate with each product manufacturer for take-back programs. Set aside scrap to be returned to manufacturer for recycling into new product.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 024200

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes historic treatment work consisting of cleaning historic clay brick and stone masonry surfaces.

1.2 ALLOWANCES

A. Allowances for cleaning historic masonry are specified in Section 012100 "Allowances."

1. Perform historic masonry cleaning work under quantity allowances and only as authorized. Authorized work includes work required by Drawings and the Specifications and work as directed in writing by Owner.
2. Notify Owner weekly of extent of work performed that is attributable to quantity allowances.
3. Perform work that exceeds quantity allowances only as authorized by Change Orders.

B. Preconstruction testing is part of testing and inspecting allowance.

C. Cleaning, including preliminary and final cleaning, is part of masonry cleaning allowance.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Section 012200 "Unit Prices."

1. Unit prices apply to authorized work covered by estimated quantities.
2. Unit prices apply to additions to and deletions from Work as authorized by Change Orders.

1.4 DEFINITIONS

A. Low-Pressure Spray:

1. Pressure: 100 to 400 psi
2. Flow Rate: 4 to 6 gpm.

B. Medium-Pressure Spray:

1. Pressure: 400 to 800 psi.
2. Flow Rate: Flow Rate: 4 to 6 gpm.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at project site.

1. Review methods and procedures related to cleaning historic masonry, including, but not limited to, the following:

a. Review of sample cleaning areas.
b. Materials, material application, and sequencing.
c. Quality-control program.
d. Coordination with building occupants.

1.6 SEQUENCING AND SCHEDULING

A. Work Sequence: Perform historic masonry cleaning work in the following sequence:

1. Remove plant growth.
2. Inspect masonry for repairs and replacement.
3. Complete masonry repairs and replacement prior to final cleaning.
4. Clean masonry.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include material descriptions and application instructions.
2. Include test data substantiating that products comply with requirements.

1.8 INFORMATIONAL SUBMITTALS

A. Preconstruction Test Reports: For cleaning materials and methods.

1.9 QUALITY ASSURANCE

A. Historic Treatment Specialist Qualifications: A qualified historic masonry cleaning specialist. Experience cleaning new masonry work is insufficient experience for historic treatment work.

B. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage.

C. Cleaning Program: Prepare a written cleaning program that describes cleaning process in detail, including materials, methods, sequence, and equipment to be used; protection of surrounding materials; and control of runoff during operations.

1. If materials and methods other than those indicated are proposed for any phase of cleaning work, add to the quality-control program a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project.

D. Mockups: Prepare mockups of cleaning on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Cleaning: Clean an area approximately 16 square feet for each type of masonry and surface condition.
2. Mock-up locations: As determined by Owner – Architect.

a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not test cleaners and methods known to have deleterious effect.
b. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations in writing.

1.10 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified historic treatment specialist or one or more chemical-cleaner manufacturers to perform preconstruction testing on masonry surfaces.

1. Use cleaning mock-up areas as indicated for pre-construction testing.
2. Propose changes to materials and methods to suit Project.

1.11 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit masonry cleaning work to be performed according to product manufacturers' written instructions and specified requirements.

B. Clean masonry surfaces only when air temperature is 40 deg F and above and is predicted to remain so for at least seven days after completion of cleaning.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

A. Water: Potable.

B. Hot Water: Water heated to a temperature of 140 to 160 deg F.

C. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent, and 20 quarts of hot water for every 5 gal. of solution required.

D. Mold, Mildew, and Algae Remover, Job Mixed: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 5 quarts of 5 percent sodium hypochlorite (bleach), and 15 quarts of hot water for every 5 gal. of solution required.

E. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cathedral Stone Products, Inc.
b. Price Research, Ltd. dba Charles Paint Research
c. PROSOCO, Inc

F. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Building Restoration Products, Inc.
b. Cathedral Stone Products, Inc.
c. Diedrich Technologies, Inc.; a Hohmann & Barnard company
d. Dumond Chemicals, Inc]
e. Hydroclean; Hydrochemical Techniques, Inc
f. Price Research, Ltd. dba Charles Paint Research
g. PROSOCO, Inc

G. Mild-Acid Cleaner: Manufacturer's standard mild-acid cleaner based on phosphoric, oxalic, or citric acid; but not containing muriatic (hydrochloric), hydrofluoric, or sulfuric acid; or ammonium bifluoride or chlorine bleaches.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Building Restoration Products, Inc.
b. Cathedral Stone Products, Inc.
c. Diedrich Technologies, Inc.; a Hohmann & Barnard company

H. One-Part Limestone Acidic Cleaner: Manufacturer's standard one-part acidic formulation for cleaning limestone.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Building Restoration Products, Inc.
b. Cathedral Stone Products, Inc.
c. EaCo Chem, Inc.
d. Hydroclean; Hydrochemical Techniques, Inc
e. Price Research, Ltd. dba Charles Paint Research
f. PROSOCO, Inc

2.2 ACCESSORY MATERIALS

A. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, glazed masonry, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Building Restoration Products, Inc.
b. Price Research, Ltd. dba Charles Paint Research
c. PROSOCO, Inc

B. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:

1. Previous effectiveness in performing the work involved.
2. Minimal possibility of damaging exposed surfaces.
3. Consistency of each application.
4. Uniformity of the resulting overall appearance.
5. Do not use products or tools that could do the following:

a. Remove, alter, or harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
b. Leave residue on surfaces.

2.3 CHEMICAL-CLEANING SOLUTIONS

A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended in writing by chemical-cleaner manufacturer.

B. Acidic Cleaner Solution for Brick: Dilute acidic cleaner with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended in writing by chemical-cleaner manufacturer.

PART 3 - EXECUTION

3.1 PROTECTION

A. Remove surface mounted appurtenances, gutters, downspouts, and associated hardware adjacent to immediate work area and store during masonry cleaning. Reinstall when masonry cleaning is complete.

1. Provide temporary rain drainage during work to direct water away from building.

3.2 CLEANING MASONRY, GENERAL

A. Have cleaning work performed only by qualified historic treatment specialist.

B. Cleaning Appearance Standard: Cleaned surfaces are to have a uniform appearance as viewed from 20 feet away by Owner.

C. Proceed with cleaning in an orderly manner; work from top to bottom of each reachable width and from one end of each elevation to the other. Ensure that dirty residues and rinse water do not wash over dry, cleaned surfaces.

D. Use only those cleaning methods indicated for each masonry material and location.

1. Brushes: Do not use wire brushes or brushes that are not resistant to chemical cleaner being used.
2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that cleaning methods do not damage masonry.

a. Equip units with pressure gauges.
b. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with nozzle having a cone-shaped spray.
c. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
d. For high-pressure water-spray application, use fan-shaped spray that disperses water at an angle of at least 40 degrees.
e. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.
f. For steam application, use steam generator capable of delivering live steam at nozzle.

E. Perform each cleaning method in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.

1. Keep wall wet below area being cleaned to prevent streaking from runoff.

F. Perform additional general cleaning, paint and stain removal, and spot cleaning of small areas that are noticeably different when viewed according to "Cleaning Appearance Standard" Paragraph, so that cleaned surfaces blend smoothly into surrounding areas.

G. Water-Spray Application Methods:

1. Water-Soak Application: Soak masonry surfaces by applying water continuously and uniformly to limited area for time indicated. Apply water at low pressures and low volumes in multiple fine sprays using perforated hoses or multiple spray nozzles. Erect a protective enclosure constructed of polyethylene sheeting to cover area being sprayed.
2. Water-Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches from masonry surface, and apply water in horizontal back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.

H. Steam Cleaning: Apply steam to masonry surfaces at very low pressures indicated for each type of masonry. Hold nozzle at least 6 inches from masonry surface, and apply steam in horizontal back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.

I. Chemical-Cleaner Application Methods: Apply chemical cleaners to masonry surfaces according to chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not spray apply at pressures exceeding 50 psi. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.

J. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.

1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.

K. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

3.3 PRELIMINARY CLEANING

A. Removing Plant Growth: Completely remove visible plant, moss, shrub growth and residual organic material from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing remaining growth to dry as long as possible before removal. Remove loose soil and plant debris from open masonry joints to whatever depth they occur.

B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to planned cleaning methods. Extraneous substances include paint, caulking, asphalt, and tar.

1. Carefully remove heavy accumulations of rigid materials from masonry surface with sharp chisel. Do not scratch or chip masonry surface.
2. Remove paint and caulking

a. Comply with requirements in "Paint Removal" Article.

b. Repeat application up to two times if needed.

3. Remove asphalt and tar with solvent-type paste paint remover.

a. Comply with requirements in "Paint Removal" Article.
b. Apply paint remover only to asphalt and tar by brush without prewetting.
c. Allow paint remover to remain on surface for 10 to 30 minutes.
d. Repeat application if needed.

3.4 CLEANING BRICKWORK

A. Cold-Water Soak:

1. Apply cold water by intermittent spraying to keep surface moist.
2. Use perforated hoses or other means that apply a fine water mist to entire surface being cleaned.
3. Apply water in cycles of five minutes on and 20 minutes off.
4. Continue spraying until surface encrustation has softened enough to permit its removal by water wash for 72 hours.
5. Remove soil and softened surface encrustation from surface with cold water applied by low-pressure spray.

B. Hot-Water Wash: Use hot water applied by medium-pressure spray.

C. Steam Cleaning: Apply steam at very low pressures not exceeding 80 psi. Remove dirt softened by steam with wood scrapers, stiff-nylon or -fiber brushes, or cold-water wash, as indicated by cleaning tests.

D. Detergent Cleaning:

1. Wet surface with hot water applied by low-pressure spray.
2. Scrub surface with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.
3. Rinse with hot water applied by medium-pressure spray to remove detergent solution and soil.
4. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup.

E. Mold, Mildew, and Algae Removal:

1. Wet surface with hot water applied by low-pressure spray.
2. Apply mold, mildew, and algae remover by brush or low-pressure spray.
3. Scrub surface with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that surface remains wet.
4. Rinse with hot water applied by medium-pressure spray to remove mold, mildew, and

algae remover and soil.
5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup.

F. Nonacidic Gel Chemical Cleaning:

1. Wet surface with hot water applied by low-pressure spray.
2. Apply gel cleaner in 1/8-inch thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively, so area is uniformly covered with fresh cleaner and dwell time is uniform throughout area being cleaned.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Remove bulk of gel cleaner.
5. Rinse with hot water applied by medium-pressure spray to remove chemicals and soil.
6. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

G. Nonacidic Liquid Chemical Cleaning:

1. Wet surface with hot water applied by low-pressure spray.
2. Apply cleaner to surface in two applications by brush or low-pressure spray.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Rinse with hot water applied by medium-pressure spray to remove chemicals and soil.
5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

H. Mild-Acid Chemical Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply cleaner to surface in two applications by brush or low-pressure spray.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

I. Acidic Chemical Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply cleaner to surface in two applications by brush or low-pressure spray.
3. Let cleaner remain on surface for period established by mockup.
4. Rinse with cold water applied by low-pressure spray to remove chemicals and soil. Rinse until all foaming, if any, stops and suds disappear.
5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam

cleaning.

3.5 CLEANING UNPOLISHED STONEWORK

A. Cold-Water Soak:

1. Apply cold water by intermittent spraying to keep surface moist.
2. Use perforated hoses or other means that will apply a fine water mist to entire surface being cleaned.
3. Apply water in cycles of five minutes on and 20 minutes off.
4. Continue spraying until surface encrustation has softened enough to permit its removal by water wash, as indicated by cleaning tests for 72 hours.
5. Remove soil and softened surface encrustation from surface with cold water applied by low-pressure spray.

B. Cold-Water Wash: Use cold water applied by medium-pressure spray.

C. Hot-Water Wash: Use hot water applied by medium-pressure spray.

D. Steam Cleaning: Apply steam at very low pressures not exceeding 80 psi. Remove dirt softened by steam with wood scrapers, stiff-nylon or -fiber brushes, or cold-water wash, as indicated by cleaning tests.

E. Detergent Cleaning:

1. Wet surface with hot water applied by low-pressure spray.
2. Scrub surface with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.
3. Rinse with cold water applied by low-pressure spray to remove detergent solution and soil.
4. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup.

F. Mold, Mildew, and Algae Removal:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply mold, mildew, and algae remover by brush or low-pressure spray.
3. Scrub surface with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that surface remains wet.
4. Rinse with cold water applied by low-pressure spray to remove mold, mildew, and algae remover and soil.
5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup.

G. Nonacidic Gel Chemical Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply gel cleaner in 1/8-inch thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively, so area is uniformly covered with fresh cleaner and dwell time is uniform throughout area being cleaned.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Remove bulk of gel cleaner.
5. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
6. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

H. Nonacidic Liquid Chemical Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply cleaner to surface in two applications by brush or low-pressure spray.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

I. Mild-Acid Chemical Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply cleaner to surface in two applications by brush or low-pressure spray.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

J. Acidic Chemical Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply cleaner to surface in two applications by brush or low-pressure spray.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Rinse with cold water applied by low-pressure spray to remove chemicals and soil. Rinse until all foaming, if any, stops and suds disappear.
5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

K. One-Part Limestone Chemical Cleaning:

1. Wet surface with warm water applied by low-pressure spray.

2. Apply cleaner to surface by brush or low-pressure spray.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. above over the same area.
5. Rinse with warm water applied by medium-pressure spray to remove chemicals and soil.

L. Two-Part Chemical Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply alkaline prewash cleaner to surface by brush or roller.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer unless otherwise indicated.
4. Rinse with warm water applied by medium-pressure spray to remove chemicals and soil.
5. Let neutralizer remain on surface for period recommended in writing by manufacturer unless otherwise indicated.
6. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
7. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

3.6 FINAL CLEANING

A. Clean adjacent non-masonry surfaces of spillage and debris. Use detergent and soft brushes or cloths.

B. Remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.

C. Remove masking materials, leaving no residues that could trap dirt.

3.7 FIELD QUALITY CONTROL

A. Notify Owner in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until Owner has had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

END OF SECTION 040310

SECTION 040343 - HISTORIC MASONRY REPOINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes historic treatment work consisting of repointing brick and stone masonry joints with mortar and sealant.

B. Related Requirements:

1.2 ALLOWANCES

A. Allowances for repointing historic masonry are specified in Section 012100 "Allowances."

1. Perform historic masonry repointing work under quantity allowances and only as authorized. Authorized work includes work required by Drawings and Specifications and work as directed in writing by Owner.
2. Notify Owner weekly of extent of work performed that is attributable to quantity allowances.
3. Perform work that exceeds quantity allowances only as authorized by Change Orders.

B. Repointing stonework is part of repointing historic masonry allowance.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Section 012200 "Unit Prices."

1. Unit prices apply to authorized work covered by quantity allowances estimated quantities.
2. Unit prices apply to additions to and deletions from Work as authorized by Change Orders.

1.4 DEFINITIONS

A. Low-Pressure Spray:

1. Pressure: 100 to 400 psi.
2. Flow Rate: 4 to 6 gpm.

B. Rift: The most pronounced direction of splitting or cleavage of a stone. Rift may be obscure in igneous rocks such as granite. Often it is obvious, as with bedding planes in many sedimentary stones.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference on historic masonry repair and repointing at Project site.

1. Review methods and procedures related to repointing historic stone masonry including, but not limited to, the following:

a. Verify historic treatment specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
b. Materials, material application, sequencing, tolerances, and required clearances.
c. Quality-control program.
d. Stone historic treatment program.
e. Coordination with building occupants.

1.6 SEQUENCING AND SCHEDULING

A. Order sand and portland cement for pointing mortar immediately after approval of mockup. Take delivery of and store at Project site a sufficient quantity to complete Project.

B. Work Sequence: Perform stone historic treatment work in the following sequence, which includes work specified in this and other Sections:

1. Remove plant growth.
2. Inspect for open mortar joints and permanently or temporarily point them before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
3. Remove paint.
4. Clean masonry.
5. Rake out mortar and remove sealants from joints adjacent masonry to be replaced and from joints adjacent to masonry repairs.
6. Repair brick and stone units and areas, including replacing existing brick and stone with new matching units.
7. Rake out mortar from joints to be repointed.
8. Point mortar and provide sealant joints.
9. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include recommendations for product application and use.
3. Include test data substantiating that products comply with requirements.

B. Shop Drawings:

1. Include plans, elevations, sections, and locations of repointing work on the structure.
2. Show provisions for expansion joints or other sealant joints.
3. Show locations of scaffolding and points of scaffolding in contact with masonry. Include details of each point of contact or anchorage.

C. Samples for Initial Selection: For the following:

1. Pointing Mortar: Submit sets of mortar for pointing in the form of sample mortar strips, 6 inches long by 3/8 inch wide wide, set in aluminum or plastic channels.

    a. Have each set consist of a close color range of three samples of different mixes of colored sands and cements that produce a mortar matching existing, cleaned mortar when cured and dry.
    b. Submit with precise measurements on ingredients, proportions, gradations, and sources of colored sands from which each Sample was made.

2. Sealant materials.
3. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For the following:

1. Pointing Mortar: Submit sets of mortar for pointing in the form of sample mortar strips, 6 inches long by 3/8 inch wide, set in aluminum or plastic channels.

    a. Include with each Sample a list of ingredients with proportions of each. Identify sources, both supplier and quarry, of each type of sand and brand names of cementitious materials and pigments if any.

2. Sealant materials.
3. Accessories: Each type of anchor, accessory, and miscellaneous support.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For historic treatment specialist.

B. Preconstruction Test Reports: For existing stone types and mortar.

C. Quality-control program.

1.9 QUALITY ASSURANCE

A. Historic Treatment Specialist Qualifications: A qualified historic masonry repointing specialist. Experience in pointing or repointing only new or non-historic masonry is insufficient experience for masonry historic treatment work.

B. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising worker

performance and preventing damage.

C. Masonry Historic Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for each phase of the historic treatment work, including protection of surrounding materials and Project site.

1. Include methods for keeping pointing mortar damp during curing period.
2. If materials and methods other than those indicated are proposed for any phase of historic treatment work, add to the quality-control program a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project.

D. Mockups: Prepare mockups of historic treatment on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Repointing: Rake out joints in two separate areas, each approximately 36 inches high by 48 inches wide for each type of repointing required and repoint one of the areas.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.

D. Store lime putty covered with water in sealed containers.

E. Store sand where grading and other required characteristics can be maintained and contamination avoided.

1.11 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit repointing work to be performed according to product manufacturers' written instructions and specified requirements.

B. Temperature Limits: Repoint mortar joints only when air temperature is between 45 and 85 deg F and is predicted to remain so for at least seven days after completion of the Work unless

otherwise indicated.

C. Cold-Weather Requirements: Comply with the following procedures for mortar-joint pointing unless otherwise indicated:

1. When air temperature is below 40 deg F, heat mortar ingredients and existing stone to produce temperatures between 40 and 120 deg F.
2. When mean daily air temperature is below 40 deg F provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for seven days after pointing.

D. Hot-Weather Requirements: Protect mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar materials. Provide artificial shade and wind breaks, and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F and above unless otherwise indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Source Limitations: Obtain each type of material for repointing historic masonry (cement, sand, etc.) from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type II; white or gray or both where required for color matching of mortar.

1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Sand: ASTM C144 unless otherwise indicated.

1. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
2. Color: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
3. Provide sand with rounded edges.

D. Mortar Pigments: ASTM C979/C979M, compounded for use in mortar mixes, and having a record of satisfactory performance in masonry mortars.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Davis Colors
b. Lanxess Corporation
c. Solomon Colors Inc.

E. Water: ASTM C270, potable.

2.3 ACCESSORY MATERIALS

A. Sealant Materials:

1. Sealant manufacturer's standard elastomeric sealant(s) of base polymer and characteristics indicated below and according to applicable requirements in Section 079200 "Joint Sealants."
2. Colors: Provide colors of exposed sealants to match colors of mortar adjoining installed sealant unless otherwise indicated.
3. Ground-Mortar Aggregate: Custom crushed and ground pointing mortar sand or existing mortar retrieved from joints. Grind to a particle size that matches the adjacent mortar aggregate and color. Remove all fines passing the 100 sieve.

B. Joint-Sealant Backing:

1. Cylindrical Sealant Backings: ASTM C1330, Type C closed-cell material with a surface skin and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
2. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended in writing by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

C. Masking Tape: Nonstaining, nonabsorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.

D. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:

1. Previous effectiveness in performing work involved.
2. Minimal possibility of damaging exposed surfaces.
3. Consistency of each application.
4. Uniformity of the resulting overall appearance.
5. Do not use products or tools that could do the following:

a. Remove, alter, or harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
b. Leave residue on surfaces.

2.4 MORTAR MIXES

A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.

B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.

1. Mortar Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent by weight of the cementitious or binder materials, except for carbon black, which is limited to 2 percent, unless otherwise demonstrated by a satisfactory history of performance. Where mortar pigments are indicated, do not exceed a pigment-to-cement ratio of 1:10 by weight.

C. Do not use admixtures in mortar unless otherwise indicated.

D. Mixes: Mix mortar materials in the following proportions:

1. Pointing Mortar by Type: ASTM C270, Proportion Specification, Type N otherwise indicated; with cementitious material limited to portland cement and lime. Add mortar pigments to produce mortar colors required.

PART 3 - EXECUTION

3.1 PROTECTION

A. Prevent mortar from staining face of surrounding stone and other surfaces.

1. Cover sills, ledges, and other projecting items to protect them from mortar droppings.
2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
3. Immediately remove mortar splatters in contact with exposed stone and other surfaces.

B. Coordinate installation timing and remove gutters and downspouts and associated hardware adjacent to immediate work area and store during stone repointing work. Reinstall when repointing is complete.

1. Provide temporary rain drainage during work to direct water away from building.

3.2 REPOINTING, GENERAL

A. Have repointing work performed only by qualified historic treatment specialist.

B. Appearance Standard: Repointed surfaces are to have a uniform appearance as viewed from 20 feet away by Owner.

3.3 REPOINTING

A. Rake out and repoint joints to the following extent:

1. Joints at locations of the following defects:

a. Holes and missing mortar.
b. Cracks that can be penetrated 1/4 inch or more by a flat feeler gauge 0.025 inch thick.
c. Cracks 1/16 inch or more in width and of any depth.
d. Hollow-sounding joints when tapped by metal object.
e. Eroded surfaces 1/4 inch or more deep.
f. Deterioration to point that mortar can be easily removed by hand, without tools.
g. Joints filled with substances other than mortar.

B. Do not rake out and repoint joints where not required.

C. Rake out joints as follows, according to procedures demonstrated in approved mockup:

1. Remove mortar from joints to depth of 2 times the joint width not less than 3/4 inch. Do not remove unsound mortar more than 2 inches deep; consult Owner for direction.
2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose stone for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
3. Do not spall edges of stone units or widen joints. Replace or patch damaged stone.

a. Cut out mortar by hand with chisel and resilient mallet. Do not use power-operated grinders without Architect's written approval based on approved quality-control program.
b. Cut out center of mortar bed joints using angle grinders with diamond-impregnated metal blades. Remove remaining mortar in bed joints and mortar in head joints by hand with chisel and resilient mallet. Strictly adhere to approved quality-control program.

D. Notify Architect of unforeseen detrimental conditions, including voids in mortar joints, cracks, loose stone, rotted wood, rusted metal, and other deteriorated items.

E. Pointing with Mortar:

1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If

rinse water dries, dampen joint surfaces before pointing.

2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch until a uniform depth is formed. Fully compact each layer thoroughly, and allow it to become thumbprint hard before applying next layer.
3. After deep areas have been filled to same depth as remaining joints, point joints by placing mortar in layers not greater than 3/8 inch. Fully compact each layer, and allow it to become thumbprint hard before applying next layer. Where existing stone has worn or rounded edges, slightly recess finished mortar surface below face of stone to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed stone surfaces or to featheredge the mortar.
4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.

    a. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
    b. Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.

6. Hairline cracking within the mortar or mortar separation at edge of a repointed joint is unacceptable. Remove mortar and repoint.

F. Pointing with Sealant: Comply with Section 079200 "Joint Sealants" and as follows:

1. After raking out, keep joints dry and free of mortar and debris.
2. Clean and prepare joint surfaces. Prime joint surfaces unless sealant manufacturer recommends against priming. Do not allow primer to spill or migrate onto adjoining surfaces.
3. Fill sealant joints with specified joint sealant.

    a. Install cylindrical sealant backing beneath the sealant. Where space is insufficient for cylindrical sealant backing, install bond-breaker tape.
    b. Install sealant using only proven installation techniques that ensure that sealant is deposited in a uniform, continuous ribbon, without gaps or air pockets, and with complete wetting of the joint bond surfaces equally on both sides. Fill joint flush with surrounding stonework and matching the contour of adjoining mortar joints.
    c. Install sealant as recommended in writing by sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead:

        1) Fill joints to a depth equal to joint width, but not more than 1/2 inch deep or less than 1/4 inch deep.

    d. Tool sealant to form smooth, uniform beads, slightly concave. Remove excess sealant from surfaces adjacent to joint.

G. Where repointing work precedes cleaning of existing stone, allow mortar to harden at least 30 days before beginning cleaning work.

3.4 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed stone surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water applied by low-pressure spray.

1. Do not use metal scrapers or brushes.
2. Do not use acidic or alkaline cleaners.

B. Remove masking materials, leaving no residues that could trap dirt or affect finish consistency.

END OF SECTION 040343

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood-preservative-treated lumber.
2. Fire-retardant-treated lumber.

B. Related Requirements:

1. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. Lumber grading agencies, and abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. SPIB: The Southern Pine Inspection Bureau.
4. WCLIB: West Coast Lumber Inspection Bureau.
5. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5664.

4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content:

1. Boards: 15 percent.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1, Use categories as follows:

1. UC1: Interior construction not in contact with ground or subject to moisture. Include all rough carpentry:

a. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
b. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

3. After treatment, redry to 19 percent maximum moisture content.

B. Kiln-dry lumber after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all rough carpentry unless otherwise indicated:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED LUMBER

A. General: Where fire-retardant-treated materials are indicated, materials are to comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment is not to promote corrosion of metal fasteners.
2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber is to be tested according to ASTM D5664 and design value adjustment factors are to be calculated according to ASTM

D6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

C. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency and other information required by authorities having jurisdiction.

D. Application: Treat all rough carpentry unless otherwise indicated.

2.4 DIMENSION LUMBER FRAMING

A. Joists, Rafters, and Other Framing by Grade: No. 1

1. Species:

a. Hem-fir (north); NLGA.
b. Southern pine; SPIB.
c. Douglas fir-larch; WCLIB or WWPA.
d. Southern pine or mixed southern pine; SPIB.
e. Spruce-pine-fir; NLGA.
f. Douglas fir-south; WWPA.
g. Hem-fir; WCLIB or WWPA.
h. Douglas fir-larch (north); NLGA.
i. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

2.5 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.
7. Utility shelving.

B. Dimension Lumber Items: Construction or No. 2 any of the following species:][the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.

7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.

C. Concealed Boards: 15 percent maximum moisture content and any of the following species and grades:

1. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
2. Eastern softwoods; No. 2 Common grade; NeLMA.
3. Northern species; No. 2 Common grade; NLGA.
4. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

D. Roofing Nailers: Structural- or No. 2-grade lumber or better; kiln-dried Douglas fir, southern pine, or wood having similar decay-resistant properties.

E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 FASTENERS

A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193, or, ICC-ES AC308 as appropriate for the substrate.

2.7 METAL FRAMING ANCHORS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. MiTek Industries, Inc.
2. Simpson Strong-Tie Co., Inc.
3. Tamlyn

B. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.

1. Width: 1-1/4 inches.
2. Thickness: 0.050 inch.
3. Length: 24 inches.

C. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick. Tie fastens to side of rafter or truss, face of top plates, and side of stud below.

D. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.

1. Bolt Diameter: 5/8 inch.
2. Width: 2-1/2 inches.
3. Body Thickness: 0.108 inch.
4. Base Reinforcement Thickness: 0.108 inch.

E. Materials: Unless otherwise indicated, fabricate from the following materials:

1. Heavy-Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M; and not less than 0.036 inch thick.

a. Use for wood-preservative-treated lumber and where indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

D. Do not splice structural members between supports.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

G. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

I. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. ICC-ES evaluation report for fastener.

K. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.

L. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other

work involved.

B. Attach wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Attach wood roofing nailers securely to substrate to resist the designed outward and upward wind loads indicated on Drawings and in accordance with ANSI/SPRI ED-1, Tables A6 and A7.

3.3 INSTALLATION OF WOOD FURRING

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

3.4 INSTALLATION OF CEILING JOIST AND RAFTER FRAMING

A. Ceiling Joists: Install with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.

B. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.

1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.
2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.

C. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

3.5 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof sheathing.
2. Composite nail base insulated roof sheathing.
3. Sheathing joint-and-penetration treatment materials.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review roofing nailbase vented sheathing; ventilation orientation, fastener type and spacing requirements, sealing of joints, special cuts and shapes.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Roof sheathing.
2. Composite nail base insulated roof sheathing.
3. Sheathing joint-and-penetration treatment materials.

B. Product Data Submittals: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

C. Shop Drawings: Composite nailbase insulated roof sheathing.

1. Show layout plan that shows panel placement, fastener types, quantities, and locations for each panel type, including panels requiring special cutting and shape.
2. Include details for sheathing joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: From air-barrier and water-resistant glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.

B. Product Test Reports: For each air-barrier and water-resistant glass-mat gypsum sheathing assembly, indicating compliance with specified requirements, for tests performed by a qualified testing agency.

C. Evaluation Reports: For the following, from ICC-ES:

1. Composite nail base insulated roof sheathing.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 ROOF SHEATHING

A. Plywood Sheathing: PS1, Exposure 1, Structural I

1. Span Rating: Not less than 48/24.
2. Thickness: 23/32 inch.

2.2 COMPOSITE NAIL BASE INSULATED ROOF SHEATHING, NON-VENTED – TYPE 2

A. Basis-of-Design Product: Subject to compliance with requirements, provide Hunter Panels; a Carlisle company, H-Shield NB.

a. or comparable product by the following:

1) Rmax, A Business Unit of Sika Corporation, Nailable Base-3

2. Polyisocyanurate-Foam Thickness: 2 inch minimum, tapered at ¼-inch per foot. As indicated on Drawings.
3. Plywood: Exposure 1, PS1, 23/32 inch thickness, 24/48 span-rated:

2.3 COMPOSITE NAIL BASED INSULATED ROOF SHEATHING, VENTED – TYPE 1

A. Vented, Plywood-Surfaced, Polyisocyanurate-Foam Sheathing: ASTM C1289, Type II, Class 1, with DOC PS 1, Exposure 1 plywood adhered to spacers.

1. Product: Hunter Panels; a Carlisle company, Cool-Vent.

a. Plywood: Exposure 1, PS1, 23/32 inch thickness, 24/48 span-rated:
b. Spacers: Wood furring blocks, 1 -inch thickness, not less than 12-inches apart, 75

percent minimum lateral air movement, 92 percent minimum open air space.

2.4 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 or ASTM D3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

B. Fasteners: Specifically design for attachment into structural gypsum decks.

1. Available product: OMG Lite-Deck Fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints, optimum joint arrangement, or fasteners. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.10.1, "Fastening Schedule," in the ICC's International Building Code.

D. Coordinate roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 INSTALLATION OF WOOD STRUCTURAL PANEL

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Roof Sheathing:

a. Screw to wood framing and gypsum structural decking.
b. Space panels 1/8 inch apart at edges and ends.

2. Vented and Non-Vented Structural Insulated Panels: Install fasteners in accordance with panel and fastener manufacturers' instructions as well as applicable sections of the Michigan Building Code. If a conflict in requirements arises, provide the most extensive requirements of each reference.

END OF SECTION 061600

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of This Section Includes:

1. Full roof tear-off.
2. Partial roof tear-off.
3. Temporary roofing.
4. Roof re-cover preparation.
5. Base flashing removal.
6. Fastener pull-out testing.
7. Disposal.

B. Related Requirements:

1. Section 011000 "Summary" for use of premises and for phasing requirements.
2. Section 015000 "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for reroofing preparation.

1.2 DEFINITIONS

A. Full Roof Tear-off: Removal of existing roofing system down to existing structural roof deck.

B. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

C. Roof Re-Cover Preparation: Existing roofing system is to remain and be prepared for new roof installed over it.

1.3 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting removal Work, conduct conference at Project site.

1. Meet with Owner, Architect, Construction Manager, roofing Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing tear-off, including, but not limited to, the following:

a. Reroofing preparation, including roofing system manufacturer's written instructions.

b. Temporary protection requirements for existing roofing system components that are to remain.
c. Existing roof drains and roof drainage during each stage of reroofing, and roof-drain plugging and plug removal.
d. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to avoid delays.
e. Existing roof deck conditions requiring Architect notification.
f. Existing roof deck removal procedures and Owner notifications.
g. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
h. Structural loading limitations of roof deck during reroofing.
i. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that affect reroofing.
j. HVAC shutdown and sealing of air intakes.
k. Shutdown of fire-suppression, -protection, and -alarm and -detection systems.
l. Asbestos removal and discovery of asbestos-containing materials.
m. Governing regulations and requirements for insurance and certificates if applicable.
n. Existing conditions that may require Architect notification before proceeding.

1.4 INFORMATIONAL SUBMITTALS

A. Field Test Reports: Fastener pull-out test report.

B. Photographs or Video: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reroofing operations.

1. Submit before Work begins.

C. Landfill Records: Indicate receipt and acceptance of hazardous wastes, such as asbestos-containing materials, by a landfill facility licensed to accept them.

D. Regulatory Requirements:

1. Comply with governing EPA notification regulations before beginning roofing removal.
2. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.5 FIELD CONDITIONS

A. Existing Roofing System: Built-up coal-tar protected membrane.

B. Owner will occupy portions of building immediately below reroofing area.

1. Conduct reroofing so Owner's operations are not disrupted.
2. Provide Owner with not less than 72 hours written notice of activities that may affect Owner's operations.
3. Coordinate work activities daily with Owner so Owner has adequate advance notice to

place protective dust and water-leakage covers over sensitive equipment and furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below work area.

4. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below affected area.

    a. Verify that occupants below work area have been evacuated before proceeding with work over impaired deck area.

C. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.

D. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

E. Limit construction loads on existing roof areas to remain, and existing roof areas scheduled to be reroofed to 15 pounds per square foot for uniformly distributed loads. Concentrated loads shall not be permitted.

F. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.

1. Remove only as much roofing in one day as can be made watertight in the same day.

G. Hazardous Materials:

1. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

    a. Hazardous materials shall be removed by Contractor.
    b. Coordinate reroofing preparation with hazardous material remediation to prevent water from entering existing roofing system or building.

PART 2 - PRODUCTS

2.1 TEMPORARY PROTECTION MATERIALS

A. EPS Insulation: ASTM C578.

B. Plywood: DOC PS 1, Grade CD, Exposure 1.

C. OSB: DOC PS 2, Exposure 1.

2.2 TEMPORARY ROOFING MATERIALS

A. Design and selection of materials for temporary roofing are Contractor's responsibilities.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:

1. Protect existing roofing system that is not to be reroofed.
2. Loosely lay 1-inch minimum thick, EPS insulation over existing roofing in areas not to be reroofed.

    a. Loosely lay 15/32-inch plywood or OSB panels over EPS. Extend EPS past edges of plywood or OSB panels a minimum of 1 inch.

3. Limit traffic and material storage to areas of existing roofing that have been protected.
4. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of reroofing.
5. Comply with requirements of existing roof system manufacturer's warranty requirements.

B. Seal or isolate windows that may be exposed to airborne substances created in removal of existing materials.

C. Shut off rooftop utilities and service piping before beginning the Work.

D. Test existing roof drains to verify that they are not blocked or restricted.

1. Immediately notify Owner - Architect of any blockages or restrictions.

E. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work.

1. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.

F. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.

G. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday.

1. Prevent debris from entering or blocking roof drains and conductors.

    a. Use roof-drain plugs specifically designed for this purpose.
    b. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.

2. If roof drains are temporarily blocked or unserviceable due to roofing system removal or

partial installation of new roofing system, provide alternative drainage method to remove water and eliminate ponding.

a. Do not permit water to enter into or under existing roofing system components that are to remain.

3.2 ROOF TEAR-OFF

A. Notify Owner each day of extent of roof tear-off proposed for that day and obtain authorization to proceed.

B. Lower removed roofing materials to ground and onto lower roof levels, using dust-tight chutes or other acceptable means of removing materials from roof areas.

C. Remove aggregate ballast from roofing. Store aggregate ballast for reuse in manner not to exceed structural loading limitations of roof deck.

D. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing using a power broom.

E. Remove pavers and accessories from roofing.

1. Store and protect suitable pavers and accessories for reuse in manner not to exceed structural loading limitations of roof deck.
2. Discard cracked or damaged pavers.

F. Full Roof Tear-off: Where indicated on Drawings, remove existing roofing and other roofing system components down to the existing structural roof deck.

1. Remove substrate board, vapor retarder, roof insulation, and cover board.
2. Remove base flashings and counter flashings.
3. Remove perimeter edge flashing and gravel stops.
4. Remove flashings at pipes, curbs, mechanical equipment, and other penetrations.
5. Remove roof drains indicated on Drawings to be removed.
6. Remove wood blocking, curbs, and nailers.
7. Remove bitumen and felts.
8. Remove fasteners from deck or cut fasteners off flush with deck surface.

3.3 DECK PREPARATION

A. Inspect deck after tear-off of roofing system.

B. If broken or loose fasteners that secure deck panels to one another or to structure are observed, or if deck appears or feels inadequately attached, immediately notify Owner - Architect.

C. If deck surface is unsuitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Owner - Architect.

3.4 TEMPORARY ROOFING

A. Install approved temporary roofing over area to be reroofed.

B. Remove temporary roofing before installing new roofing.

3.5 ROOF RE-COVER PREPARATION

A. Remove blisters, ridges, buckles and other substrate irregularities from existing roofing that inhibit new recover boards from conforming to substrate.

1. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing with a power broom.
2. Broom clean existing substrate.
3. Coordinate with Owner's inspector to schedule times for tests and inspections.
4. Verify that existing substrate is dry before proceeding with installation.

a. Spot check substrates with an electrical capacitance moisture-detection meter.

3.6 BASE FLASHING REMOVAL

A. Remove existing base flashings.

1. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.

B. Do not damage metal counterflashings that are to remain.

3.7 FASTENER PULL-OUT TESTING

A. **Perform** fastener pull-out tests according to SPRI FX-1, and submit test report to Owner - Architect and roofing manufacturer before installing new roofing system.

1. Obtain roofing manufacturer's approval to proceed with specified fastening pattern.

a. Roofing manufacturer may furnish revised fastening pattern commensurate with pull-out test results.

3.8 DISPOSAL

A. Collect demolished materials and place in containers.

1. Promptly dispose of demolished materials.
2. Do not allow demolished materials to accumulate on-site.
3. Storage or sale of demolished items or materials on-site is not permitted.

B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION 070150.19

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Aerogel blanket-board insulation.

B. Related Requirements:

1. Section 070150.19 "Preparation for Reroofing" and Section 075113 Modified Bituminous Protected Membrane Roofing" for insulation specified as part of low slope roofing construction.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Research Reports: For foam-plastic insulation, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than Class A, 25 and 450 when tested in accordance with ASTM E84.

B. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

C. Thermal-Resistance Value (R-Value): R-value as indicated on Drawings.

2.2 Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25 psi minimum compressive strength; unfaced.

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Diversiform Products
2. DuPont de Nemours, Inc.
3. MBCI; Cornerstone Building Brands
4. Owens Corning
5. The Dow Chemical Company

2.3 Reflective Insulation: ASTM C1224, with one or more low-emittance surfaces with emittance value of 0.1 or less as measured per ASTM C1371.

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Covertech Flexible Packaging; division of Balcan Plastics
2. Fi-Foil Company, Inc.
3. Innovative Energy, Inc
4. Innovative Insulation, Inc.
5. ISI Building Products
6. Reflectix Inc.

2.4 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Miscellaneous Application Accessories:

1. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
2. Crack Sealer: Closed-cell insulating foam in aerosol dispenser recommended in writing by insulation manufacturer for filling gaps in board insulation.
3. Detailing Foam Insulation for Voids: Urethane foam complying with AAMA 812, low expansion pressure suitable for filling insulation gaps and voids adjacent to openings to protect against water, air, and sound intrusion.
4. Tapes for Reflective Insulation and Barriers:

    a. Aluminum-foil tape for repairs or splicing material.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or those that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products, applications and applicable codes.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

F. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
2. Detailing Foam Insulation for Voids: Apply in accordance with manufacturer's written instructions.

3.3 INSTALLATION OF BOARD INSULATION

A. Install board insulation in accordance with manufacturer's written instructions per project applications and conditions.

3.4 INSTALLATION OF REFLECTIVE AND RADIANT BARRIERS INSULATION

A. Install sheet reflective insulation in accordance with ASTM C727.

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Synthetic roof tile, roof underlayment, and accessories.

B. Related Requirements:
   1. Division 01 and 02 Sections.
   2. Section 076200 – Sheet Metal Flashing and Trim.
   3. Section 076221 – Copper Gutters and Downspouts.
   4. Section 079200 – Joint Sealants.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM) (www.astm.org):
   1. D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
   2. D3161/D3161M - Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method).
   3. E108 - Standard Test Methods for Fire Tests of Roof Coverings.

B. Underwriters Laboratories (UL) (www.ul.com):
   1. 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings.
   2. 2218 - Standard for Impact Resistance of Prepared Roof Covering Materials.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Convene at Project Site 2 weeks prior to beginning work of this Section.
   2. Attendance: Owner, Architect, Contractor, Installer, and Related Trades.
   3. Review and discuss the following:
      a. Installation procedures and manufacturer's recommendations.
      b. Safety procedures.
      c. Coordination with installation of other work.
      d. Preparation and approval of substrate and penetrations through roof.
      e. Other items related to successful execution of work.

1.4 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings: Show tile layout, method of attachment, flashings, trim, conditions at eaves, intersections with adjacent materials, and other installation details.
   2. Product Data: Manufacturer's data sheets on each product including:
      a. Tiles, underlayment, flashings, fasteners, and accessories:
         1) Indicate composition, properties, and dimensions.
         2) Show compliance with specified requirements.

b. Preparation instructions and recommendations.
c. Storage and handling requirements and recommendations.
d. Installation methods.

3. Samples:
   a. Selection Samples: Two sets of color chips representing manufacturer's full range of available colors and surface textures.
   b. Verification Samples: After selection, submit two samples representing actual product, color, and texture.

A. Maintenance Material Submittals: Provide one hundred (100) square feet of extra tiles.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of synthetic tiles.

B. Installer Qualifications: Minimum three years of experience installing products of this Section.

C. Mockup:
1. Provide mockup of tiles, underlayment, and related flashings.
2. Size: Minimum 10-feet by 10-feet.
3. Location: Where requested by Owner and directed by General Contractor.
4. Mockup shall be approved by Owner/Architect.
5. Approved mockup may remain as part of the Work.

1.3 DELIVERY, STORAGE AND HANDLING

A. Prepare and ship tiles in bundles as follows:
1. Collate in sequence of widths and colors as required for selected color blend.
2. Assemble bundles so that sorting at job site is not required.

B. Deliver tiles to site in manufacturer's unopened, labeled bundles.
1. Verify quantities and condition upon delivery.
2. Remove damaged products from site.

C. Store products in protected and secure environment, off the ground, protected from moisture, traffic, and construction activities.

D. Store tiles on a level flat surface. Do not store on site for prolonged period.

E. Store products at temperature between 40 and 120 degrees F.

F. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of authorities having jurisdiction.

1.4 SITE CONDITIONS

A. Environmental Requirements:
1. Observe manufacturer’s temperature, humidity, and moisture limits.
2. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.5 WARRANTIES

A. Furnish manufacturer's 50 years warranty against breakage and deterioration resulting in leaks under normal weather and use conditions.

B. Furnish installer's 2-year total roof system warranty against water penetration, including underlayment, flashings, trim, and other roof components.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: DaVinci Roofscapes, LLC, 800-DAVINCI, www.davinciroofscapes.com.
B. Substitutions shall not be considered.

2.2 MATERIALS

A. Performance Requirements:
   1. Roof system: Manufactured synthetic tiles attached to structural substrate to form weather tight roof envelope with no measurable water penetration.
   2. Method of attachments designed to adequately resist wind uplift for roof configuration and Project location.
   3. Meet minimum uplift resistance of 186 pounds per square foot with a 2:1 safety factor in accordance with TAS 125.

B. Synthetic Slate Tiles:
   1. Description: Lightweight, synthetic roof tiles with appearance, color, texture, and thickness of natural quarried slate shingles.
   2. Product: Province Slate.
   3. Material: Engineered polymer formulated from 100 percent virgin plastic resins; recycled materials not acceptable.
   4. Performance characteristics:
      a. Fire resistance Class A installed over one layer of Eco Chief Solarhide™
      b. Impact rating: Class 4, tested to UL 2218.
      c. Wind rating: 110 MPH, tested to ASTM D3161
   5. Size:
      a. Width: 12 inches (305 mm).
      b. Length: 11-1/2 inch (397 mm).
      c. Thickness: 1/2 inch (13 mm) at butt, 3/8 inch (9.5 mm) at top.
   6. Starter shingle: 3.5 inches (89 mm) long x 11.5 inches (292 mm) wide.
   7. Markings: Form shingles with markings on upper surface to indicate nailing locations and provide alignment guidelines.
   8. Color:
      a. Provide shingles in color comparable to natural slate.
      b. Provide internal ultraviolet stabilizers.
   9. Color:
      a. Provide shingles factory blended in multiple colors.
      b. Blend: As selected via submittals and samples

2.3 ACCESSORIES

A. Underlayment: Class A System for Fire: Eco Chief Solarhide over entire deck.

B. Waterproof Sheet Membrane: Self-Adhering Sheet Membrane Roof Underlayment: Provide Grace Ice and Water Shield HT by GCP Applied Technologies, Inc with the following characteristics:
   1. Material: Cold applied, self-adhering membrane composed of an innovative and proprietary rubberized asphalt adhesive and interwound with a disposable release sheet. An embossed, slip resistant surface is provided on the high performance film with UV barrier properties.
   2. Membrane Thickness: 40 mils (1.02 mm) per ASTM D3767 Method A.
   3. Membrane Tensile Strength: MD 33 lbf/in, CD 31 lbf/inch per ASTM D412 Die C Modified.
   4. Membrane Elongation: 250% per ASTM D412 Die C Modified.
   5. Low Temperature Flexibility: Unaffected at -20 degrees F (-29 degrees C) per ASTM D1970.
   6. Adhesion to Plywood: 5.0 lb/in. width (876 N/m) per ASTM D903.
   7. Maximum Permeance: 0.05 perms (2.9 ng/sgms Pa) per ASTM E96.
   8. Maximum Material Weight Installed: 0.22 pounds/sqft (1.1 kg/sqm) per ASTM D461.
   9. Service Temperature: 260 degrees F (115.6 degrees C) per ASTM D1204
   10. Compatibility: Suitable for use under all types of sloped roofing with the exception high altitude climates where zinc, copper or Cor-Ten roof coverings are used.
   11. Adhesive: Rubberized asphalt adhesive containing post-consumer recycled content, contains no calcium carbonate, sand or fly ash.
   12. Exposure: Can be left exposed for a maximum of 120 days from date of installation per ASTM G90 – EMMAqua test.
   13. Primer: Water-based Perm-A-Barrier WB Primer by GCP Applied Technologies, Inc.
   14. Code and Standards Compliance: Grace Ice and Water Shield HT meets the following requirements:
       a. ASTM D1970.
       b. CC-ES ESR-3121, per AC 48 Acceptance Criteria for Roof Underlayments used in Severe Climate Areas.
       c. Underwriters Laboratories Inc. R13399 - Class A fire classification under fiber-glass shingles and Class C under organic felt shingles (per ASTM E108/UL 790).
       d. Underwriters Laboratories Inc. Classified Sheathing Material Fire Resistance Classification with Roof Designs: P225, P227, P230, P237, P259, P508, P510, P512, P514, P701, P711, P717, P722, P723, P732, P734, P736, P742, P803, P814, P818, P824
       e. Miami-Dade County Code Report NOA #15-0728.11
       f. Florida State Approval Report No. FL289-R3
       g. CCMC Approval No. 13671-L
   15. Low temperature flexibility: Unaffected at minus 32 degrees F (minus 36 degrees C).
   16. Minimum tensile strength: 250 PSI (1724 kPa).
   17. Minimum elongation: 250 percent.
   18. Permeance: Maximum 0.05 perms.

C. Fasteners:

1. 3/8 inch (9.5 mm) flat head nails, 1-1/2 inches (38 mm) long.
2. Material: Type 304 Stainless Steel.

D. Snow Guards: Basis-of-Design
1. Manufacturer: Alpine Snow Guards.
2. Style: PD-10, Half Round Pad-Style Snow Guard.
3. Material: Copper.
4. Fasteners: Type 304 Stainless Steel. Type, style and dimension as recommended by snow guard manufacturer.
5. Products by other manufacturers deemed equivalent by Owner shall be considered. Contractor shall submit substitution request.

3 EXECUTION

3.1 EXAMINATION

A. Inspection of roof framing and substrate.
1. Verify that roof deck is sound and securely fastened.
2. Verify intended slopes and lines are true to not negatively impact installation.
3. Ensure that proper ventilation has been provided for roof space.
4. Verify that roof deck is clean, dry, and ready to receive shingles.
5. Remove dirt, loose fasteners, and protrusions from roof surface.
6. Report deficiencies to Architect / Owner, prior to installation and roof system components.

3.2 INSTALLATION - GENERAL

A. Self-Adhered Sheet Waterproof Underlayment:
1. Install continuous, 36-inch wide sheet, of self-adhered waterproof sheet membrane evenly divided from centerline of valleys, and minimum 18-width on gable ends, against walls, and around projections. Install continuous 36-inch wide sheet at gable eaves. Refer to Drawings for additional locations.

2. Install waterproof sheet membrane as follows:
a. Apply waterproof sheet membrane at temperatures of 40 degrees F or higher.
b. Adhere and attach as recommended by manufacturer of waterproof sheet membrane.
c. Start underlayment installation at lower edge of roof. Install perpendicular to roof slope with minimum 4 inch (102 mm) side laps and minimum 6 inch (152 mm) end laps.
d. Extend underlayment minimum 4 inches (102 mm) up vertical wall intersections.
e. Do not leave underlayment membrane exposed in excess of time limit required by manufacturer. Do not puncture or tear underlayment.

B. Underlayment Slip Sheet: Install one ply asphalt felt over full roof area, including areas receiving self-adhered sheet waterproofing underlayment, with ends weather lapped minimum 4 inches (102 mm). Nail in place with roofing nails spaced in accordance with manufacturer's recommendations.

3.3 FLASHING INSTALLATION

A. Install drip edge on eaves, gable ends, and metal flashings at valleys, ridges, hips, roof curbs, penetrations, and intersections with vertical surfaces, in accordance with Section 07 62 00.

B. Weather lap joints minimum 2 inches (52 mm) and seal with sealant as specified in Section 07 92 00.

C. Secure in place with clips, nails, or other fasteners.

3.4 SHINGLE INSTALLATION

A. Install shingles in accordance with manufacturer's instructions and approved Shop Drawings.

B. Stagger shingle joints in one course minimum 1-1/2 inches (38 mm) from joints in course below. In addition, stagger shingles so that gaps between any two vertical courses shingles in adjacent courses are offset to a minimum of 1-1/2 -inches

C. Exposure: Install shingles in straight pattern with exposure specified and bottom shingle edges evenly aligned.

D. Spacing: Provide 3/16-inch minimum to 3/8-inch maximum gap between shingles placed horizontally adjacent to each other and to other vertical abutting elements including but not limited to walls, parapets, and roof mounted equipment.

E. Eaves:
   1. Install a row of starter tiles at eaves as a base course, staggered in conjunction with the first exposed course of tiles.
   2. Project eave shingles approximately 1 inch, as required to allow water to drain, or 1/8-inch past overhanging drip edge.

F. Gables: Project shingles approximately ¾-inch beyond gable rakes or 1/8-inch past overhanging drip edge.

G. Ridges and Hips:
   1. Refer to Drawings.

H. Fastening: Attach each shingle to deck with two nails:
   1. Place nails at locations indicated on shingles.
   2. Ensure full penetration but do not overdrive nails.
   3. Do not nail at an angle.
   4. Ensure that nail head is flush with shingle surface.
   5. At valleys do not nail shingles within 5 inches (127 mm) of valley center line.

3.5 FIELD QUALITY CONTROL

A. Inspect units as they are installed. Do not install cracked, broken, twisted, curled, or otherwise damaged tile. Immediately separate defective material and remove from installation area.

B. As work progresses, take care not to scratch or mar installed shingles. Replace damaged shingles prior to installation of subsequent courses. If damaged or defective shingles are to be replaced below installed coursings, remove installed coursings to access damaged tile fasteners and replace removed tile with new, unused tile.

C. After approximately 200 units have been installed, inspect roof from ground. Verify proper layout and appearance. Repeat inspection every 200 shingles.

D. Visually inspect completed installation for weathertight condition.

3.6 PROTECTION

A. Protect installed roofing until completion of Project.

B. Do not allow traffic on completed roof.

3.7 ADJUSTING

A. Replace damaged shingles prior to Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes SBS-modified bituminous protected membrane roofing.

B. Related Requirements:
   1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
   2. Section 072100 "Thermal Insulation" for insulation beneath the roof deck.
   3. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
   4. Division 22 Section for roof drains.

1.02 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.03 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressure as indicated on drawings.

D. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
   1. Hail Resistance Rating: MH.
   2. Fire/Windstorm Classification: Class 1A-90

1.04 ACTION SUBMITTALS

A. Submittal Compliance Form: If Basis-of-Design products are provided, Submittal Compliance Form may be submitted in lieu of required Product Data submittal. Ensure compliance with requirements included in Section 013300 "Submittal Procedures."

B. Product Data: For each type of product indicated.

C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
   1. Base flashings and membrane terminations.
   2. Tapered insulation, including slopes.
   3. Crickets, saddles, and tapered edge strips, including slopes.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

B. Source Limitations: Obtain components including roof insulation for membrane roofing system approved by membrane roofing manufacturer.

C. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

D. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

E. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
   5. Review structural loading limitations of roof deck during and after roofing.
   6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
   7. Review governing regulations and requirements for insurance and certificates if applicable.
   8. Review temporary protection requirements for roofing during and after installation.
   9. Review roof observation and repair procedures after roofing installation.

F. Provide the following upon request:
   1. Submit evidence of compliance with performance requirements.
   2. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.
   3. Field quality control reports.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. All rolls of roofing materials are to be stored on site in standing, upright position, off the ground, in a dry location.

C. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing manufacturer. Protect stored liquid material from direct sunlight.

D. Refer to MSU Planning and Construction standards for additional packaging requirements.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

D. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

E. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and warranty requirements.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
   1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, substrate board, roofing accessories, roof pavers, and other components of membrane roofing system.
   2. Warranty Period: 30 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SBS-MODIFIED ASPHALT-SHEET MATERIALS

A. SBS-Modified Bituminous Membrane Roofing:
   1. Manufacturers: Subject to compliance with requirements, provide products by:
      a. Soprema, Inc.

2.02 VAPOR RETARDER AND BASE SHEET MATERIALS

A. Vapor Retarder: SOPREMA SOPRALENE FLAM STICK: SBS-modified bitumen membrane with release film on the bottom surface and a plastic burn-off film top surface self-adhered to the primed substrate. Prime all appliable substrates using ELASTOCOL STICK PRIMER where required. Non-woven polyester reinforced. Meets or exceeds ASTM D6164, Type I, Grade S, per ASTM D5147 test methods.

2.03 BASE AND MID SHEET MATERIALS

A. Inter-Ply Sheet: SOPREMA SOPRALENE FLAM 180: SBS-modified bitumen membrane with a plastic burn-off film on the bottom surface and a plastic burn-off film top surface heat welded to the base sheet. Non-woven polyester reinforced. Meets or exceeds ASTM D6164, Type I, Grade S, per ASTM D5147 test methods.

2.04 CAP SHEET MATERIALS

A. Cap Sheet: SOPREMA SOPRALENE FLAM 180 SP 3.5: SBS-modified bitumen membrane with a plastic burn-off film on the bottom surface and a sanded top surface heat welded to the inter-ply. Non-woven polyester reinforcement. Meets or exceeds ASTM D6164, Type I, Grade S, per ASTM D5147 test methods.

2.05 BASE FLASHING SHEET MATERIALS

A. Flashing Base Sheet: SOPREMA SOPRALENE FLAM STICK: SBS-modified bitumen membrane with release film on the bottom surface and a plastic burn-off film top surface self-adhered to the primed substrate. Prime all appliable substrates using ELASTOCOL STICK PRIMER where required. Non-woven polyester reinforced. Meets or exceeds ASTM D6164, Type I, Grade S, per ASTM D5147 test methods.

B. Granule-Surfaced Flashing Cap Sheet: SOPREMA SOPRALENE FLAM 180 FR GR: SBS-modified bitumen membrane Cap Sheet with a sanded bottom surface and mineral granule top surface heat welded to flashing base sheet. Non-woven polyester reinforced. UL Class A for specified roof slope requirements. Meets or exceeds ASTM D6164, Type I, Grade G:
   1. Granule Color: White.

2.06 AUXILIARY ROOFING MEMBRANE MATERIALS

A. General: Auxiliary materials recommended by roofing manufacturer for intended use and compatible with roofing membrane.
   1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Primer: Soprema : ELASTOCOL STICK PRIMER.

C. Mastic Sealant: Polyisobutylene, plain or modified bitumen, nonhardening, nonmigrating, nonskinning, and nondrying.

D. Liquid applied flashing/waterproofing: SOPREMA ALSAN.

E. Reinforcement material: SOPREMA POLYFLEECE.

F. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

2.07 SUBSTRATE BOARD

A. Substrate Board: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
   1. Thickness: 5/8 inch (15.9 mm), Type X, fire-resistant.
   2. Products: Georgia-Pacific; DensDeck Prime with EONIC Technology: www.densdeck.com/#sle.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

2.08 ROOF INSULATION

A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
   1. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Global-approved roof insulation.
   2. Classifications:
      a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
         1) Compressive Strength: Classes 1-2-3, Grade 2 - 20 psi (138 kPa), minimum.
   3. Tapered Board: 1/4 inch and 1/2 inch per foot slopes as indicated on the Drawings; fabricate of fewest layers possible.
      a. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
   4. Board Edges: Square.
   5. Products: SOPREMA SOPRA-ISO and SOPREMA SOPRA-ISO TAPERED.

2.09 COVER BOARDS

A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
   1. Thickness: 1/4 inch (6.4 mm), fire-resistant.
   2. Product: Georgia-Pacific; DensDeck Prime Roof Boards with EONIC Technology: www.densdeck.com/#sle.

2.10 OVERBURDEN ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, of thicknesses indicated and that produce FM Approvals-approved roof insulation.

B. Extruded-Polystyrene Board Insulation: Dupont Stryrofoam Brand Roofmate XPS.
   1. Board Size: 2'-0" x 8'-0".
   2. Thickness: Two layers minimum, of total thickness required to provide a minimum aged thermal resistance of R30 (deg. F.h.sf/Btu).

2.11 OVERBURDEN INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.

C. Separation sheet: Polyethylene film.
   1. Thickness: 6 mil.

2.12 BALLAST

A. Ballast: Comply with SPRI RP-4 for System 2, Exposure C, using aggregate over entire surface.

B. Rounded, Water-Worn Gravel:
   1. No. 4 Aggregate: 1-1/2-inch (38-mm) nominal diameter, sound, hard, washed, water-worn gravel; ASTM D448, with size classification of 4.
   2. No. 2 Aggregate: 2-1/2-inch (64-mm) nominal diameter, sound, hard, washed, water-worn gravel; ASTM D448, with size classification of 2.

C. Roof Pavers: Heavyweight, hydraulically pressed, concrete units, with top edges beveled 3/16 inch, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:
   1. Size: 24 by 24 by 2 inches, non-slip surface with grooved backs with 4-way drainage capability. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch in length, height, and thickness.
   2. Weight: 22 lb per sq ft (107 kg/sq m)
   3. Compressive Strength: 7500 psi, minimum; ASTM C 140.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
   2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations.

3. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
4. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method in accordance with ASTM D 4263.
5. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.03 PRIMER APPLICATION:

A. Examine all substrates, and conduct adhesion peel tests as necessary, to ensure satisfactory adhesion is achieved.

B. Apply the appropriate specified primer to dry, compatible substrates as required to enhance adhesion of new specified roofing materials.

C. Apply primer using brush, roller, or sprayer at the rate published on the product data sheet. Lightly prime for uniform coverage, do not apply heavy or thick coats of primer.

D. Self-Adhesive Membrane Primer: Apply ELASTOCOL STICK PRIMER to dry, compatible substrates as required to enhance adhesion of self-adhesive membrane plies. Ensure self-adhered membrane primer is tacky to-the-touch, but not wet. Primer should not transfer to the fingertips when touched.

E. Project conditions vary throughout the day. Monitor changing conditions, monitor the drying time of primers, and monitor the adhesion of the membrane plies. Adjust primer and membrane application methods as necessary to achieve the desired results.

3.04 ROOFING MEMBRANE INSTALLATION, GENERAL

A. Install roofing membrane system in accordance with roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing" and as follows:
1. Membrane: S (SBS).
2. Adhering Method: T (torched) / Self-adhered.
3. Vapor Retarder: One.
4. Base Sheet: One.
5. Number of Inner Ply Sheets: One.
6. Number of Cap sheets: One.
7. Surfacing Type: P (protected).

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Where roof slope exceeds 1/2 inch per 12 inches, install roofing membrane sheets parallel with slope.

D. Cooperate with testing agencies engaged or required to perform services for installing roofing system.

E. Coordinate installing roofing system so components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
   1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.
   2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
   3. Remove and discard temporary seals before beginning work on adjoining roofing.

3.05 BASE-SHEET INSTALLATION

A. Install lapped base sheet course, extending sheet over and terminating beyond cants. Attach base sheet as follows:
   1. Follow material product data sheets and published general requirements for installation instructions.
   2. Ensure environmental conditions are satisfactory, and will remain satisfactory, during the application of the self-adhesive membrane.
   3. Unroll membrane onto the roof surface and allow time to relax prior to installing the membrane.
   4. Starting at the low point of the roof, lay out the membrane to ensure the plies are installed perpendicular to the roof slope, shingled to prevent back-water laps.
   5. Ensure all roofing and flashing substrates are prepared and acceptable to receive the self-adhesive membrane.
   6. Ensure primer is tacky to-the-touch, but not wet. Primer should not transfer to the fingertips when touched. Do not proceed if primer is wet or becomes fully dry and dirty. If primer becomes fully dry, dirty and loses all tack, re-prime the substrate as necessary to achieve membrane adhesion.
   7. Cut rolls to working lengths and widths to conform to rooftop conditions, and lay out to always work to a selvage edge.
   8. Ensure membrane side-laps and end-laps are maintained.
   9. Peel the release film from the underside of the membrane. Press and adhere the leading edge of the membrane to the substrate, but leaving the 6-inch end-lap un-adhered in order to heat weld the end-lap.
   10. As the release film is peeled away, use a weighted roller to firmly set the sheet in place. Ensure full contact is made between the ply and the substrate for full adhesion. Use a hand-roller to roll-in vertical flashings and confined areas to firmly apply pressure.
   11. At the 6-inch end-laps, use a torch or hot-air welded to melt plastic burn-off film from the top surface where present. Embed granules or otherwise remove surfacing where present using a torch or hot-air welder. For sanded membrane, specified cold adhesive may be used to adhered end-laps. Adhere all base ply and Cap Sheet end-laps using torch or hot-air welder, or adhere using specified cold adhesive.
   12. At 6-inch end-laps, cut a 45-degree dog-ear away from the 3-inch selvage edge, or otherwise ensure the membrane is fully heat-welded or adhered watertight at all T-joints. Apply a bead of SOPRAMASTIC SBS ELASTIC CEMENT to the angled cut of self-adhered plies.
   13. Offset self-adhered end-laps 3 ft.
   14. Do not leave base plies exposed; cover all exposed film during the same day.
   15. Each day, physically inspect all side and end-laps, and ensure the membrane is watertight. Where necessary, use a torch or hot-air welder and a clean trowel to ensure all laps are fully sealed.

16. Inspect the installation each day to ensure the plies are fully adhered. Repair all un-adhered voids, wrinkles, open laps and all other deficiencies.
17. Offset cap sheet side and end-laps away from the base ply laps so that cap sheet laps are not located within 18 inches of base ply laps.

3.06 MODIFIED BITUMINOUS MEMBRANE INSTALLATION

A. Install modified bituminous roofing membrane sheet and cap sheet in accordance with roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants.
   1. Ensure environmental conditions are safe and satisfactory, and will remain safe and satisfactory, during the application of the heat-welded membrane and flashings.
   2. Ensure all primers are fully dry before beginning heat-welding operations.
   3. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.
   4. Starting at the low point of the roof, lay out the membrane to ensure the plies are installed perpendicular to the roof slope, shingled to prevent back-water laps.
   5. Ensure all roofing and flashing substrates are prepared and acceptable to receive the heat-welded membrane.
   6. Cut membrane to working lengths and widths to conform to rooftop conditions and lay out to always work to a selvage edge.
   7. Ensure specified side-laps and end-laps are maintained. End-laps should be staggered 3 ft apart.
   8. Direct roof torch on the roll as necessary to prevent overheating and damaging the membrane and substrates.
   9. As the membrane is unrolled, apply heat to the underside of the membrane until the plastic burn-off film melts away. Continuously move the torch side-to-side across the underside of the roll to melt the bitumen on the underside of the sheet, while continuously unrolling membrane.
   10. While unrolling and heating the sheet, ensure approximately 1/4 to 1/2-inch of hot bitumen flows ahead of the roll as it is unrolled, and there is 1/8 to 1/4-inch bleed out at all laps.
   11. Adjust the application of heat to the underside of the membrane and to substrate as required for varying substrates and environmental conditions.
   12. At the 6-inch end-laps, melt the plastic burn-off film from the top surface or embed granules and remove surfacing, where present, using a torch or hot-air welder.
   13. At end-laps where T-Joints exist, cut a 45-degree dog-ear away from the selvage edge, or otherwise ensure the membrane is fully heat-welded watertight at all T-joints.
   14. Each day, physically inspect all side and end-laps, and ensure the membrane is sealed watertight. Where necessary, use a torch or hot-air welder and a clean trowel to ensure all laps are fully sealed.
   15. Inspect the installation each day to ensure the plies are fully adhered. Repair all voids, wrinkles, open laps and all other deficiencies.
   16. Offset cap sheet side and end-laps away from the base ply laps so that cap sheet laps are not located within 18 inches of base ply laps.

3.07 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates in accordance with roofing system manufacturer's written instructions and as follows:

1. Refer to SBS modified bitumen membrane manufacturer's application instructions, flashing detail drawings, and follow product data sheets and other published requirements for installation instructions. Refer to manufacturer's SBS modified bitumen membrane flashing detail drawings.
2. Ensure all flashing substrates are primed using self-adhesive membrane primer. Refer to self-adhesive membrane primer application requirements.
3. Unroll the flashing base ply and flashing cap sheet onto the roof surface to their complete length. Once relaxed, cut the membrane to the required working lengths to accommodate the flashing height, cants and the required over-lap onto the horizontal roof surface.
4. Cut the flashing membrane from the end of the roll in order to always install flashings to the side-lap line or selvage edge line.
5. Lay out the flashing base ply and flashing cap sheet to offset all side-laps a minimum of 12 inches so that side-laps are never aligned on top of the ply beneath. Shingle the flashing ply laps to prevent back-water laps.
6. Ensure correct membrane and flashing sequencing to achieve redundant, multi-ply, watertight flashings.
7. Roof Membrane Base Ply.
    a. Before installing flashings, install the roof membrane base ply in the horizontal field of the roof, and extend the base ply up to the top of the cant, where present, at roof terminations, transitions and penetrations.
8. Flashing Base Ply.
    a. Install the flashing base ply starting at the top leading edge of the vertical flashing substrate, down over the cant and onto the horizontal surface of the roof a minimum of 3 inches beyond the of base of the cant. Cut the base ply at corners to form 3-inch side-laps. Install gussets to seal corner transitions.
    b. Install one flashing base ply at all roof terminations, transitions and penetrations.
9. Roof Membrane Cap Sheet.
    a. Install the roof membrane cap sheet in the horizontal field of the roof over the flashing base ply up to the roof termination, transition or penetration, and up to the top of cants where present.
    b. Using a chalk line, mark a line on the membrane cap sheet a minimum of 4 inches from the base of the cant onto the roof. Where granules are present, embed the cap sheet granules using a torch and trowel or granule embedder to prepare the surface to receive the flashing cap sheet. Where hot work is prohibited, utilize specified flashing cement to seal flashing end-laps.
10. Flashing Cap Sheet:
    a. Install the flashing Cap Sheet starting at the top leading edge on the vertical substrate, over the cant and onto the roof surface 4 inches from the base of the cant onto the roof.
    b. Install the flashing Cap Sheet to ensure a minimum two (2) ply flashing system is present at all roof terminations, transitions and penetrations.
11. During the membrane and flashing installation, ensure all plies are completely adhered into place, with no bridging, voids or openings. Use weighted roller, or hand roller for confined areas, to apply pressure to ensure full contact and complete adhesion.
12. Heat weld or hot-air weld all flashing side and end-laps, or adhere using specified flashing cement.
13. Seal all flashing ply and cap sheet T-joints at end laps using torch and trowel, hot-air welder or flashing cement.

14. Apply SOPREMA gun-grade sealant or flashing cement to seal the membrane termination along all roof terminations, transitions and penetrations. These include gravel stop edge metal, pipe penetrations, along the top edge of curb and wall flashing, and all other flashing terminations where necessary to seal flashings watertight.
15. Fasten the top leading edge of the flashing 8-inch on-centers with appropriate 1 inch metal cap nails or other specified fasteners and plates. Seal fastener penetrations watertight using SOPREMA sealant or mastic.
16. Manufacturer's liquid-applied, reinforced flashing systems should be installed where conditions are not favorable to install SBS modified bitumen flashings. Such conditions may include irregular shapes penetrating roof surfaces (I-beams), confined areas and low flashing heights. Liquid-applied, reinforced flashing systems are required in lieu of pitch pans and lead pipe flashings.
    a. For SBS modified bitumen flashings that are self-adhesive, heat-welded, installed using hot asphalt or SOPREMA COLPLY EF Adhesive and/or Flashing Cement, refer to manufacturer's installation guidelines for SOPREMA ALSAN FLASHING and SOPREMA ALSAN RS.

B. Extend base flashing up walls or parapets a minimum of 8 inches above roofing membrane.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
    1. Seal top termination of base flashing.

D. Install roofing membrane cap-sheet stripping where metal flanges and edgings are set on membrane roofing in accordance with roofing system manufacturer's written instructions.

E. Roof Drains: Set 30-by-30-inch lead flashing (4 lbs/sq ft) in bed of roofing-manufacturer-approved asphaltic adhesive on completed roofing membrane. Cover lead flashing with roofing membrane cap-sheet stripping and extend a minimum of 6 inches beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, lead flashing, and stripping into roof-drain clamping ring.
    1. Install stripping in accordance with roofing system manufacturer's written instructions.

3.08 SUBSTRATE BOARD INSTALLATION

A. Install substrate board on metal deck.
    1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
    2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.
    3. Mechanically fasten substrate board to roof deck, in accordance with Factory Mutual recommendations and roofing manufacturer's instructions.
        a. Fasten substrate board to top flanges of steel deck according to recommendations in FM Global's "RoofNav" and FM DS 1-29 for specified Windstorm Resistance Classification.

3.09 INSULATION INSTALLATION

A. Adhere polyisocyanurate insulation using SOPREMA DUOTACK 365 insulation adhesive applied in 1/2-inch to 3/4-inch wide continuous ribbons.
    1. Adhere insulation according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.

3.10 COVER BOARD INSTALLATION

A. Adhere coverboard using SOPREMA DUOTACK 365 insulation adhesive applied in 1/2-inch to 3/4-inch wide continuous ribbons.

1. Adhere cover boards according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
2. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction.

3.11 OVERBURDEN INSULATION INSTALLATION

A. Prior to installation of first layer of insulation, install layer of 6 mil polyethelene sheets over cap sheet of modified bitumen roof membrane. Lap edges minimum of 4" wide.

B. Install one or more layers of insulation to achieve required thickness over roofing membrane. Cut and fit to within 3/4 inch of projections and penetrations.

C. Install geotextile fabric over insulation, overlapping edges and ends at least 12 inches. Do not lap ends of fabric sheets within 72 inches of roof perimeter. Extend fabric 2 to 3 inches above ballast at perimeter and penetrations. Apply additional layer of fabric around penetrations to prevent aggregate from getting between penetration and insulation. Do not cover drains or restrict water flow to drains.

3.12 BALLAST INSTALLATION

A. To roofed area, apply aggregate ballast uniformly over geotextile fabric at rate required by insulation manufacturer, but not less than the following, carefully spreading aggregate to not damage roofing membrane and base flashings. Install roof-paver ballast in accordance with insulation manufacturer's written instructions. Apply ballast as insulation is installed, leaving roofing membrane insulated and ballasted at end of workday.
   1. Corners: Use No.2 aggregate ballast at 1,300 lb per 100 sq ft (590 kg/9.3 sq m) in areas within 8.5 feet (2.9 m) of corners of roof measured along edge and perpendicular to edge.
   2. Perimeter: Use No.2 aggregate ballast at 1,300 lb per 100 sq ft (590 kg/9.3 sq m) in areas within 8.5 feet (2.9 m) of edge of roof between corner areas.
   3. Field: Use No.4 aggregate ballast of 1,000 lb per 100 sq ft (454 kg/9.3 sq m) over remaining area of roof.
      a. Install roof pavers in lieu of aggregate ballast at roof perimeter, corners, and around all roof penetrations.
   4. Walkway Pavers: Install walkways formed from one row of roof pavers, loosely laid and butted.

3.13 ROOF-PAVER INSTALLATION

A. Install roof pavers over roofed area in accordance with insulation manufacturer's written instructions.

3.14 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.

END OF SECTION 075552

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sheet metal flashing and trim:

1. Formed steep-slope roof flashing and trim
2. Formed low-slope roof flashing and trim.
3. Formed wall flashing and trim.

B. Related Sections include the following:

1. Division 01 Section ALTERNATES for copper finish alternate.
2. Division 07 Section PROTECTED MEMBRANE ROOFING for installing sheet metal flashing and trim integral with roofing membrane.
3. Division 07 Section JOINT SEALANTS for field-applied sheet metal flashing and trim sealants.
4. Division 07 Section COPPER GUTTERS AND DOWNSPOUTS for installing copper gutters and downspouts.

1.2 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Verification: On request, for each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches long. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: Full-size Sample.

1.4 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1. Copper Standard: Comply with Copper Development Association Incorporated’s "Copper in Architecture Handbook," the latest published edition.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.6 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the following:
   a. Hillman Brass and Copper, a Subsidiary of Arbor/Metals, Incorporated.
   b. United States Brass and Aluminum.

2.2 SHEET METALS

A. Copper Sheet: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Nails for Copper Sheet: Copper, hardware bronze, or Type 304 stainless steel, 0.109 inch minimum and not less than 7/8 inch long, barbed with large head.
2. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
5. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
6. Refer to Drawings for other fasteners.

C. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

D. Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

E. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

F. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items to the greatest extent possible. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.5 ROOF SHEET METAL FABRICATIONS

A. Base Flashing: Fabricate from the following material:

1. Copper: 20-ounce per square foot, except as otherwise noted on Drawings.

B. Counterflashing: Fabricate from the following material:

1. Copper: 16-ounce per square foot, except as otherwise noted on Drawings.

C. Roof-Penetration Flashing: Fabricate from the following material:

1. Lead: 4.0 lb/sq. ft. hard tempered.

D. Roof-Drain Flashing: Fabricate from the following material:

1. Lead: 4.0-lb/sq. ft., hard tempered.

2.6 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12 foot long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch- high end dams. Fabricate from the following material:

1. Copper: 16-ounce per square foot, except as otherwise noted on Drawings.

2.7 FINISHES

A. Copper Standard: Comply with Copper Development Association Incorporated's "Copper in Architecture Handbook," section "Chemical Finishes" utilizing synthetic or natural patina to match existing copper patina of building copper to remain.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of uncoated aluminum, stainless-steel, and lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
1. Use copper, hardware bronze, or stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.

1. Do not solder aluminum sheet.
2. Copper Soldering: Tin uncoated copper surfaces at edges of sheets using solder recommended for copper work.

3. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant.

1. Secure in a waterproof manner by means of anchor and washer at 36-inch centers.

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Turn flashing down inside vent piping, being careful not to block vent piping with flashing.
2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes shop and field formed copper roofing accessories and trim, such as:
   1. Hung gutters
   2. Downspouts (rain drainage).
   3. Through-wall scuppers and conductor heads.
   4. Miscellaneous accessories such as downspout strainers and gutter covers.

B. Related Requirements:
   1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this Section.
   2. Roofing accessories installed integral with roofing membrane are specified in roofing system sections as roofing work.
   3. Section 076110 – Copper Roofing.
   4. Section 076210 – Copper Roofing Specialties: Roof accessory units of pre-manufactured, set-on type.

1.2 COORDINATION

A. Coordinate work of this section with interfacing and adjacent work for proper sequencing. Ensure weather resistance and durability of work and protection of materials and finishes.

1.3 PERFORMANCE REQUIREMENTS

A. Installation Requirements: Fabricator is responsible for installing system, including anchorage to substrate and necessary modifications to meet specified and drawn requirements and maintain visual design concepts in accordance with Contract Documents and following installation methods as stipulated in the "Copper in Architecture" handbook published by the Copper Development Association (CDA).
   1. Make modifications only to meet field conditions and to ensure fitting of system components.
   2. Obtain Owner's approval of modifications.
   3. Provide concealed fastening wherever possible.
   4. Attachment considerations: Account for site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening and fracturing connection between units and building structure or between components themselves.
   5. Obtain Owner's approval for connections to building elements at locations other than indicated in Drawings.
   6. Accommodate building structure deflections in system connections to structure.

B. Performance Requirements:
   1. System shall accommodate movement of components without buckling, failure of joint seals, undue stress on fasteners, or other detrimental effects when subjected to seasonal temperature changes and live loads.
   2. Design system capable of withstanding building code requirements for negative wind pressure.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.

B. Product data for gutters, downspouts, and accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.

C. Shop drawings showing layout, profiles, expansion provisions, gutter slopes, methods of joining, and anchorage details, including downspout strainers, gutter covers, scuppers, and conductor head, and attachments to scuppers and conductor head systems. Provide layouts at 1/4-inch (1:50) scale and details at 3-inch (1:4) scale.

D. Samples of the following flashing, sheet metal fabrications, and accessory items:
   1. Provide one of each of the following: 6-inch long sample for each fabricated product including each type of fastener, each assembled product including each type of fastener. Provide each sample with specified finish.

1.5 CLOSEOUT SUBMITTALS

A. Provide maintenance data in Operations and Maintenance manual for maintaining applied coatings on copper panels.

1.6 QUALITY ASSURANCE

A. Fabricator’s Qualifications: Company specializing in copper gutter and downspout work with five years experience in similar size and type of installations.

B. Installer: A firm with five years of successful experience with installation of copper gutter and downspout work of type and scope equivalent to Work of this Section.

C. Industry Standard: Except as otherwise shown or specified, comply with applicable recommendations and details of the "Copper in Architecture” handbook published by the Copper Development Association (CDA). Conform to dimensions and profiles shown.

D. Mock-Up: Before proceeding with final purchase of materials and fabrication of copper gutter and downspout work components, prepare a mock-up of work. Incorporate materials and methods of fabrication and installation identical with project requirements. Install mock-up at location directed by Owner. Retain accepted mock-up as quality standard for acceptance of completed copper work. If accepted, mock-up may be incorporated as part of copper work.
   1. Mock-up area indicated on Drawings.
   2. Mock-up approved by Owner shall be acceptable as part of the Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading: Protect finish metal faces.

B. Acceptance at Site: Examine each component and accessory as delivered and confirm that material and finish is undamaged. Do not accept or install damaged materials.

C. Storage and Protection:
   1. Stack pre-formed material to prevent twisting, bending, and abrasions.
   2. Provide ventilation.
   3. Prevent contact with materials which may cause discoloration or staining.

1.8 WARRANTY

A. Warrant installed gutters, downspouts, and trim components to be free from defects in material and workmanship for period of 2 years starting from the date of project completion.

B. Include coverage against leakage.

PART 2 - PRODUCTS

2.1 GUTTER AND DOWNSPOUT MATERIALS

A. Copper: ASTM B370; minimum temper H00 (cold-rolled) except where temper 060 is required for forming.
   1. Hung Gutters and Downspouts: 16 oz. per sq. ft. (0.0216-inch thick) (0.55 mm) except as otherwise indicated.

B. Gutter Cover Guards: 20-gage bronze mesh or fabricated units, with selvaged edges and noncorrosive fasteners. Select materials for compatibility with gutters and downspouts.

C. Bronze wire ball downspout strainer meeting the Copper Development Association Inc details.

2.2 ACCESSORIES

A. Solder: ASTM B32; Provide 50-50 tin/lead.

B. Flux: Muriatic acid neutralized with zinc or approved brand of soldering flux.

C. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

D. Bituminous Coating: SSPC - Paint 12, Cold-Applied Asphalt Mastic (Extra Thick Film), nominally free of sulfur, compounded for 15-mil dry film thickness per coat.

E. Joint Sealant: One-part, copper compatible elastomeric polyurethane, polysulfide, butyl or silicone rubber sealant as tested by sealant manufacturer for copper substrates. Refer to Division 07.

F. Metal Accessories: Provide cleats, straps, hangers, anchoring devices, and similar accessory units as required for installation of work, noncorrosive, size and gage required for performance.

G. Rivets:
   1. Pop Rivets: 1/8-inch (3 mm) to 3/16-inch (4.5 mm) diameter, with solid brass mandrels.
   2. Provide solid copper rivet (tinner’s rivets) where structural integrity of seam is required.

2.3 FABRICATION

A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of Copper Development Association (CDA) "Copper in Architecture” handbook and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed copper work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
   1. Fabricate to allow for adjustments in field for proper anchoring and joining.
   2. Form sections true to shape, accurate in size, square, free from distortion and defects.
   3. Cleats, Spacers, Straps, and Hanger Brackets: Fabricate of same material as gutters and downspouts, interlockable with sheet in accordance with CDA recommendations.
   4. Fabricate corners from one piece with minimum 18 inch (450 mm) long returns; solder corners for rigidity.

B. Seams: Fabricate nonmoving seams with 1 inch (25 mm) lapped riveted and soldered seams. Tin edges to be seamed, lap seams, rivet seams, and solder.

C. Expansion Provisions: Follow CDA Copper in Architecture Handbook guidance and provisions to accommodate expansion and contraction of gutter systems.

D. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

E. Solder
   1. Solder metal joints except those indicated or required to be movement type joints in accordance with the "Copper in Architecture" handbook published by the Copper Development Association (CDA).
   2. Tin edges of copper sheets and cleats at soldered joints.
   3. After soldering, remove flux. Wipe and wash solder joints clean with fresh water and baking soda to neutralize flux.

F. Copper Thickness: As indicated on Drawings or Comply with CDA recommendations for copper size and shape.

G. Gutters and Downspouts:
   1. Fabricate as indicated on Drawings and in accordance with the "Copper in Architecture" handbook published by the Copper Development Association (CDA).
   2. Fabricate front edge at least 1 inch (25 mm) lower than back edge.
   3. Transverse Seams in Gutter Liners: Lapped, riveted and soldered for watertight gutter condition.
   4. Provide spacers, hanger brackets and straps, end caps, and fasteners as indicated on Drawings and as recommended by CDA.
   5. Fabricate gutters and downspouts to sizes and profiles shown on Drawings.

H. Through Wall Scupper: As indicated on Drawings and in accordance with the "Copper in Architecture" handbook published by the Copper Development Association (CDA). Fabricate scuppers of dimensions required with closure flange trim to exterior, 4 inches (100 mm) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof.
   1. Fasten gravel guard angles to base of scupper.

I. Conductor Head: As indicated on Drawings and in accordance with CDA "Copper in Architecture" handbook. Coordinate with Section 076220 for connection to downspout.

2.4 FINISHES

A. Natural weathering mill finished copper. No applied finish.

B. ALTERNATE #1: Provide pre-patinated to match existing as indicated on Drawings.

2.5 EXAMINATION

A. General: Examine conditions and proceed with work when substrates are ready.

B. Confirm that substrate system is even, smooth, sound, clean, dry, and free from defects.

2.6 INSTALLATION

A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with the "Copper in Architecture" handbook published by the Copper Development Association (CDA). Anchor units of work securely in place by methods indicated, providing for thermal expansion of units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

1. Install units plumb, level, square, and free from warp or twist while maintaining dimensional tolerances and alignment with surrounding construction; except install gutters with required straight and consistent slope.
2. Apply asphalt mastic on copper surfaces of units in contact with cementitious materials and dissimilar metals.
3. Fit gutters to downspouts and flashings for watertight connections. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
4. Miter, lap seam and close corner joints with solder. Seal seams and joints watertight with solder
5. Install expansion joints at frequency recommended by the CDA "Copper in Architecture" handbook. Do not fasten moving seams such that movement is restricted.
6. Coordinate with installation of roofing system and roof accessories.

B. Gutters and Downspouts:
1. Flash and seal gutter to downspout.
2. Slope gutters not less than 1/8 inch per foot (1:100).
3. Provide expansion joints at 48'-0" (14 400 mm) maximum, not more than 24 feet (7200 mm) from corners.
4. Hang gutter with copper straps spaced as indicated on Drawings.
5. Integrate gutter flashing conditions with requirements of adjacent roofing for watertight installation.

C. Install continuous gutter guards on gutters, arranged as hinged units to swing open for cleaning gutters. Install "beehive"-type strainer-guard at downspouts in open gutters; removable for cleaning downspouts.

D. Install counterflashing as indicated to prevent water from migrating behind gutter system.

E. Parapet Scuppers:
1. Install scuppers where indicated through parapet.
2. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
3. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
4. Loosely lock front edge of scupper with conductor head.
5. Seal or solder exterior wall scupper flanges into back of conductor head.

F. Conductor Heads: Flash and seal conductor head to scupper.

2.7 CLEANING

A. Remove protective film (if any) from exposed surfaces of copper promptly upon installation. Strip with care to avoid damage to finishes. Do not allow protective film to fuse to copper.

B. Clean exposed copper surfaces, removing substances that might cause abnormal discoloration of metal.

C. Upon completion of each area of soldering, carefully remove flux and other residue from surfaces. Neutralize acid flux by washing with baking soda solution and then flushing clear water rinse. Use special care to neutralize and clean crevices.

D. Clean exposed metal surfaces of substances that would interfere with uniform oxidation and weathering.

2.8 PROTECTION

A. Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pad-type, flat-mounted metal snow guards.

1.2 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.

C. Samples:

1. Pad-Type Snow Guards: Full-size unit with installation hardware.

a. For units with factory-applied finishes, submit metal type and finish specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of snow guard, for tests performed by a qualified testing agency, indicating load at failure of attachment to roof system identical to roof system used on this Project.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 PAD-TYPE SNOW GUARDS

A. Mounted Metal Snow Guards:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Alpine Snowguards; PD-10 Half Round Pad Style or comparable product by one of the following:

a. Berger; division of OmniMax International, Inc.
b. Rocky Mountain Snow Guards, Inc.
c. Sieger Snow Guards Inc.
d. Zaleski Snow-Guards for Roofs, Inc.

2. Material:

a. Copper Sheet: ASTM B370, not less than 16 oz./sq. ft.

1) Finish: Mill.
2) See Alternate #1 for pre-patinated copper finish.

3. Attachment: Manufacturer's tested system, capable of resisting design loads.

a. Material: Type 304 Stainless Steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install snow guards according to manufacturer's written instructions.

1. Space rows as indicated on Drawings.

B. Attachment for Synthetic Tile Roofing:

1. Pad-Type, Flat-Mounted Snow Guards: Mechanically anchored through each factory-prepared hole with fasteners concealed by the shingles attachment.

END OF SECTION 077253

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes joint sealants for the applications listed in 3.6 JOINT SEALANT SCHEDULE below, and including those specified by reference to this Section:

1.2 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.3 SUBMITTALS

A. VOC Statement and Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.

E. Qualification Data: For Installer and testing agency.

F. Preconstruction Field Test Reports: When requested by owner, indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.

G. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

H. Field Test Report Log: For each elastomeric sealant application.

I. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

J. Warranties: Submit written special warranty as specified in this Section. Include contact information, description of coverage, and start date for each special warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 or manufacturer’s standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than six pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the commencement of the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:

    a. Each type of elastomeric sealant and joint substrate indicated.
    b. Each type of non-elastomeric sealant and joint substrate indicated.

3. Notify M.S.U. Project Manager seven days in advance of dates and times when test joints will be erected.

    a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.

        1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

4. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
5. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.5 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 WARRANTY

A. Special Warranty

1. Provide installation warranty for a period of 5 years against defective materials and workmanship.
2. During the warranty period restore defective work to the standard of the contract documents without additional compensation, including all materials, labor, refinishing and other costs incidental to the work. Within 24 hours after receipt of notice from the owner, inspect the work and immediately repair leaks. Restore work found to be defective as defined in the contract documents, within 10 days after receipt of notice from the owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.

D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

E. Single-Component Neutral-Curing Silicone Sealant; **SEALANT A**

1. Available Products:

   a. Dow; DOWSIL 790 Silicone Building Sealant.
   b. GE Silicones; SilPruf SCS2000.
   c. Dow; DOWSIL 791 Silicone Weatherproofing Sealant.
   d. Dow; DOWSIL 795 Silicone Building Sealant.
   e. Pecora Corporation; 895.
   f. Dow; DOWSIL 756 SMS Building Sealant.
   g. Or as approved

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 50.

4. Use Related to Exposure: NT (nontraffic).
5. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

F. Multicomponent Immersible Urethane Sealant **SEALANT B**

1. Available Products:

   a. LymTal International, Inc., Iso-Flex 881 (NS – nonsag)
   b. LymTal International, Inc., Iso-Flex 880 (P – pourable).
   c. Or as approved

2. Type and Grade: M (multicomponent) and NS (nonsag) or P (pourable).
3. Class: 25.
4. Uses Related to Exposure: T (traffic), NT (nontraffic) and I (immersible).

2.4 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) O (open-cell material) or B (bicellular material with a surface skin), as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates**,** where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning

methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. **SEALANT A**: Control joints in interior and exterior (non-traffic) masonry. Joints in interior and exterior precast architectural concrete. Joints between interior masonry non-bearing walls or partitions and under side of floors, beams and slabs. Joints around pipes, conduits, and ducts that penetrate walls and partitions. Exterior joints at perimeter of metal frames, including door and window frames. Exterior joints at ends of aluminum windowsills. Horizontal (non-traffic) and vertical expansion joints in exterior brick masonry.

B. **SEALANT B**: Isolation and control joints in exposed interior concrete floors. Expansion joints in interior tile. Expansion and control joints in exterior curbs and walks, and in paving other than concrete road paving, subject to pedestrian and vehicular traffic.

END OF SECTION 079200

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. This Section includes lightning protection for buildings and structures.

B. Provide all labor, materials, and equipment necessary to complete all work as indicated on the drawings, and as specified herein.

C. The Contractor shall furnish and install a complete lightning protection system with all necessary components for a complete system.

D. The entire lightning protection system shall be manufactured and installed in complete accordance with the following standards.
1. UL 96A Lightning Protection Systems Standards for Installation
2. UL 96 Lightning Protection Systems Standards for Components
3. LPI-75 Lighting Protection Installation Code
4. NFPA 780 Lighting Protection Code

1.3 DEFINITIONS

A. LPI: Lightning Protection Institute.

B. UL: Underwriters Laboratory.

C. NRTL: National Recognized Testing Laboratory.

D. NFPA: National Fire Protection Association.

1.4 SUBMITTALS

A. Product Data: For air terminals and mounting accessories.

B. Shop Drawings: Detail lightning protection system, including air-terminal locations, conductor routing and connections, and bonding and grounding provisions. Include indications for use of raceway, data on how concealment requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.

C. Qualification data for firms and people specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include data on listing or certification by LPI or NRTL.

D. Certification, signed by Contractor, that the attachment method for air terminals is approved by manufacturers of both the terminal assembly and the roofing manufacturer.

E. Field inspection reports indicating compliance with specified requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installation of systems shall be performed by fully qualified personnel having had a minimum of five years of experience on installing these types of systems. They shall have been certified for installation by NRTL or a Master Installer/Designer by the Lightning Protection Institute

B. Listing and Labeling: As defined in NFPA 780, "Definitions" Article.

C. The entire installation shall be in compliance with the LPI-175 for class I and class II buildings.

D. All materials shall comply in weight size, and composition with the following requirements and whichever is the most stringent shall apply relating to the type of building or structure involved.

1. Lightning Protection Institute
2. National Fire Protection Association
3. Underwriters Laboratories Lightning Protection Master Label System

E. The design of the systems shall be performed by fully qualified personnel who have had a minimum of five years of experience in designing these types of systems. They shall have been certified for design by a recognized lightning protection school such as the Lightning Protection Institute.

1.6 COORDINATION

A. Coordinate installation of lightning protection with installation of other building systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.

B. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and Installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers and materials shall be in compliance with the project requirements and shall be the standard products of:

1. Heary Bros. Lightning Protection Co. Inc.
2. Independent Protection Co.
3. Michigan Lightning Protection, Inc.
4. Thompson Lightning Protection, Inc.

2.2 LIGHTNING PROTECTION SYSTEM COMPONENTS

A. Lightning protection system components shall comply with UL 96. All materials shall comply with the requirements of Underwriters Laboratories, Inc and the National Fire Protection Association code relating to the type of structure.

B. Air Terminals: Chrome tipped, solid copper, sized according to NFPA 780.

C. Air Terminal Base Plate: Compatible copper, or copper alloy suitable for intended mounting.

D. Main and Secondary Conductors: Class 1 or 2 copper conductors sized according to NFPA 780.

E. Ground Electrode: Copper Rod or equivalent ground plate as required by soil conditions and required for optimum performance of entire system.

F. Miscellaneous Hardware: Copper, electrically compatible with other components of the system.

G. Fasteners: Noncorrosive, UL-approved metal with ample strength to support the conductors.

H. Connectors: Provide the following
1. Cable Connectors: UL-approved copper, cooper-bronze, or cast bronze for use with copper conductors. Provide screw-pressure type using stainless steel bolts and nuts. Provide Cad-weld or equivalent connections for underground connections.
2. Connections to Building Steel or Reinforcing Steel: Cad-weld or equivalent connections.
3. Dissimilar Metals: UL-approved bimetallic connector.
4. Connections to Ground Rods: UL-approved clamp or Cad weld

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to UL 96A and NFPA 780.

B. For existing buildings, install the lightning protection system as follows:
1. Horizontal wiring at sloped roof ridges: place the wiring under ridge cap.
2. Sloped wiring at sloped roofs from ridge to eaves: Place wiring at interior corners of roof and parapet wall intersections.
3. Horizontal wiring at sloped roof eaves: Place wiring above and/or behind gutters.
4. Horizontal wiring at low slope roofing: Place wiring on the roof side of parapet walls.
5. Vertical wiring at exterior walls: Place wiring at interior wall corners and behind downspouts.
6. Mechanical equipment: Route wiring across roof surface to inside face of parapet wall.

C. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends.

3.2 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.3 TESTING

A. Ground Resistance Test: Perform a ground resistance test. Overall system resistance shall not exceed 25 ohms total. Tests shall be performed using a Biddle Megger Earth Tester, AEMC Earth Ground Tester or equivalent test instrument.

B. Submittals: Contractor shall furnish a report indicating personnel and instruments for test. Test report shall include time and date of tests, relative humidity, temperature and weather conditions.

3.4 FIELD QUALITY CONTROL

A. The entire installed system shall be an LPI certified lighting protection system complying with the requirements of UL 96A for a Master Label C for the system. Provide Master Label C certification document.

END OF SECTION 264113

SECTION 311400 – SITE CLEARING

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. Provide all labor, materials and equipment as necessary to complete all work as indicated on the Drawings and specified herein.

B. This Section includes sod and topsoil stripping.

C. Related sections include the following:

1. Division 01 Section “General Requirements - Temporary Facilities and Controls.”
2. Division 02 Section “Site Demolition.”
3. Division 31 Section “Earthwork.”

1.3 DEFINITIONS

A. Topsoil: Friable clay loam surface soil containing 2.5% to 12% organic matter. Topsoil shall be free of subsoil, clay lumps, stones, rocks, weeds, roots, construction debris, and other unsuitable materials as determined and approved by the Project Representative.

1.4 PLANT PROTECTION

A. Refer to Division 01 Section “General Requirements - Temporary Facilities and Controls.”

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 SOD STRIPPING

A. Stripping and stockpiling sod shall be done under reasonably dry conditions. Secure approval of soil quality in advance from the Project Representative to begin sod stripping. Sod removal shall include the entire root system but not an excess amount of topsoil. Contractor shall haul the sod to a campus location, as directed.

3.2 TOPSOIL STRIPPING

A. Stripping and stockpiling topsoil shall be done under reasonably dry conditions. Stripping and stockpiling under wet conditions will not be allowed.

B. Contractor shall strip available topsoil to its full depth from within the Contract limits, excluding areas in close proximity to trees designated to remain, unless otherwise specified or directed by the Project Representative.

C. Contractor shall stockpile topsoil in a storage pile in an area shown on the Drawings or as directed by the Project Representative. Storage pile shall be shaped to freely drain surface water during and after stockpiling operations. Excess topsoil shall be removed from campus by the Contractor unless directed otherwise prior to bidding. The stockpile shall be protected from soil and sediment erosion as required elsewhere in these Specifications.

END OF SECTION 311400

SECTION 312300 – EARTHWORK

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. Provide all labor, materials and equipment as necessary to complete all work as indicated on the Drawings and specified herein.

B. Related sections include the following:

1. Division 01 Section 15000-TEMPORARY FACILITIES AND CONTROLS
2. Division 02 Section 024116-SITE DEMOLITION
3. Division 31 Section 311400-SITE CLEARING
4. Division 32 Section 321216-BITUMINOUS PAVEMENT
5. Division 32 Section 321313-CONCRETE PAVEMENT

C. Approved Topsoil Installation Contractors shall bid directly to and be contracted directly by the General Contractor or Construction Manager.

D. Approved Topsoil Installation Contractors:

1. Anderson Fischer Associates Inc., 225 E. Kipp Rd, Mason MI 48854-1946
(517) 676-5522

2. Carols Excavating Inc., 5103 Lansing Rd, Charlotte MI 48813
(517) 645-0670

3. Central Excavating LLC , 11303 W Price Rd, Westphalia MI 48894-8208
(517) 749-2566

4. E.T. MacKenzie, 4248 W. Saginaw Highway, Grand Ledge MI 48837
(517) 627-8408

5. Eagle Excavation Inc., 4295 Holiday Drive, Flint MI 48507
(810) 767-7878

6. Owner Pre-Approved Topsoil Installation Contractor

E. Testing and inspection agency will be under contract with the contractor and will perform QA activities of the material below all pavements and structures.

1.3 DEFINITIONS

A. Excavation: Removal of material encountered to indicated subgrade elevations and subsequent disposal of materials removed. Excavation material is unclassified.

B. Unauthorized Excavation: Removal of materials beyond indicated subgrade elevations or dimensions without specific direction by the Project Representative. Unauthorized excavation shall be at the Contractor's expense. Undermining of existing footings or disturbing the bearing soil shall not be permitted unless it is specifically indicated or specified in the Contract Documents.

C. Additional Excavation: When excavation has reached required subgrade elevations the Contractor shall notify the Project Representative who will inspect conditions. If the Contractor encounters unsuitable bearing materials at the required subgrade elevations Contractor shall carry excavations deeper and replace excavated material as directed by the Project Representative. Removal of unsuitable material and its replacement, as directed, is part of this Contract.

D. Backfilling: Placement of fill soil, either provided on site or Contractor-furnished, which shall be uniformly compacted to the required density.

E. Bedding: The material placed around a utility between 4 inches below to 12 inches above the utility the full width of the trench.

F. Building Compacted Areas: Areas under slabs on ground within the building line. Exterior concrete slabs attached to the building, such as entrances, shall be considered within the building line.

G. Contract Limits: Those areas of the project site on which, or upon which, work will be done in accordance with the Contract.

H. Fill: Imported material which is placed in structure undercut.

I. Imported Material: Soil material which is purchased by Contractor and hauled onto the site.

J. MDOT: Michigan Department of Transportation's Standard Specifications for Construction, 2012.

K. Proof-Rolling: The use of a loaded 10 CY capacity or larger truck driven over the subgrade and subbase to check for unstable areas that should be undercut. The method, pattern and frequency will be determined by the Pavement Consultant.

L. Quality Assurance (QA): All activities that have to do with the Owner ensuring the quality of the product as specified, including materials sampling and testing, construction inspection, and review of Contractor quality control documentation. This work will be performed by the Pavement Consultant.

M. Quality Control (QC): All activities that have to do with the Contractor producing the quality of the product as specified, including training, materials sampling and testing, project oversight and documentation.

N. Rock Excavation:

1. Excavation of igneous, metamorphic or sedimentary rock or hardpan which cannot be excavated without continuous drilling or continuous use of a ripper or other special equipment.

2. Excavation of boulders of 1/2-cubic yard or more in volume.

O. SESC: Soil Erosion and Sedimentation Control as required in Division 01 "General Requirements – Temporary Facilities and Controls" and elsewhere in these Specifications.

P. Site Compacted Areas: Areas outside of the building line within the Contract limits.

Q. Structure: A building, retaining wall, tank, footing, slab or other similar construction.

R. Structure Backfill: Soil or other material which is placed against walls or sides of structures.

S. Subbase: Compacted fine and course aggregate layers used in the pavement between the subgrade and the pavement.

T. Subgrade: Compacted soil, either existing or provided as part of the Work, upon which new construction is to be installed.

U. Undercut: Excavation of native material from below the bottom of footings, floors, structures and subbases.

1.4 SUBMITTALS

A. Warranties: Submit written special warranty as specified in this Section. Include contact information, description of coverage, and start date for each special warranty.

1.5 SOIL EROSION AND SEDIMENTATION CONTROL

A. Prior to and during earthwork operations refer to Division 01 Section "General Requirements - Temporary Facilities and Controls" to ensure that provisions of that section are fulfilled.

1.6 BACKFILL COMPACTION TESTING

A. Contractor shall retain a licensed soils testing engineer, approved by the Owner, paid for as an allowance item, and shall submit to the Project Representative 3 copies of a report containing testing procedure, test results, and a statement that soil has been compacted in accordance with the specifications. The Project Representative shall give final approval of the backfill before construction continues. The following submittals shall be submitted directly to the Project Representative from the soils testing engineer, with one copy to the Contractor:

1. Test reports of borrow material.
2. Verification of each footing subbase.
3. Field density test reports.
4. One optimum moisture-maximum density curve for each type of soil.

B. Where more than one lift of soil is being placed, the soils testing engineer shall be present during the entire filling operation to confirm that each lift is properly compacted with approved soil.

C. Perform a maximum density test conforming to ASTM D1557 (Modified Proctor) for each type of soil encountered.

D. Field density tests shall conform to ASTM D2922 - Nuclear Method.

E. The frequency of testing shall be as follows:

1. Footing Subgrade: As required by Project Representative.

2. Paved Areas and Building Slab Subbase: One test per 2000 square feet for Subbase and one test per 1500 square feet per lift.

3. Footing and Trench Backfill: One test per 50 lineal feet per lift.

4. Trench Backfill: One test per 50 lineal feet per lift.

5. Post Backfill: One test per 12-inch lift (provided equipment is available).

6. Tree Stump Backfill: One test per 12-inch backfill lift (same as above).

F. Quality Assurance for Bituminous Pavement: the Pavement Consultant will perform QA of existing and installed material below the bituminous pavement. In order to perform that function, Contractor shall contact the Pavement Consultant 2 days prior to seperatly proof rolling the subgrade and subbase material, as well as keep the Pavement Consultant informed of the schedule of the installation of aggregates prior to paving. the Pavement Consultant will inform the Owner of deficient areas that have not been identified by Contractor as part of the Contractor’s quality control procedure. This inspection by the Pavement Consultant does not relieve Contractor of Contractor's responsibility to provide adequate quality control.

1.7 DESIGN AND PERFORMANCE REQUIREMENTS

A. Trench Bottom Suitability:

1. Contractor shall be responsible for the suitability of the normal trench bottom in supporting utility, bedding and backfill.

2. Contractor shall notify the Project Representative and await the Project Representative’s decision if a possible unsuitable condition exists.

3. NOTE: Poor dewatering techniques or lack of excess water control shall not be a reason for additional payment for remedial measures.

B. Trench Wall Stability:

1. Contractor shall be responsible for trench configuration, including sheeting, shoring and bracing necessary to support trench side walls from collapsing.

2. Contractor shall be responsible for structural design and stability of a pipe-laying box if utilized on the Project to prevent trench walls from collapsing.

C. Excavation Side Stability: Be responsible for structural design of sheet piling, underpinning, shoring and bracing to prevent sides of excavation from collapsing and causing damage to adjacent structures pavements and materials.

1.8 MATERIAL STORAGE

A. Stockpile satisfactory excavated materials in accordance with MDOT Standards where directed, until required for backfill or fill. Place grade, and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain. Place silt fence around stockpile, if left overnight.

1.9 WARRANTY

A. Failures of surface areas caused by settlement shall be repaired at Contractor's expense for a period of 3 years after completion of Contract.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Materials: For backfill and fill, soils complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP. (Contractor shall note exceptions under Article 3.11 – Backfill and Fill.)

B. Unsatisfactory Soil Materials: For backfill and fill, soils complying with ASTM D2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT.

C. Granular Materials: In accordance with MDOT Sections 301, 302 and 902 for 22A aggregate, Class I, II and Class II Subbase materials, except no foundry sand is permitted. Granular material shall contain sufficient binder to provide fill capable of supporting construction equipment without displacement.

1. Sections 2.11 and 8.02 for Class II Subbase and shall meet or exceed a minimum permeability requirement (K) of 8 feet per day as determined by the Michigan Test Method (MTM) 122.

2. Quality control shall include a lab test prior to delivery and field testing each 1000 cubic yard delivered or fraction thereafter. Each test shall include taking 3 samples, testing them individually and averaging the results.

3. The Michigan Test Method (MTM) shall be used to determine acceptable material. Once tested and accepted, Contractor shall acquire the material from the identical location.

4. Contractor shall notify the Project Representative in advance of changing the source location.

5. Field permeability test samples shall only be taken after the material has been spread uniformly on the subgrade and before compaction takes place. Material shall be less than 90% saturated upon completion of the test.
6. Material that fails the test shall be replaced at no cost to the Owner, and the cost for failed tests shall be paid by Contractor.

D. Sand:

1. Fill Sand: MDOT Class II granular material that is free of clay.
2. Washed Sand: MDOT 2NS.

E. Lean Concrete: Mixture of Portland cement, aggregate and water having compressive strength of 2,000 psi at 28 days.

F. Granular Surface Materials: In accordance with MDOT specifications.

1. Gravel Drives: 22A aggregate modified to minimum 6% wash.

2. Limestone Drives: 21AA limestone aggregate.

3. Construction Tracking Mat: 6A crushed limestone.

4. Pavement Subbase: If not specified on Drawings, place thicknesses and materials as follows:

a. For concrete pavement, use 2-inch Class II sand compacted in place (CIP).

b. For bituminous pavement in parking lots, use 6-inch Owner provided 21AA recycled concrete aggregate (CIP) over 6-inch Class II Subbase (CIP).

1) Provided to Contractor from Owner stockpile. Loaded by Owner. Contractor is responsible for hauling, spreading and compacting.

c. For bituminous pavement in roadways and loading docks with parking spaces, use 8-inch -21AA aggregate (CIP) over 12-inch Class II Subbase (CIP).

G. Topsoil
1. Topsoil (Owner-Provided & Placed).

2.2 UTILITY SLEEVING

A. Schedule 80 PVC under roads.

B. Schedule 40 PVC under walks.

C. End caps as required.

2.3 SMART BALL

A. Product 1428-XR/1D purple; manufactured by 3M Dynatel. Michigan Representative: Gregware Equipment, Grand Rapids, Michigan; 1-800-248-5678.

1. Provided by Owner

B. Quantity:

1. One smart ball on pipe lengths 0 to 12 feet; with end cap at other end.
2. For pipe lengths over 12 feet, place one smart ball at each end of the sleeve.

PART 3 - EXECUTION

3.1 SOIL EROSION AND SEDIMENTATION CONTROL

A. Prior to and during earthwork operations, refer to Division 01 Section “General Requirements - Temporary Facilities and Controls” to ensure that provisions of that section are fulfilled.

3.2 PREPARATION

A. Plan the Work to minimize the time excavation remains open. If excavation remains open beyond the time approved in the Project schedule, additional requirements may be imposed at no additional cost to the Owner.

B. Adequately barricade the excavation at all times to protect workers and the public from the danger of the open excavation.

3.3 EXCAVATION FOR STRUCTURES

A. Excavations shall extend a sufficient distance from footings and foundations to permit placement and removal of concrete formwork, installation of services, other construction, and inspection. Care shall be taken not to disturb bottom of excavation. Trim bottoms to required lines and grades to leave solid base to receive concrete.

B. Bracing and Sheeting:

1. Do not install by jetting.

2. Furnish, put in place and maintain sheeting, bracing and shoring, as may be required to properly support the sides of excavations and to prevent movement of earth which could in any way injure the Work or adjacent property.

3. Exercise care in removal of sheeting, shoring, bracing and timbering to prevent collapse or caving of excavation faces being supported and damage to the Work and adjacent property.

4. Do not leave sheeting or bracing in the excavation after completion of the Work, unless approved by the Project Representative.

C. Undercut:

1. If suitable bearing for foundations is not encountered at elevations indicated on the Drawings, immediately notify the Project Representative.

2. If soft material, which in the opinion of the independent testing laboratory is not suitable, is encountered below a structure, the Project Representative may order removal of this soft material and its replacement with specified material in order to make a suitable foundation for construction of the structure.

3. Undercutting made at the order of the Project Representative will be paid for on the basis of the actual quantity of material excavated. Do not proceed further until instructions are received and necessary measurements made for purposes of establishing additional volume of excavation.

4. No extra payment will be made if removal is required as a result of poor dewatering techniques.

5. Undercutting, which is specifically indicated on the Drawings or herein specified, shall be included in the base bid.

6. Soil removed may be used as fill in areas not below driving surfaces, structures or utility structures.

7. Compact subgrade at bottom of undercut prior to placing fill.

8. Place and compact specified fill in undercut.

9. Lateral extent of undercut shall be a horizontal distance equal to the depth of undercut below structure.

D. Excavating:

1. Excavation shall be by open cut from the surface except as herein specified or as indicated on the Drawings.

2. Excavations for structures shall be made in such manner and to such depth and width as will give ample room for building the structures and for bracing, sheeting and supporting

the side of the excavation, for pumping and draining groundwater and wastewater which may be encountered, and for removal of material excavated.

3. Excavate to required cross section and elevation indicated on the Drawings. Subgrade shall not vary more than 0.1 feet above or below the established elevations.
4. Depression caused by excess excavation, traffic or rolling shall be filled with MDOT 902 Granular Material Class II or approved fill and rerolled and compacted in place as specified herein.

5. If required because of excess water conditions, place stone stabilization course prior to proceeding with construction. Place filter fabric over stone stabilization course.

3.4 EXCAVATION FOR PAVEMENT

A. Cut surface under pavements to comply with cross-sections, elevations and grades as indicated on Drawings.

3.5 EXCAVATION FOR UTILITIES

A. Width of Trenches:

1. Steam Tunnels: Widths at bottom of trench shall be 3 feet wider than the overall width of tunnel or vault, and shall at all times be of sufficient width to permit tunnel and vaults to be built properly, waterproofed and backfilled.

2. Pipelines: Widths of trenches for pipe lines shall allow for proper compaction of the haunching. The trench width at the spring line of the pipe for pipes less than 48 inches shall be pipe width plus 18 inches. The trench width for pipes larger than 48 inches shall be the pipe diameter plus 30 inches.

3. Electric and Telephone Ducts: Trench shall be the proper width and depth for the duct bank, allowing a minimum of 3 inches of concrete on each side of the duct formation.

4. Street Light Cable: Minimum trench width shall be 6 inches, maximum width shall be 12 inches, and minimum depth shall be 30 inches.

B. Length of Trenches: Excavation shall be finished to the required grade for an adequate distance in advance of the completed installation. Unless otherwise permitted by the Project Representative, the amount of trench that shall be open in advance of the construction shall not exceed the following limits:

1. Steam Tunnels: Length between 2 vaults, minimum.
2. Buried Steam Systems: Length between 2 vaults, minimum.
3. Sewers: 50 lf.
4. Water Mains: 50 lf.
5. Electric and Telephone Ducts: The amount that can be encased in concrete in a day.
6. Street Light Cable: The amount of cable that can be laid in a day.

3.6 REMOVAL OF EXCESS SUBSOIL

A. Excess subsoil shall be removed from the Owner's property and legally disposed.

3.7 UTILITIES TO BE ABANDONED

A. When pipes, conduits, sewers or utility structures are removed from the trench, leaving dead ends in the ground, fully plug such ends with brick and mortar.

B. Entirely remove abandoned utility structures unless otherwise specified or indicated on Drawings.

C. Remove materials which can be readily salvaged from the excavation and store on site as indicated on the Drawings.

D. Salvageable materials will remain the property of the Owner unless otherwise indicated on the Drawings.

3.8 UTILITY SLEEVING

A. Place sleeve as located on the Drawings. Maintain structural integrity of pipe.

B. Place Smart ball at end of pipe and fabric. Attach with duct tape to end of pipe. See PART 2 - PRODUCTS for quantities.

C. Place PVC cap on end of pipe when only one Smart ball is required.

3.9 BEDDING

A. Place bedding material up to 1/8 the height of the utility. Compact as herein specified.

B. Accurately shape bedding material to fit pipe shape. Recess bedding to relieve pressure on the bell or other projecting utility joint.

C. After laying out the utility, tamp additional bedding in place up to the midpoint of the utility. Use hand-operated compactors to achieve required compaction.

D. Place additional bedding up to 12 inches above top of utility. Use hand-operated compactors to achieve required compaction.

E. Place bedding in maximum lifts of 12 inches.

F. No payment shall be made for aggregate or stone bedding when used for Contractor convenience.

G. Provide concrete encasement at utilities as indicated on the Drawings.

3.10 SHEETING, SHORING AND BRACING EXCAVATIONS

A. General:

1. Furnish, put in place and maintain sheeting, bracing and shoring as may be required to properly support side of excavations and to prevent movement of earth, which could in any way injure the Work or adjacent property.

2. Exercise care in the removal of sheeting, shoring, bracing and timbering to prevent collapse or caving of excavation faces being supported and damage to the Work or adjacent property.

3. A pipe-laying box may be used in lieu of sheeting.

B. Sheeting:

1. Do not install by jetting.

2. Remove as backfilling proceeds, unless ordered left in place by the Project Representative. Use care to fill and compact voids created by removal, especially below mid-height of utility.

3. Sheeting Left In Place:

a. Required written approval of the Project Representative.
b. Cut off minimum of 4 feet below finished grade.

3.11 BACKFILL AND FILL

A. General:

1. Commencement of Backfill Operations: Backfill excavations as promptly as work permits, but not until completion of the following:

a. Acceptance by Project Representative of construction below finish grade including where applicable, dampproofing, waterproofing and perimeter insulation.

b. Removal of trash and debris.

c. Permanent or temporary horizontal bracing is in place on horizontally supported wall.

d. Removal of concrete formwork.

e. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities. Contractor shall leave shoring to be embedded in the backfill of the trench or other excavation, for the purpose of preventing injury to the completed structure or other adjacent structures or property. Ends of sheeting, bracing or timber left embedded in the backfill shall be cut off and removed at least 2 feet below the established grade.

2. Acceptable Backfill: Place specified soil material in layers to required subgrade elevations, up to, but not including subbase material, for each area classification listed below:

    a. In excavations, use approved excavated or borrow material, except as otherwise specified.

    b. Under grassed areas use satisfactory excavated materials, unsatisfactory excavated soil classification groups GC, SC, ML, and CL, or approved borrow material.

    c. Under pavement use satisfactory excavated Class II and Class II subbase granular material. Soil classification groups GC, SC, ML and CL may be used with the approval of the Project Representative.

    d. Under building slabs, use Class II granular material.

    e. In utility trenches, use Class II granular material.

3. Required Concrete Within Backfill:

    a. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and are carried below bottom of such footings, or which pass under wall footings. Place concrete to level of bottom of adjacent footing.

    b. For piping or conduit less than 2′-6″ inches below surface of roadways, provide 4-inch thick concrete base slab support. After installation and testing of piping or conduit, provide minimum 4-inch thick encasement (sides and top of concrete) prior to backfilling or placement of roadway subbase.

B. Ground Surface Preparation:

1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break-up sloped surfaces steeper than 1-foot vertical to 4 feet horizontal so that fill material will bond with existing surface.

2. Subsoil Preparation Prior to Topsoiling: This procedure is required to prevent permanent establishment of a dense layer of soil caused by construction operations, that would make it difficult for vigorous plant growth and proper drainage. In areas of the Project site that are compacted during construction, as determined by Project Representative, and after completion of exterior building construction operations, where vehicles/equipment would be required to travel across the soil around the structure or the constructed site improvements, or both, the existing subsoil, as well as the top 12 inches of newly placed subsoil, shall be loosened using the following procedures:

    a. Prior to beginning this work, notify Project Representative at least 1 business day in advance. Also, re-stake existing and new utilities that may be disturbed by these earthwork operations.

b. The moisture content of existing and new soil shall be optimum for this earthwork operation. Each step shall be approved by the Project Representative, prior to continuing to the next step, and prior to satisfactory completion of the final step.

c. For areas where the existing subsoil grade is to remain and for areas which will receive additional soil:

1) STEP 1 – Loosening Existing Subsoil and Debris Removal: Existing subsoil shall be brought to a friable condition 12-inches deep, prior to placing additional subsoil fill. Possible equipment to use to loosen the soil include, but are not limited to, chisel plow, backhoe bucket, disc or harrow; followed by discing, if a disc is not initially used, to reduce the soil clump to the desired size. Contractor will submit a proposed method of loosening the subsoil to the Project Representative for approval at least 14 days prior to commencement of the work. The submittal shall include the method of equipment to be used. The soil shall be broken up sufficiently so that the resulting soil fragments are small. Also it is equally important to legally dispose of construction debris and rocks larger than 27 cubic inches exposed during this process.

2) STEP 2 – Placing of Additional Subsoil Fill- Transitional Layer Blending: Where additional fill is required, place the initial "transitional" layer and blend with the existing subsoil utilizing methods mentioned in Step 1.

3) STEP 3 –Subsoil Fill - Top Layer Loosening: Loosen top layer to a friable condition, blending in the first 1"-2" of topsoil. If no additional subsoil is required, delete Step 2.

4) STEP 4 – Final Grading and Protection: Grade the disturbed area to the elevations as specified, in preparation for topsoil placement. Do not otherwise recompact the subsoil. Once the subgrade is approved, construction equipment and vehicles unrelated to topsoiling and planting operations shall be prohibited. (Contractor may be required to provide temporary construction fencing to prevent recompaction of the subsoils. Costs for temporary fencing is a Contractor expense.)

d. For areas where existing subgrade is to be lowered:

1) STEP 1 – Existing Subsoil Excavation and Debris Removal: Excavate the subsoil, removing all excess material from the site to the proposed subgrade. Remove and legally dispose of construction debris exposed during this process.

2) STEP 2 – Subsoil Loosening: Existing subsoil shall be brought to a friable condition 12-inches deep. Possible equipment to use to loosen the soil include, but are not limited to, chisel plow, backhoe bucket, disc or harrow; followed by discing, if a disc is not initially used, to reduce the soil clump to the desired size. The resulting soil shall be broken up sufficiently so that the resulting soil fragments are small.

3) STEP 3 – Final Grading and Protection: Grade the disturbed area, as specified, in preparation for topsoil placement. Do not otherwise recompact the subsoil. Once the subgrade is approved, construction equipment and vehicles, unrelated to topsoiling and planting operations, shall be prohibited. (Contractor may be required to provide temporary construction fencing to prevent recompaction of the subsoils. Costs for temporary fencing is a Contractor expense.)

3. Subsoil Preparation for Paved Areas:

a. If, after rough grade has been achieved in cut areas and prior to placement of fill material in fill areas, the exposed subgrade has a density less than that specified under Article 3.12 – Compaction for particular area classification, break-up ground surface, pulverize, moisture condition to optimum moisture content, and compact to required depth and percentage of maximum density. Entire area shall be proof rolled with a heavy rubber-tired vehicle, such as a loaded scraper or loaded dump truck, to locate areas of extreme pumping and yielding, which shall be repaired as follows:

1) Soft areas due to moisture laden soil shall be corrected by applying an appropriate soil stabilization procedure to be specified, or as directed by Project Representative.

2) If required density cannot be obtained, the objectionable material shall be removed and replaced as ordered by the Project Representative.

3) The cost of corrective measures incurred as a result of stabilizing poor subgrade conditions shall be paid on basis of contract conditions relative to changes in work.

C. Placement and Compaction:

1. No backfill shall be placed without it being compacted in place. Backfill material shall be compacted in layers not exceeding 6 inches in compacted thickness.

a. Granular, non-cohesive soils shall be compacted with mechanical tamping or vibration-type compactors. Sand may be compacted by flooding the trench when water is available.

b. When clays are encountered, a mechanical tamper or sheeps-foot roller shall be used to compact the soil. Manual mechanical tamping equipment shall have a rammer which weighs not less than 20 pounds and has surface area of not more than 36 square inches. Hand compaction is not acceptable.

2. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen or contain frost or ice.

3. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift.

4. Existing Utilities: Where existing utilities are required to be tunneled under, the area under the utility shall be filled with compacted sand, and have the pipe embedment reconstructed as for new piping.

5. Pipe Embedment: New piping shall be laid on a sand leveling bed compacted to maximum thickness of 6 inches. Dig holes in bedding for bells and fittings so pipe bears uniformly along its length. Hand compact the haunching under the spring line of the pipe. Take extra care to control the density of the haunching on plastic pipe in accordance with the manufacturer's instructions.

3.12 COMPACTION

A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification. Perform all required tests.

B. Moisture Control:

1. Where soil material must be moisture conditioned before compaction, uniformly apply water to surface of subbase, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

3. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

C. Required Densities:

1. Structures, Building Slabs and Steps: Compact top 18 inches of subgrade and each layer of backfill or fill material to 95% of maximum density or greater.

2. Pavements: Compact disturbed soil to remain and subbase material to 95% maximum density or greater.

3. Lawn or Unpaved Areas: 80-85% maximum density, Refer to Article 3.11.B.

4. Trench Backfill: Compact layers 6 inches or less to 95% maximum density or greater.

5. Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 95% maximum density or greater.

6. Fill Under Existing Utilities: Compact top 6 inches of subgrade and each layer of backfill to 95% maximum density or greater.

7. Sand Pipe Bedding: Compact top 6 inches of subgrade and 6-inch layer of sand to 95% maximum density or greater.

3.13 FINISH GRADING

A. Finish surfaces free from irregular surface changes, and as follows:

1. Lawn or Unpaved Areas: Finish topsoil to within not more than 0.10 feet above or below specified finish grade as measured after settlement and/or specified compaction is attained

2. Pavements: Shape surface of areas under pavement to line, grade and cross section, with finish surface not more than ¾ of an inch above or below required subgrade elevation.

3. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within tolerance of 2 inches when tested with a 10 foot straightedge.

B. After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

C. Proof Roll: Contractor shall arrange with the Pavement Consultant to approve subgrade as indicated in Articles 3.11 and 3.12.

3.14 PAVEMENT SUBBASE COURSE

A. Grade Control: During construction, maintain lines and grades including crown/cross-slope of subbase course.

B. Placing: Place subbase course material on prepared subgrade in layers of uniform thickness of 6 inches or less, conforming to indicated cross section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.

C. Class II subbase shall be spread and compacted identical to regular Class II material.

D. Proof-roll before placing the bituminous pavement.

3.15 GRANULAR SURFACE COURSE

A. Grade Control: During construction, maintain lines and grades including cross-slope of subbase course.

B. Placing: Place granular course material (22A gravel for parking areas and 21AA for roadways and loading docks) on prepared subbase in a layer of uniform thickness, as indicated on the Drawings for cross section and thickness.

3.16 BUILDING SLAB SUBBASE

A. Place subbase material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.

B. Compact subbase in maximum 6-inch lifts.

3.17 TOPSOIL OPERATIONS (SUBSOIL SURFACE PREPARATION, HAULING, SPREADING, ROUGH GRADING AND CLEAN-UP)

A. Project Representative shall approve rough grade elevations of existing subsoil prior to commencement of subsoil loosening operations.

B. Once loosening of subsoil has been completed, the Project Representative shall approve prior to topsoiling.

C. Topsoiling operation shall be complete before October 31, unless approved by the Project Representative.

D. Topsoil shall be placed by an approved topsoil installation contractor.

E. Contractor shall submit a proposed method for placement of topsoil to the Project Representative for approval at least 14 days prior to commencement of the Work. The submittal shall include equipment to be used.

F. Owner will identify topsoil stockpile for use. The contractor will be responsible for hauling and spreading the topsoil. Stockpile storage site is open from 6 a.m. to 4:30 p.m., unless other times are arranged with Project Representative and MSU Landscape Services Department. *(Option 1)*

Topsoil shall be placed in quantities appropriate to result in 6 inches of depth when compacted to 80-85% maximum density, spread to minimize uneven compaction, and placed as follows:

1. Place 6 inches of screened topsoil over loosened subgrade blending first 1”-2” into the subgrade. Obtain approval of subgrade from Project Representative prior to placement of topsoil (review Article 3.11 B Ground Surface Preparation for requirements and procedures).

G. Place silt fence at locations designated on the Contract Documents and locations specified by the Project Representative prior to topsoil placement. Silt fence shall become property of Owner and removed by Owner.

H. Notify the Project Representative when topsoiling is complete for final inspection, approval and Owner seeding of site.

3.18 INSPECTION

A. Contractor shall notify the Project Representative when the excavation is complete. A visual subgrade inspection shall be performed prior to placing reinforcing steel, concrete, pipe beddings, etc. If satisfactory soil conditions are not found at the depths indicated, immediately notify the Project Representative in writing before proceeding further. Should Contractor fail to notify the Project Representative, all settlement and damage caused by new work resting on soft or unsound earth shall be made good at the sole expense of the Contractor.

3.19 PROTECTION

A. Protect newly graded areas from traffic and erosion. Keep free of trash, debris and plant material, including weeds and grass.

B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances. Where settling is measurable or observable at excavated areas during Project warranty period, remove pavement, lawn or other finish, add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

C. Where completed compacted areas are disturbed beyond specified tolerances by subsequent construction operations or adverse weather, scarify, reshape, and restore surface to match surface of originally installed work. Eliminate evidence of the repair to the greatest extent possible.

D. Continue to properly maintain soil erosion and sedimentation control measures. Perform and document required site inspections until the Owner has officially accepted the Project site.

3.20 CLEAN-UP

A. Refer to Division 01 Section “General Requirements - Temporary Facilities and Controls.”

B. The Contractor shall perform daily maintenance and cleanup of construction materials and debris tracked on and off site. Materials and debris that accumulate and are not removed or maintained after a 24-hour notification of a violation by the Owner, will be separately contracted by the Owner and all associated costs will be charged to the Contractor.

END OF SECTION 312300

SECTION 314100 – SHORING AND UNDERPINNING

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. Provide all labor, materials and equipment as necessary to complete all work as indicated on the Drawings and specified herein.

B. This section includes shoring and underpinning of utilities, structures and property.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials utilized shall be as selected by Contractor.

PART 3 - EXECUTION

3.1 SHORING AND UNDERPINNING

A. Contractor shall design, furnish, install, and maintain sheeting, bracing, and shoring required to properly support the sides of excavation and to prevent movement of earth which could in any way damage the work under construction, existing utilities and structures, and adjacent property.

B. If the Project Representative is of the opinion that sufficient or proper supports have not been provided at any point, additional supports may be ordered, at the expense of the Contractor. Neither the placing of such additional supports by the order of the Project Representative nor the failure of the Project Representative to order such additional supports placed shall release the Contractor from the responsibility of the adequacy of such supports and the integrity of the Work.

C. In the removing of sheeting and bracing, special care shall be taken to prevent caving of the sides of the excavation and damage to the completed work or adjacent property.

END OF SECTION 314100

SECTION 321216 – BITUMINOUS PAVEMENT

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. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the Drawings and specified herein.

B. This section includes bituminous pavement.

C. Work Excluded: This section does not apply to bituminous pavement patching.

D. Related sections include the following:

1. Division 02 Section 024113-SITE DEMOLITION
2. Division 31 Section 312300-EARTHWORK
3. Division 32 Section 321723-PAVEMENT MARKING

E. Quality assurance

1. Removal:

a. If the pavement density for a sublot (average of sublot cores) is less than 92.0 percent, the Contractor shall remove and replace the sublot.

b. The Engineer reserves the right to evaluate a sublot whose test results for asphalt binder content, Gmm, VMA, or air voids, exceed the single test tolerances indicated in Table 1 – Bituminous Quality Assurance Testing Tolerances (+ or -) from JMF, included at the end of this section. If the Engineer determines that the in-place mixture will not perform in accordance with normal standards, the Contractor shall remove and replace the sublot.

c. General: The cost of the mixture removed and the removal cost shall be borne by the Contractor. Removal decisions will be applied to individual sublots.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the Work of this section shall comply with the following:

1. ASTM:

a. C 117 – Test Method for Materials Finer Than 75µ-m (no. 200) Sieve in Mineral Aggregates by Washing.

b. C 136 – Test Method for Sieve Analysis of Fine and Coarse Aggregates.

c. D 1559-89 – Test Method for Resistance to Plastic Flow of Bituminous Mixtures using Marshall Apparatus (section 4.5).

d. D 2041 – Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.

e. D 2172 – Test Methods for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures.

f. D 2726 – Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens.

g. E 29 – Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications. All equipment requirements to perform these sampling and testing procedures shall apply.

2. MTM (Michigan Test Method):

a. 110 – Determining Deleterious and Objectionable Particles in Aggregates.

b. 117 – Determining Percentage of Crushed Particles in Aggregates.

c. 118 – Measuring Fine Aggregate Angularity.

d. 311 – Determining Aggregate Gradation for Bituminous Mixture.

e. 313 – Sampling Bituminous Mixtures.

f. 319 – Determination of Asphalt Content from Asphalt Paving Mixtures by the Ignition Method.

1.4 DEFINITIONS

A. Quality Control (QC): Activities that have to do with the Contractor producing a quality product as specified; including training, materials sampling and testing, project oversight and documentation.

B. Quality Assurance (QA): Activities that have to do with the Owner ensuring a quality product, as specified; including materials sampling and testing, construction inspection, and review of Contractor quality control documentation. To perform this service, the Contractor shall notify the Engineer 2 days (see definition below) in advance so that QA activities can be properly performed.

C. Bituminous Mix Design: The selection and proportioning of aggregate(s), mineral filler (if required), reclaimed asphalt pavement (RAP) and asphalt binder such that the specified mixture design criteria are met. Laboratory evaluation is required to determine if the stated mix design complies with specifications.

D. Job Mix Formula (JMF): A bituminous mixture for a specific project. This may include adjustments to the mix design to optimize the field application.

E. Target Value: A JMF parameter value that may be adjusted, if approved by the Engineer, to account for changes in the physical properties of the mixture.

F. JMF Adjustment: The Contractor may propose an adjustment to the JMF based upon QC or QA test results; or both. The proposed JMF shall meet the requirements of MDOT 2012 Standard Specifications for Construction. When approved by the Engineer, a JMF adjustment may be applied retroactively to 1 lot, for parameters with target values. The Engineer may also require the Contractor to make adjustments to the mixture to assure that the parameters of the mix design are being met.

G. Voids in Mineral Aggregate (VMA): The volume of void space between the aggregate particles of a compacted paving mixture that includes the air voids and the asphalt binder, including the absorbed asphalt binder, expressed as a percent of the total volume of mixture.

H. Effective Specific Gravity (Gse): The ratio of the oven dry weight in air of a unit volume of an aggregate (excluding voids permeable to asphalt) at a stated temperature to the weight of an equal volume of water at a stated temperature.

I. Bulk Specific Gravity of Aggregate (Gsb): The ratio of the oven dry weight in air of a unit volume of an aggregate at a stated temperature to the weight of an equal volume of water at a stated temperature.

J. Maximum Specific Gravity of Mixture (Gmm): The ratio of the weight in air of a unit volume of an uncompacted bituminous paving mixture at a stated temperature to the weight of an equal volume of water at the same temperature.

K. Lot: Bituminous mixtures produced and placed under this specification will be evaluated on a lot-by-lot basis. A lot is made up of a discrete tonnage of 1 mixture. Each lot consists of up to 3 sublots. These sublots shall be of approximately equal size up to a maximum of 2,000 tons. The sublot size shall be approved by the Engineer prior to the start of production. The Contractor may request a change in the sublot size during production based upon the Contractor's ability to produce a mixture that meets the specification contained within the Contract Documents, and upon approval of the Engineer. If only 1 or 2 sublots are included in a lot at the end of production, they shall be combined with the previous lot using the same mix, and this combined lot shall be evaluated based upon all sublot samples.

L. Lot Average Test Result: The average of all sublot QA test results, for a specific parameter, for the lot. Test results for a sublot removed from the project shall not be used in calculating a lot average. However, the replacement material shall be tested and the results included in the lot average.

M. Process Quality Control Targets: Targets established by the Contractor based upon initial production lot test results (and from an approved trial run) for air voids, VMA, asphalt binder content and Gmm. QC tolerances shall be applied to these established targets to determine the need for production changes, including stopping production, to control the quality of the product. Process quality control targets shall be reported to the Engineer prior to the end of placement of the second lot.

N. Rounding of Numbers: Rounding of numerical data shall follow ASTM E 29-93a, as described in MDOT Bituminous QC/QA Procedures Manual of Field Testing.

O. Random Sampling: Selection of QA samples (bituminous mixture and density) and verification samples may be by a random process managed by the Engineer. The Engineer may use a random number generating calculator to determine the locations of each density core and mixture sample. The Contractor will be given the opportunity to observe the sampling process. However, the random numbers selected and the sampling locations will not be revealed to the Contractor until the time of sampling in order to avoid bias in the random sampling process.

P. Project Representative: An individual appointed by the Owner, Board of Trustees, Michigan State University.

Q. Engineer: Third party testing and inspection agency. The Contractor will contract directly with the Engineer for the QA services under the allowance indicated the bid form.

R. MDOT Specification: Michigan Department of Transportation 2012 Standard Specifications for Construction.

S. RAP: Recycled Asphalt Pavement.

1.5 SUBMITTALS

A. Submit a 4-point mix design, including regression chart, to the Owner for review and approval. Mix design shall follow the format as indicated in the Asphalt Institute Manual MS-2 Marshall Stability Method. It is the intent of this specification for the Contractor to produce mixtures at the parameters indicated in Table 3 – Mixture Type and Table 4 – Gradations (Percent Passing), both included at the end of this section.

B. If the Engineer believes the Contractor is producing mixture at the high or low end of any of these specification limits, the Engineer shall have the authority to make changes necessary to bring the mixture back to the specified parameters.

C. Quality Control Test: Provide test reports as described in this section.

D. Project Documentation: Provide documentation as described in this section.

E. Warranties: Submit written special warranty as specified in this Section. Include contact information, description of coverage, and start date for each special warranty.

1.6 QUALITY CONTROL

A. Sampling and Testing:

1. Follow the sampling and testing procedures listed in Article 1.2 - References in completing this work.

B. The Contractor shall take random samples of loose mixture at a sampling frequency agreed upon with the Engineer. The Contractor shall provide the Engineer a split Sample of QC Samples. This Sample may be taken anywhere in the production process, except behind the paver. The Contractor shall be responsible for establishing process quality control targets for air voids, asphalt binder content, aggregate gradation, Gmm, obtaining QC Samples, and conducting QC testing in accordance with the Contractor's quality control plan (QCP).

C. Each QC Sample shall be identified to allow test reports to be linked to a specific lot or sublot within the Project.

D. The Contractor shall maintain daily control charts and have them available for review at Infrastructure Planning and Facilities at all times. Copies of these control charts shall be provided to the Engineer, if requested. Test results shall be plotted and used in quality control decisions. When corrective action is necessary, the Contractor shall notify the Engineer in writing of the specific action taken, if it required a JMF adjustment.

E. The Contractor shall have available a density gauge for quality control testing during the compaction process and an apparatus for determining the temperature of the hot mix asphalt. The Contractor shall also have the capability to take 6-inch cores from random locations throughout the paved area for acceptance testing. The Contractor may take up to 3 informational cores from each mixture type, to help correlate the density gauge. The average in-place density shall be not less than 95 percent of the theoretical maximum density.

1.7 QUALITY ASSURANCE

A. The Engineer may collect bituminous mixture quality assurance Samples and provide the Contractor with splits of these Samples. If the criteria for the verification procedure are satisfied, the Contractor's test results may be incorporated into the acceptance and payment decisions for the mixture. During the course of production, the Engineer may acquire random Samples at any point in the production process. These Samples may be tested to determine if the mixture, the aggregate and the binder meet the specification requirements contained in the Contract Documents. As the Samples are collected, the Engineer will assign an alphanumeric identifier to the sample and split, which can be used to trace the test results to the lot and sublot. This alphanumeric identifier must be included on Engineer test reports associated with that Sample. An example is 4-2-A, which would designate the Engineer's split (A) of the Sample from sublot 2 of lot 4 on a Project.

B. A minimum 16,000 gram Sample may be taken. The Sample will be divided equally for Contractor and Engineer testing. The following tests may be conducted by the Engineer on the QA Sample splits.

1. Maximum Specific Gravity, Gmm (ASTM D 2041).

2. Bulk Compacted Density (ASTM D 1559, paragraph 4.5).

3. Air Voids (calculated).

4. Voids in Mineral Aggregate, VMA (calculated).

5. Composition of the Mixture: Asphalt binder content based on calculated value using sublot maximum specific gravity (Gmm) and current JMF effective specific gravity (Gse). The retained Gmm sample may be used for gradation (ASTM C 117 and C 136) and crushed particle content (MTM 117) from extracted (ASTM D 2172) or incinerated (MTM 319) aggregate, or from MTM 311.

C. In-Place Density: The Engineer may identify random core sample locations for each sublot based on longitudinal and transverse measurements. The Engineer will mark each core location with a paint dot, which represents the center of the core. The Contractor shall drill a 6-inch core sample at each core location. The Contractor shall notify the Engineer sufficiently in advance of coring to ensure that a representative can be present to witness the coring. The core Samples shall be taken after final rolling.

1. As an option, when mutually agreed to by the Engineer and Contractor, the core Samples may be waived and the density gauge will be used for acceptance testing.

2. Core Samples shall not be damaged during removal from the roadway. If, for any reason, a core is damaged or determined not to be representative at the time of coring, the Engineer will evaluate and document the problem and determine whether re-coring is necessary.

3. All previous pavement, base aggregate or bond coat material shall be sawed off the bottom of the core Samples before the core density is calculated.

4. The core holes shall be filled with hot mixture and thoroughly compacted as part of the coring operation. The method of filling holes and obtaining compaction shall be agreed upon prior to production. Pavement density acceptance testing will be completed within 1 work day after the cores were taken. Testing will be in accordance with ASTM D 2726. The test results on the compacted bituminous mixture may be used as a basis of acceptance and payment.

D. Verification of Quality Control Test:

1. The Engineer will review the Contractor’s sampling and testing procedures, test results and Engineer QA test results. If, in the opinion of the Engineer, sampling and testing

procedures are proper, the Contractor's quality control test data may be used for acceptance decisions.

2. The Contractor's QC test results may be considered verified if the following criteria are satisfied:

   a. The difference between the Contractor's QC test results and the JMF fall within the single test tolerance indicated in Table 1 – Bituminous Quality Assurance Testing Tolerances (+ or -) from JMF, included at the end of this section, **or**

   b. The difference between the Engineer's test results and the Contractor's test results fall within the single test tolerance indicated in Table 1 – Bituminous Quality Assurance Testing Tolerances (+ or -) from JMF, included at the end of this section.

3. If the difference between the Contractor's QC test results, compared to the JMF, exceed the single test tolerances indicated in Table 1 – Bituminous Quality Assurance Testing Tolerances (+ or -) from JMF, included at the end of this section, the Engineer's test results will be used as the acceptance test. If the sublot is not verified, the Contractor shall be notified and given a copy of the test results. Both the Contractor and the Engineer will verify that testing equipment is calibrated and operating properly, and correct testing procedures have been followed. Unless it is documented that the difference resulted from equipment or procedural problems, the Engineer's test results will remain as the acceptance test of record.

E. Project Documentation:

1. The format of test reports and QC charts to be submitted by the Contractor shall be approved by the Engineer before mixture production is allowed to commence. Suggested formats of reports and charts are available from the Engineer. Project documentation to be provided by the Contractor shall include, but may not be limited to, the following:

   a. Lot Basis:

      1) A complete report of QA tests shall be submitted to the Engineer within 24 hours of the time the last tests were completed.

      2) Control charts of test data must be current (data should be plotted as soon as the test is complete) and available for review by the Engineer.

   b. Project Summation:

      1) Control charts for test data indicating individual test values, lot averages and the running average of 5.

      2) A tabulation of test data including sublot data, lot averages, Project average, Project standard deviation and a projection of which lots are subject to a price adjustment.

2. Provide documentation to confirm that the material used on the Project meets or exceeds minimum specified requirements in accordance with MDOT 2012 specifications.

3. The Contractor shall provide a letter to the Owner certifying that materials approved in the mix design were, in fact, used in the production of the mixture installed on this Project.

1.8 DELIVERY, STORAGE AND HANDLING

A. Provide to the Engineer the asphalt delivery tickets showing asphalt cement grade, date of delivery, and quantity delivered.

1.9 PROJECT CONDITIONS

A. Weather and seasonal limitations shall not exceed those specified in MDOT 2012
B. MSU will reject loads with a temperature either below 250 deg F or greater than +/- 20 deg F from the recommended maximum mixing temperature selected by the binder producer at the time of discharge from behind the screed.

1.10 WARRANTY

A. Furnish and sign 5 year written warranty (last page of this section) which shall cover the following conditions:

1. Cracking: A crack caused by improper joints in the pavement, either a construction joint, a butt joint, or cracking caused by expansion or contraction of the pavement, or by any settlement of the pavement.

2. Delamination: An instance where the surface course de-bonds from the underlying layer of asphalt pavement, causing slippage or complete separation.

3. Raveling: An area where the aggregate or matrix becomes loose, or separates from the asphalt pavement. This condition will generally be caused by poor density or segregation.

B. Remedies for the conditions described above shall be as follows:

1. Cracking: Cracks over 3-inch length or wider than 1/8-inch, or both, shall be corrected by routing/sawing and sealing or overband sealing, as directed by the Engineer, with a sealer approved by the Engineer.

2. Delamination: Areas that exhibit delamination shall be repaired by removing the surface course and cleaning the leveling course, installing a bond coat, and furnishing and installing a new surface course of a like hot mix asphalt.

3. Raveling: Areas that exhibit raveling, or a loss of aggregate or matrix, shall be repaired by removing the distressed area, cleaning the leveling course, applying a bond coat, and furnishing and installing a new surface course of a like hot mix asphalt.

C. At least once a year, for the duration of the warranty period, Project Representative will inspect the pavement to determine if warranty work is necessary. If deficiencies are found, the Project Representative shall notify the Contractor in writing as to the extent of the repairs needed. The Contractor shall perform the repairs within 30 calendar days or other period as approved by the Project Representative. Should the Contractor not perform the required repairs, the Owner may make the repairs at the Contractor's expense. The Contractor may also inspect the lot from time to time to determine if warranty work is necessary. The Contractor will be allowed, with approval of the Project Representative, to perform warranty work that will retard any further deterioration of the warranted conditions. Any and all costs to repair deficiencies in the asphalt shall be paid for by the Contractor.

PART 2 - PRODUCTS

2.1 SUBBASE COURSE

A. See Division 31 Section 312300-EARTHWORK.

2.2 BASE COURSE

A. Not used.

2.3 BITUMINOUS MIXTURES

A. See Table 3 – Mixture Type and Table 4 – Gradations, both included at the end of this section.

2.4 ASPHALT EMULSION

A. The bond/tack coat shall conform to MDOT 2012 Specification for Asphalt Emulsion SS-1h.

2.5 ASPHALT CEMENT

A. Final binder properties shall meet asphalt PG 58-28. The asphalt cement shall conform to MDOT 2012 Specification for Asphalt Cement and conform to the Project Specifications. If the binder obtained from the recycled asphalt pavement exceeds 17 percent of the total binder in the mixture, the Contractor shall furnish documentation (i.e., blending chart) in order to determine the proper grade of virgin binder required to achieve the desired final binder properties.

2.6 TRAFFIC PAINT

A. See Division 32 Section 321723-PAVEMENT MARKING.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare subbase according to MDOT 2012 Specifications and Project requirements.

B. Where entire pavement thickness is to be completely removed, cut existing pavement neatly with a saw. Otherwise, edges shall be cut straight and smooth allowing for a full depth pavement throughout.

C. Proof roll subgrade and subbase to check for unstable areas and areas requiring additional compaction. Perform proof rolling as directed by the Engineer.

D. Notify Project Representative of unsatisfactory conditions. Do not begin paving work until deficient subgrade areas have been corrected, tested, and approved by the Project Representative.

E. Required Grades for Barrier Free Parking Areas:

1. In areas designated on the Drawings as a barrier free parking space, either so noted or with a uniform barrier free graphic symbol, the slope of the parking space and adjacent access aisle shall not exceed 2 percent (1/4-inch per foot) in any direction.

2. Should this provision conflict with the Drawings, inform the Project Representative so that the necessary revision(s) can be made.

3.2 INSTALLATION OF PAVEMENT

A. General: Place bituminous pavement and bond coats over approved subbase or existing pavement according to MDOT 2012 Specifications, Division 5.

B. Pavement Thickness and Type: Over the subbase, place bituminous pavement as indicated on the Drawings. For courses exceeding 3-inch, place bituminous pavement in 2 lifts with a bond coat between each layer. For patching, provide 4-inch leveling course and 2-inch surface course over compacted subbase.

1. Mix Type:

a. Surface Course – Roadway and Dock Areas:

1) Thickness: 1.5-inch.
2) Yield: 165 lbs/syd.

b. Surface Course – Parking:

1) Thickness: 1.5-inch.
2) Yield: 165 lbs/syd.

c. Leveling Course – Roadway and Dock Areas:

1) Thickness: 3.5-inch.
2) Yield: 385 lbs/syd.

d. Leveling Course – Parking:

1) Thickness: 2.5-inch.
2) Yield: 275 lbs/syd.

C. Bond Coat: Uniformly apply a coat of SS-1h at a rate of 0.10 to 0.15 gallon per square yard over the entire surface of each bituminous course, except the last.

D. Protection: After final rolling, protect pavement from vehicular traffic until the surface has cooled sufficiently to eliminate surface abrasion.

3.3 TABLES

TABLE 1 – BITUMINOUS QUALITY ASSURANCE TESTING TOLERANCES (+ OR -) FROM JMF

Parameter	Single Test	Lot Average
Air Voids	1.00%	0.60%
Voids in Mineral Aggregate (VMA)*	1.20%	0.75%**
Maximum Specific Gravity (Gmm)*	0.019	0.012
Asphalt Binder Content*	0.50%	0.35%

* Parameters with Target Values
** Or less, determined by VMA Value from MDOT 2012 Standard Specifications for Construction.

TABLE 2 – BITUMINOUS MIXTURE PAY ADJUSTMENTS

Parameter (Lot Average)	Deviation (d)	Negative Unit Price Adjustment (%)
Asphalt Binder Content (deviation from JMF)	$0.35 < d \leq 0.55$	10
	$d > 0.55$	25
Air Voids (deviation from JMF)	$0.6 < d \leq 0.7$	2
	$0.7 < d \leq 0.8$	4
	$0.8 < d \leq 1.0$	6
	$1.0 < d \leq 1.1$	8
	$1.1 < d \leq 1.2$	10
	$d > 1.2$	25
Maximum Specific Gravity (Gmm) (deviation from JMF)	$0.012 < d \leq 0.014$	2
	$0.014 < d \leq 0.015$	4
	$0.015 < d \leq 0.017$	6
	$0.017 < d \leq 0.019$	8
	$0.019 < d \leq 0.021$	10
	$d > 0.021$	25
Voids in Mineral Aggregate (VMA) (deviation below minimum value in the MDOT 2012 Standard Specifications for Construction)	$0.0 < d \leq 0.1$	2
	$0.1 < d \leq 0.3$	4
	$0.3 < d \leq 0.4$	6
	$0.4 < d \leq 0.5$	8
	$0.5 < d \leq 0.6$	10
	$d > 0.6$	25

TABLE 3 – MIXTURE TYPE

	Surface Course		Leveling Course	
	Roadway & Dock Area	**Parking Only**	**Roadway & Dock Area**	**Parking Only**
Mixture Number	5C Modified	36A Modified	3C Modified	13A Modified
VMA % (Eff. Spec. Gravity)	16.0	16.5	15.0	15.5
Air Voids % *	3.0	2.5	3.0	2.5
Fines to Binder Ratio (Max.)	1.2	1.2	1.2	1.2
Fine Angularity (Min.) MTM 118	4.0	3.0	4.0	2.5

* Modified from MDOT specifications.
No more than 50% of the material passing the #4 sieve shall pass the #30 sieve for Parking mixtures.

TABLE 4 – GRADATIONS (PERCENT PASSING)

	Surface Course		Leveling Course	
	Roadway & Dock Area	**Parking Only**	**Roadway & Dock Area**	**Parking Only**
Mixture Number	5C Modified	36A Modified	3C Modified	13A Modified
1-inch	100	100	100	100
3/4-inch	100	100	99-100	100
1/2-inch	100	100	90 Max.	75-95
3/8-inch	99-100	92-100	77 Max.	60-90
#4	90 Max.	65-90	57 Max.	45-80
#8	55-70	55-75	15-45	30-65
#16	30-55		33 Max.	20-50
#30	20-30	25-45	25 Max.	15-40
#50	15-25		19 Max.	10-25
#100	15 Max.		15 Max.	5-15
#200	3-6	3-7	3-6	3-6
Crush (Min.) MTM 117*	90	60	90	50

* Modified from MDOT specifications.
No more than 50% of the material passing the #4 sieve shall pass the #30 sieve for Parking mixtures.

(BITUMINOUS PAVEMENT WARRANTY ON THE FOLLOWING PAGE.)

BITUMINOUS PAVEMENT WARRANTY

PROJECT:

CONTRACTOR:

OWNER: **BOARD OF TRUSTEES**
MICHIGAN STATE UNIVERSITY

We, the undersigned, hereby provides a five (5) year warranty to Owner against defects caused by deficiencies in the materials and/or workmanship of the bituminous pavement in accordance with the requirements set forth in the Drawings and Specifications for the above named project.

The warranty covers the following conditions:

1. Cracking as defined shall be any cracked caused by improper joints in the pavement, either a construction joint, a butt joint, or any cracking caused by expansion or contraction of the pavement, or by any settlement of the pavement, i.e., thermal cracking. Cracks caused by fatigue or settlement will not be covered by this Warranty.
2. Delamination as defined shall be any instance where the surface course de-bonds from the underlying layer of bituminous pavement, causing slippage or complete separation.
3. Raveling, as defined shall be any area where the aggregate or matrix becomes loose, or separates from the asphalt pavement. This condition is generally caused by poor density or segregation.

Remedies for the conditions described above will be as follows:

1. Cracking. Any cracks over 3" in length and/or wider than 1/8" shall be corrected by routing/sawing and sealing or band sealing, as directed by the Owner's Representative, with a sealer approved by the Owner's Representative.
2. Delamination. Any area that exhibits delamination will be repaired by removing the surface course and cleaning the leveling course, installing a bond coat and furnishing/installing a new surface course of a like hot mix asphalt.
3. Raveling. Any area that exhibits raveling, or a loss of aggregate or matrix, will be repaired by removing the distressed are, cleaning and leveling course, applying a bond coat and furnishing and installing a new surface course of a like hot mix asphalt.

At least once a year, for the duration of the Warranty period, Owner's Representative will inspect the pavement to determine if any warranty work is necessary. If deficiencies are found, the Owner's Representative will notify the Contractor, in writing, as the extent of the repairs needed. The Contractor will perform the repairs within 30 calendar days, or within period as approved by the Owner's Representative. Should the Contractor not perform the required repairs, the Owner may make the repairs at the Contractor's expense. The Contractor may also inspect the lot from time to time to determine if any warranty work is necessary. The Contractor will be allowed, with approval of the Owner's Representative, to perform any warranty work that it appears will retard any further deterioration of any of the warranted conditions. Any and all costs to repair any deficiencies in the pavement shall be paid by this Contractor.

CONTRACTOR: _____ DATE _____

ADDRESS: _____

AUTHORIZED REPRESENTATIVE: _____ _____
(Print) (Signature)

SUBSCRIBED AND SWORN TO BEFORE ME,
THIS____DAY OF_____
A.D._____
NAME
MY COMMISSION EXPIRES

END OF SECTION 321216

SECTION 321313 – CONCRETE PAVEMENT

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. Provide all labor, materials and equipment as necessary to complete all work as indicated on the Drawings and specified herein.

B. This section includes concrete pavement.

C. Related sections include:

1. Division 01 Section 014000-QUALITY REQUIREMENTS
2. Division 31 Section 312300-EARTHWORK
3. Division 33 Section 334000-STORM DRAINAGE

1.3 SUBMITTALS

A. Shop Drawings: For heated walks, paving areas showing the layout of expansion joints, tubing and manifold areas.

1. Submit to Project Representative for approval.

2. Design tubing system to minimize the crossing of expansion joints. Adjustments can be made to correspond to design requirements of the tubing system, with approval from Project Representative.

B. Warranties: Submit written special warranty as specified in this Section. Include contact information, description of coverage, and start date for each special warranty.

1.4 QUALITY ASSURANCE

A. Provide required testing and inspection as indicated in Division 01 Section “General Requirements - Quality Requirements.”

B. Concrete sampling, testing, and inspection shall conform to the following requirements:

1. Sampling Fresh Concrete: ASTM C172, except initial Samples shall be taken immediately after first 1/4 cubic yard (CY) has been discharged and subsequent Samples shall be taken as specified herein. If found to be in non-conformance, the concrete shall be removed from the forms.

2. Slump: ASTM C143, except initial Sample shall be taken in accordance with paragraph above. Additional tests shall be made for each set of compressive strength test specimens, and as required by the Project Representative.

3. Air Content: ASTM C231, except as previously specified herein and additional tests at the end of the load, if possible.

4. Concrete Temperature: Taken each time compression test specimens are made and hourly when temperature is 40 degrees F and below and over 80 degrees F.

5. Unit Weight: ASTM C138, except the Sample volume shall be equal to air content specimen.

6. Compressive Strength: ASTM C31 and C39, except one set of 3 cylinders for every 40 cy or fraction thereof. One specimen shall be tested at 7 days and the remaining 2 specimens shall be tested at 28 days. Strength level of the concrete will be considered unsatisfactory if the 7 day compressive strength does not equal or exceed 60% of the 28 day design strength. Strength level of concrete will be considered satisfactory if the average compressive strength of two consecutive 28 day tests equals or exceeds the 28 day design strength, and neither individual strength test results falls below the specified compressive strength requirement by more than 100 psi.

7. Inspection: Monitored by the Project Representative.

8. Frequency: In accordance with Division 01 Section “General Requirements - Quality Requirements.”

9. Concrete Replacement: Failure of a test or to follow proper installation procedures will require that the concrete be removed and properly replaced at Contractor’s expense.

10. Additional Tests: Contractor may have the testing agency make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42. Contractor shall pay for all such tests conducted. Holes shall be patched at the Contractor’s expense.

1.5 SEQUENCING AND SCHEDULING

A. Concrete shall not be placed after October 15 without written permission from the Project Representative.

1.6 WARRANTY

A. Furnish and sign 2 year written warranty (last page of this section) which shall cover cracking, spalling, settling, finishing and forming.

PART 2 - PRODUCTS

2.1 CEMENT

A. Portland cement conforming to the requirements of the current specifications for Portland Cement ASTM C150 Type 1L.

2.2 AIR-ENTRAINING ADMIXTURE

A. Conform to ASTM C260 for concrete.

2.3 FINE AGGREGATE

A. Limestone or other fine aggregate that is free of soft particles or other material that could cause staining or pitting of the pavement surface. For gradation purposes only, the material shall conform to MDOT Specification 2NS.

2.4 COARSE AGGREGATE

A. Well-graded limestone. Gradation and physical requirements to conform to MDOT Specification 6AA.

2.5 WATER

A. Potable.

2.6 REINFORCEMENT

A. Welded Wire Reinforcement:
1. Standard; Welded wire fabric (6 x 6 - W4.0 / W4.0) in flat sheets only, conforming to ASTM A1064.
2. Heavy duty and heated pavement; Welded wire fabric (4 x 4 - W4.0 / W4.0) in flat sheets only, conforming to ASTM A1064.

B. Bar Reinforcement: No. 3, No. 4 and No. 5 bar reinforcement as specified on the Drawings. It shall be new billet stock of intermediate grade in accordance with ASTM A615.

2.7 DOWELS

A. Construction Expansion Joints:

1. No. 5 speed dowel 9 inches long, as manufactured by Greenstreak, Inc., 3400 Tree Court Industrial Blvd., St Louis, MO; 800-325-9504; or approved equal.

2. Dowel: 18 inches long, No. 5 smooth epoxy-coated rebar (coated all surfaces); or approved equal.

3. 1/4” x 4-1/2” x 4-1/2” electroplated zinc steel, ASTM A36, ASTM B633 with pocket formers

a. Diamond Dowel System as manufactured by PNA Construction Technologies www.PNA-INC.com ; 800-542-0214 ; or approved equal.

B. Construction Joints:

1. As specified above.

2.8 FORMED KEYWAY

A. Standard keyway, 1-5/8-inch x 1-3/4-inch x 2-3/4-inch, as manufactured by Dee Concrete Accessories Company, P.O. Box 11119, Chicago, IL 60611; or approved equal.

2.9 ASPHALT EXPANSION JOINTS

A. Conform with ASTM Specification D994-53. Fiber joint material is not acceptable.

2.10 JOINT SEALER

A. Tremco Spectrem 800. Primer: Tremco Silicone Primer No. 23. Tremco-Sealant/Weatherproofing Division, 3735 Green Road, Beachwood, OH 44122; 800 321 7906.

2.11 CURING AND ANTI-SPALLING COMPOUNDS

A. Curing and Anti-Spalling Compound:

1. For use when the concrete is placed at 40 degrees F and above.

2. Sealtight brand Lin-Seal Emulsion curing and sealing compound; Clear emulsion product (not to be confused with Lin-Seal or Lin-Seal white).

3. Manufactured by M.G. by W.R. Meadows, Inc, PO Box 338, Hampshire, IL 60140 0338; 847-683-4500, 800-342-5976.

B. Waterproofing Compound:

1. For use when the concrete is placed below 40 degrees F or when the concrete pavement is within 50 feet of building entrances; or both. Either of the following will be accepted.

2. Products:

a. Lifetime™ Water Sealant by Coatings International, Inc., 112 North Monroe, N.E. Rockford, MI 49341; 616-863-6529; Fax: 616-863-1076; www.coatingsinternational.com

b. Consolideck Saltguard WB by PROSOCO, Inc., 3741 Greenway Circle, Lawrence, KS 66046; 785-865-4200; Fax: 785-830-9016; www.prosoco.com.

C. Evaporation Retardant:

1. Conspec Aquafilm by Conspec Marketing & Manufacturing, 636 S. 66th Terrace, Kansas City, Kansas 66111; 800-348-7351

2. Confilm Evaporation Reducer by BASF Construction Chemicals, LLC, 23700 Chagrin Boulevard, Cleveland, Ohio 44122-5544, 800-628-9990; Fax 216-839-8821

3. Approved equal

2.12 ADMIXTURES

A. As approved by Project Representative.

2.13 FORMWORK

A. Steel or wood forms of an approved section shall be used throughout the construction. On radii 3 feet or less, 1/4-inch plywood or masonite shall be used. All forms shall have a height equal to concrete thickness. Built-up, battered, bent, twisted, or broken forms shall be removed from the Work. Expansion joint materials shall not be used.

2.14 CONCRETE QUALITY

A. The mixture shall contain 6 sack Portland cement concrete, coarse aggregate, fine aggregate admixtures and water. The concrete mix design shall have a minimum 4000 psi compressive strength at 28 days. The maximum allowable slump shall be 4.5 inches. Aggregates shall be batched by weight. Air content shall be 5% to 8%. Maintain a maximum water/cement ratio of 0.46 pounds of water per pound of cement.

B. Contractor shall provide the Project Representative with delivery tickets which shall list slump, sack mix, percent of air entraining agent, time the truck left the plant, arrived on the site and departed the site, and water added at the site.

C. When requested, Contractor shall provide documentation from the concrete supplier certifying that the concrete meets the specifications of this section.

D. Color shall be limestone. Consistency of the color shall be uniform throughout the Project.

2.15 DETECTABLE WARNING PLATES

A. 24” x 24” Duralast Detectable Warnings, Product number 00700571, Natural Finish by East Jordan Iron Works, Inc.; 800-626-4653

PART 3 - EXECUTION

3.1 PLACING FORMS

A. Forms shall be so constructed and set as to resist, without springing or settlement, the pressure of the concrete. Forms shall not deviate more than 1/8-inch in 10 feet from the true horizontal alignment and no more than 1/8-inch in vertical alignment.

B. Where forms are set above general surrounding area, earth shall be placed along outside edges of forms to ensure stability.

C. Forms shall be cleaned and oiled each time they are used.

D. Forms shall be reviewed by the Project Representative prior to pouring.

3.2 PLACING REINFORCEMENT

A. Place reinforcement mesh as indicated on the Drawings and in the following areas:

1. Where the pavement crosses a recently filled trench and extending a minimum of 5 feet beyond the trench wall.

2. Where fill soil of 18 inches or more occurs.

3. As directed by the Project Representative.

B. Concrete shall be placed in 2 layers when mesh reinforcing is used. Use of brick, stones, etc., or unusual raising with bars or tools is prohibited. Proper positioning of the mesh can be achieved by either; (1) the use of metal or plastic chairs specifically intended for holding mesh reinforcement in the soil conditions present at the required depth, or (2) placing and consolidating a layer of concrete at the specified elevation of the reinforcement prior to placing reinforcement and a top layer of concrete

3.3 PLACING CONCRETE

A. Placing 6-inch (or greater, if specified) concrete shall not commence until the subbase and forms have been approved. Subbase shall be moistened in advance of concreting, but shall not be muddy or excessively wet. A sufficient quantity of forms shall be placed to accommodate the concrete that is scheduled to be poured at any one time. Concrete shall be deposited with a minimum of re-handling and shall be spaded adjacent to forms and joints. In the case of isolation joints, concrete shall be placed simultaneously against both sides of the joint.

B. Concreting shall not be continued when the air temperature is below 45 degrees F, unless the aggregates or water, or both, are heated to produce a placing temperature of the concrete between 60 degrees F and 90 degrees F., and unless adequate provisions are made for maintaining protection against freezing of the concrete for at least 7 days after placing. No concrete shall be placed on frozen subbase.

C. Should placement of concrete be necessary over or near tree roots, a thin layer of sulfur shall be placed on the area of the subbase which may be affected by the roots. Owner shall place sulfur. Provide 2 day notice to coordinate work with Owner’s crews.

3.4 JOINTING

A. As indicated on the Drawings, as directed in the field by the Project Representative and in the following situations, unless otherwise specified:

1. Control (contraction) joints shall ordinarily be placed at intervals equal to the width of the slab or 8 feet, whichever is less. They shall be 1/8-inch to 3/16-inch wide and 1-1/4 inch deep, or 1/4 the thickness of the slab, whichever is greater. Where slabs exceed 8 feet in width, a straight longitudinal control joint shall be placed along the centerline of the slab. This joint shall begin and end only at isolation or construction joints.

2. Expansion joints shall be placed as indicated on the Drawings and if not conflicting with Drawings at intervals of at least every 40 lineal feet (LF), adjacent to footings and foundations, adjacent to curbs when required, adjacent to existing concrete where new concrete is to abut or at next available joint that is parallel to the edge of the existing concrete. Continue joints in adjoining concrete, in the same location as existed in the concrete that was removed, and where 2 or more walks intersect. Joints shall be placed in a vertical position through the entire slab thickness.

3. Construction joints (with dowels) shall be installed when placing operations are delayed more than a 1/2-hour at locations where normal control joints would occur, as indicated on the Drawings and as directed by the Project Representative.

B. Joints shall be tooled to the specified depth. If the pavement thickness is greater than 6 inches, sawing will be permitted after the joints have first been tooled. The only exception to this requirement is for basketball courts, where only saw cutting is permitted.

C. Joints shall be perpendicular to the edge and tangents and normal to curves. The joints shall not vary from the true line more than 1/4-inch.

D. When new walkways are adjacent to new curb and gutter or when required by the Project Representative, the Contractor shall install a Diamond Dowel System.

E. Place sealant in non-heated pavement joints when specified, according to manufacturer's recommendations, using primer as specified.

3.5 FINISHING

A. Concrete shall be placed and struck off with a straight board until voids are removed in the surface at the required grade and cross section.

B. Adding water to the surface of the concrete to assist in finishing operations is not permitted. If a finishing aid is permitted by the Project Representative, it shall only be an approved product for that intended purpose and then applied according to the product recommendations.

C. Immediately after the concrete has been struck off, the surface shall be floated with a magnesium bull float, just enough to produce a smooth surface free from irregularities. Edges shall be rounded to a radius of 1/4-inch with an approved edging tool. Jointing shall then commence immediately after edging and before the large aggregate in the concrete has started to settle.

D. The entire surface shall then be steel-troweled so that the large aggregate is set and the surface is free of edging joints and trowel marks.

E. The surface shall be heavy-broomed, keeping mortar out of joints. Brooming direction shall generally be perpendicular to the normal path of travel, unless otherwise directed by the Project Representative. Provide 2-inch retool at joints, if detailed on the Drawings.

F. Surface variations greater than 1/8-inch in 10 feet are unacceptable.

G. Walks shall be protected from pedestrian traffic for 2 days and vehicles for 7 days.

H. Concrete shall be stamped at each end of the work with the Contractor's name and the current year.

3.6 CURING AND ANTI-SPALLING COMPOUND APPLICATION

A. For temperatures above 40 degrees F, concrete shall be cured utilizing the specified curing/anti-spalling compound in accordance with product specifications using only a motorized sprayer. This application includes the sides of the concrete, once the forms have been removed.

B. For temperatures between 32 degrees F and 40 degrees F and on concrete within 50 feet of building entrances, cure pavement using an approved wet cure method for a period of not less than 7 full days while maintaining a concrete temperature above 34 degrees F for 14 days. After 30 days, the specified water proofing compound shall be applied according to product specifications.

3.7 DETECTABLE WARNING PLATES

A. Follow manufacturer’s installation specifications to properly install detectable warning plates per site plan layout. Pay special attention to be sure the plastic concrete comes through all the holes in the plate to eliminate all cavities below the plate that could trap water.

(CONCRETE PAVEMENT WARRANTY ON THE FOLLOWING PAGE.)

CONCRETE PAVEMENT WARRANTY

PROJECT:
CONTRACTOR:
OWNER: BOARD OF TRUSTEES
MICHIGAN STATE UNIVERSITY

We, the undersigned, herewith warranty all the work to be free from defective workmanship and/or materials for **two (2) years** from November 1st of the calendar year of the date written below, in accordance with the requirements set forth in the Drawings and Specifications for the above-named Project.

The Contractor agrees that by acceptance of this Work and in consideration thereof, for them and for each of their Subcontractors, binds themselves to all warranties called for. The Contractor shall warranty all work, except as noted elsewhere in these Contract Documents in which a longer warranty is specified. This shall include, but not be limited to, the following defects:

1. Cracking
2. Spalling
3. Settling
4. Finishing
5. Forming

If during the warranty period, it is found by the Owner's Representative, that the warranty Work needs to be repaired or replaced because of the use of materials, equipment, or workmanship which is inferior, defective, or not in accordance with the terms of Agreement, the Contractor, upon notification, shall promptly and without additional expense to the Owner:

a. Place in satisfactory condition all of such warranted Work,
b. Make good all damage to the project, or contents thereof, which is a result of such unsatisfactory warranted Work, and
c. Make good any Work, materials and equipment that are disturbed in fulfilling the Warranty, including any disturbed work, materials and equipment that may have been warranted under another contract.

Should the Contractor fail to proceed promptly in accordance with the Warranty, the Owner's Representative may have such work performed at the expense of the Contractor and their surety.

CONTRACTOR: _____ DATE: _____

ADDRESS: _____

AUTHORIZED REPRESENTATIVE: _____ _____
(Print) (Signature)

SUBSCRIBED AND SWORN TO BEFORE ME,

THIS _____ DAY OF _____

A.D. ____

NAME

MY COMMISSION EXPIRES

END OF SECTION 321313

SECTION 321416 – BRICK PAVERS

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. Provide all labor, materials and equipment as necessary to complete all work as indicated on the Drawings and specified herein.

B. This section includes brick pavers, prepared subgrade, subbase, sand leveling course and fabric layer.

C. Related sections include the following:

1. Division 31 Section “Earthwork.”
2. Division 32 Section “Concrete Pavement.”

1.3 SUBMITTALS

A. Furnish Samples, manufacturer's product data, test reports, and materials certifications for brick.

B. Warranties: Submit written special warranty as specified in this Section. Include contact information, description of coverage, and start date for each special warranty.

1.4 QUALITY ASSURANCE

A. Approved Installation Contractors:

1. Anderson-Fischer & Associates Inc., 225 East Kipp Road, Mason, MI 48854, 517-676-5522

2. Ephraim Stoneworks, 2613 Murray Rd. Dansville, MI 48819, 517-977-7704

1.5 WARRANTY

A. Contractor agrees that by acceptance of this work and in consideration thereof, and for each of the Subcontractors, binds them to the guarantees and warranties called for. Work to be free from defective workmanship for 2 years after the date of final acceptance.

B. If within warranty period, it is found that the warranted work needs to be repaired or changed because of the use of defective materials, equipment, or inferior workmanship, or work not in accordance with the terms of the Agreement, the Contractor, upon notification, shall promptly and without additional expense to the Owner:

1. Place such warranted work in a satisfactory condition.

2. Repair or replace damage to the Project, or contents thereof, which is a result of such unsatisfactory warranted work.

3. Repair or replace work, materials, and equipment that are disturbed in fulfilling the warranty, including disturbed work, materials, and equipment that may have been warranted under another Contract.

C. Should the Contractor fail to proceed promptly in accordance with the warranty, the Owner may have such work performed at the expense of the Contractor and sureties.

D. Contractor shall execute and deliver to the Owner, before final payment, a written warranty subject to the stipulations and provisions above.

PART 2 - PRODUCTS

2.1 BRICK PAVERS

A. General: Provide solid brick paver units, class SX, in colors where indicated on Drawings. Colors will be subject to Owner approval. Units are to be made from clay, shale, fireclay, or mixtures thereof, and shall be fired to incipient fusion. The units are intended for use as a paving material to support pedestrian and light vehicular traffic. Units shall conform to ASTM C902.

1. Pavers Adjacent to Concrete Curbs: 2-1/4-inch x 4-inch x 8-inch with spacer bars; color shall be English Edge Rose supplied by Pine Hall Brick.

2. Pavers in Walk Panels: 2-1/4-inch x 4-inch x 8 inch with spacer bars, color and pattern to be determined. Supplied by Glen-Gery Brickwork or Belden Brick.

B. Physical Requirements and Tests:

1. Compressive Strength: Not less than 8,000 psi for an average of 5 brick, with no individual unit having a strength of less than 7,000 psi.

2. Cold Water Absorption: Shall not exceed 8% for an average of 5 brick, with no individual unit having an absorption of greater than 11%.

3. Saturation Coefficient (Maximum): Shall not exceed 0.78 for an average of 5 brick, with no individual unit having a coefficient of greater that 0.80. Saturation coefficient is the ratio of absorption by 24 hour submersion in room temperature water to that after 5 hours of submersion in boiling water.

4. Warpage: Shall not exceed 1/16-inch for each 6 inches of brick length when measured in accordance with ASTM C67 Section 12.

5. Efflorescence: When units are tested in accordance with Section 10 of Methods C67, the rating for efflorescence shall not be more than "slightly effloresced."

6. Abrasion Requirements: The Abrasion Index for brick paver units shall not exceed 0.11. The Volume Abrasion Loss (CM;/CM5) shall not exceed 1.7.

7. Chippage: Maximum permissible extent of chippage from edges shall be 1/4-inch; from corners shall be 3/8-inch. The aggregate length of chips on a single unit shall not exceed 10% of the perimeter of the exposed face of the brick.

8. Dimensional Tolerances: Brick pavers shall conform to ASTM grade PX. Brick to be selected will be approximately 2-1/4-inch x 4-inch x 8-inch.

2.2 SUBBASE

A. Base Course: 6-inch thick concrete paving as specified in Division 32 Section "Concrete Pavement."

B. Leveling Course: Clean, coarse, concrete sand (not mason sand), with the following gradation limits:

1. Sieve Size: 3/4-inch; Percent Passing: 100.
2. Sieve Size: 4-inch; Percent Passing: 90 to 100.
3. Sieve Size: 8-inch; Percent Passing: 80 to 95.
4. Sieve Size: 16-inch; Percent Passing: 55 to 85.
5. Sieve Size: 50-inch; Percent Passing: 10 to 35.
6. Sieve Size: 200-inch; Percent Passing: 0 to 5.

2.3 SEPARATOR FABRIC

A. AMOCO Landscape Fabric; or approved equal.

2.4 JOINT SAND

A. RG Polymeric Locking Joint Sand, supplied by Brickscape, Northville, Michigan, 248-348-2500. Color: Tan/ochre. Joint sand shall be placed only when completely dry.

PART 3 - EXECUTION

3.1 PLACEMENT

A. Leveling Course: Spread evenly over concrete base to be paved and screed to a level that will produce the required finished elevation when the brick pavers have been placed and vibrated.

B. Separator Fabric: Secure over concrete base drainage openings, as well as over leveling course. Locate to minimize seams, where seams are necessary, and overlap fabric 6-inch minimum.

C. Brick Pavers:

1. Lay in the pattern indicated on Drawings; joints between units shall not exceed 1/8-inch. Brick shall be cut to a straight, even surface without cracks or chips. To minimize need

for small brick segments, review brick layout with landscape architect. Brick row alignments shall be uniform and straight.

2. Vibrate to final level by 2 or 3 passes of a vibrating plate compactor. After the first vibration, joint sand shall be swept into joints. To avoid scratching, do not pass vibrating plate over brick with sand on the surface. Execute additional passes of the plate vibrator. Sweep fill the joints again if necessary to completely fill joints. Surplus material shall then be swept from the surfaces and the entire site left clean. The finished surface shall be true to grade and shall not vary by more than 1/4-inch when tested with a 10-foot board at any location on the surface.

D. Install joint sand the full depth of the joints and as indicated in the manufacturer's specifications.

1. Water the pavers in a manner that will activate the polymeric binder without washing the sand away.

END OF SECTION 321416

SECTION 321613 – CONCRETE CURBS AND GUTTERS

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. Provide all labor, materials and equipment as necessary to complete all work as indicated on the Drawings and specified herein.

B. This section includes:

1. Curb and gutters.

C. Related sections include the following:

1. Division 01 Section 015000-TEMPORARTY FACILITIES AND CONTROLS
2. Division 31 Section 312300-EARTHWORK
3. Division 32 Section 321218-BITUMINOUS PAVEMENT
4. Division 32 Section 321313-CONCRETE PAVEMENT

1.3 SUBMITTALS

A. Testing and Inspection: Provide reports as described in this section.

B. Warranties: Submit written special warranty as specified in this Section. Include contact information, description of coverage, and start date for each special warranty.

1.4 QUALITY ASSURANCE

A. Provide the required testing and inspection as indicated in Division 01 Section “General Requirements - Temporary Facilities and Controls.” Concrete sampling, testing, and inspection shall conform to the requirements found in Division 32 Section “Concrete Pavement.”

1.5 SCHEDULE

A. Concrete shall not be placed after October 15 without written permission from the Project Representative.

1.6 WARRANTY

A. Furnish and sign 2 year written warranty (last page of this section) which shall cover cracking, spalling, settling, finishing and forming.

PART 2 - PRODUCTS

2.1 Refer to Division 32 Section "Concrete Pavement" for all products, except for the following:

A. Reinforcement: Shall be No. 4 bar reinforcement of new billet stock of intermediate grade in accordance with ASTM A615.

PART 3 - EXECUTION

3.1 PLACING FORMS

A. Steel or wood forms of an approved section shall be used throughout the construction. On radii 3 feet or less, 1/4-inch plywood or masonite shall be used. All forms shall have a height equal to concrete thickness. Built-up, battered, bent, twisted, or broken forms shall be removed from the work. Expansion joint materials shall not be used.

B. Forms shall be so constructed and set as to resist, without springing or settlement, the pressure of the concrete. On curbs of sharp radius, plywood or other approved flexible material shall be used in sections short enough to form a smooth, uninterrupted curb which shall not vary form the true radius by more than 1/4-inch. Forms shall not deviate more than 1/8-inch in 10 feet from the true horizontal alignment and no more than 1/8-inch in vertical alignment.

C. Where forms are set above general surrounding area, earth shall be placed along outside edges of forms to ensure stability.

D. Forms shall be cleaned and oiled each time they are used.

E. Forms must be approved by the Project Representative prior to placing concrete.

3.2 PLACING REINFORCEMENT

A. Place 2 bars in gutter pan as specified in Drawings and in the following areas:

1. Where curb crosses a recently filled trench and extending a minimum of 5 feet beyond trench wall.

2. Where fill soil of 18 inches or more occurs.

3. In all valley gutter pans. (exception – 3 bars as shown on the detail drawing)

4. In all path ramps and extending a minimum of eighteen inches beyond the bottom of the curb taper or curb transition.

5. As directed by the Project Representative.

3.3 PLACING CONCRETE

A. Refer to Division 32 Section "Concrete Pavement." However, the time restriction may be extended with the approval of the Project Representative.

3.4 JOINTING

A. Control (contraction) joints shall be perpendicular to the curb edge, 1-1/2-inch deep, open and free of all excess concrete. Control joints shall be placed at intervals of not more than 10 feet as indicated on the Drawings.

B. Expansion joints shall be placed at all points of curvature, tangency, and at intervals of not more than 100 lineal feet.

3.5 FINISHING

A. Concrete shall be struck off true to cross section, after which it shall be finished smooth and even. Face forms, if used, shall be left in place until the concrete has set sufficiently so that they can be removed without injury to the curb. The remaining forms shall be rounded with an edging tool. No tool marks are to be left on exposed edges.

B. A straight edge check is to be made while concrete is still plastic. Irregularities exceeding 1/8-inch shall be corrected. Finish surfaces shall not vary form the required cross section as indicated on Drawings by more than 1/8-inch. They shall not vary from the true horizontal alignment by more than 1/4-inch in 10 lineal feet. Sections exceeding those limitations are subject to rejection and replacing at Contractor's expense.

C. Adding water to the surface of the concrete to assist in finishing operations is not permitted. If a finishing aid is permitted by the Project Representative, it shall only be an approved product for that intended purpose and then applied according to the product recommendations.

D. For heated pavement (or snow melt) systems, the heated portion of the concrete shall be stamped with the words "Heated Walk Limit" at the edge of the heated pavement. If part of the system includes the curb or gutter, then the stamp shall be placed on the gutter pan. Stamp spacing shall be at approximately 20-foot increments and positioned exactly between each control joint. Stamp locations shall be approved by the Project Representative in advance. A stamp may be available for use from the Project Representative if arrangements are made in advance. Otherwise, the Contractor is responsible to secure a stamp that is approved by the Project Representative.

3.6 CURING AND ANTI-SPALLING COMPOUND APPLICATION

A. Refer to Division 32 Section "Concrete Pavement."

(CONCRETE CURB AND GUTTER WARRANTY ON FOLLOWING PAGE.)

CONCRETE CURB & GUTTER WARRANTY

PROJECT:
CONTRACTOR:
OWNER: BOARD OF TRUSTEES
MICHIGAN STATE UNIVERSITY

We, the undersigned, herewith warranty all the work to be free from defective workmanship and/or materials for **two (2) years** from November 1st of the calendar year of the date written below, in accordance with the requirements set forth in the Drawings and Specifications for the above-named Project.

The Contractor agrees that by acceptance of this Work and in consideration thereof, for them and for each of their Subcontractors, binds themselves to all warranties called for. The Contractor shall warranty all work, except as noted elsewhere in these Contract Documents in which a longer warranty is specified. This shall include, but not be limited to, the following defects:

1. Cracking
2. Spalling
3. Settling
4. Finishing
5. Forming

If during the warranty period, it is found by the Owner's Representative, that the warranty Work needs to be repaired or replaced because of the use of materials, equipment, or workmanship which is inferior, defective, or not in accordance with the terms of Agreement, the Contractor, upon notification, shall promptly and without additional expense to the Owner:

a. Place in satisfactory condition all of such warranted Work,
b. Make good all damage to the project, or contents thereof, which is a result of such unsatisfactory warranted Work, and
c. Make good any Work, materials and equipment that are disturbed in fulfilling the Warranty, including any disturbed work, materials and equipment that may have been warranted under another contract.

Should the Contractor fail to proceed promptly in accordance with the Warranty, the Owner's Representative may have such work performed at the expense of the Contractor and their surety.

CONTRACTOR: _____ DATE: _____

ADDRESS: _____

AUTHORIZED REPRESENTATIVE: _____ _____
(Print) (Signature)

SUBSCRIBED AND SWORN TO BEFORE ME,

THIS _____ DAY OF _____

A.D. _____

NAME

MY COMMISSION EXPIRES

END OF SECTION 321613

SECTION 321723 – PAVEMENT MARKINGS

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. Provide all labor, materials and equipment as necessary to complete all work as indicated on the Drawings and specified herein.

B. This section includes pavement markings.

C. Related sections include the following:

1. Division 32 Section “Bituminous Pavement.”
2. Division 32 Section “Concrete Pavement.”

1.3 QUALITY ASSURANCE

A. Approved installation contractors for both pavement marking types:

1. P.K. Contracting, P.O. Box 184, Clawson, MI 48017; 313-362-2130.
2. Parallel Contracting, Inc., 3420 E. Grand River, Williamston, MI 48895; 517-819-3853.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC PAVEMENT MARKINGS

A. According to 2012 MDOT Section 811 specification. Color: White and yellow, as indicated on the Drawings.

2.2 PRE-FORMED THERMOPLASTIC BARRIER FREE SYMBOL

A. Barrier Free Kit White on Blue Item #89230237HS, 40-inch x 40-inch size. Color: Blue.

B. Manufacturer: Ennis-Flint, Inc. (allow 2 weeks for delivery), 115 Todd Court, Thomasville, NC 27360; 336-475-6600, Fax: 336-475-7900.

2.3 THERMOPLASTIC BIKE WITH HELMET SYMBOL

A. Bicycle Rider Item #89230524(+)HS add “L” for Left or “R” for Right to indicate facing direction of marking. (Ennis-Flint, Inc.) 6′-6″ x 3′-4″.

2.4 THERMOPLASTIC BIKE LANE ARROW

A. Yield Line (Shark's Teeth) Item #8231002 (Ennis-Flint, Inc.) 2-foot x 3-foot.

2.5 PRIMER FOR THERMOPLASTIC MATERIAL

A. #623206-20 – 5 gallon.

B. #623206-4 – 1 gallon.

2.6 GLASS BEADS

A. According to 2012 MDOT Section 811 specification.

2.7 CONCRETE PAVEMENT MARKINGS/SPEED TABLES

A. Liquid pavement markings using a polyurea coating material 3M Stamark, Epoplex L590; or approved equal.

2.8 TRAFFIC PAINT

A. Regular dry pavement marking paint according to 2012 MDOT Section 811 specification.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pavement cleaning and marking application shall be according to 2012 MDOT section 811 specification and as indicated on the Drawings.

B. Use primer on installations as indicated in the manufacturer's specifications.

C. Cyclist symbol with arrow to be located as indicated on the Drawings.

D. Barrier Free Symbol Placement: Bottom edge of the symbol square shall be aligned with the end of the line striping closest to the travel aisle and in the center of the parking space.

E. Place glass beads on thermoplastic lines.

F. All thermoplastic pavement markings (symbols and line work) on bituminous pavement in roadways shall be recessed to the thickness of the pavement marking.

1. The resulting surface interface between the markings and the bituminous shall be smooth.

2. Concrete pavement shall not be recessed for pavement markings.

G. Pavement markings in new bituminous pavement parking areas shall be thermoplastic unless otherwise noted on plans.

H. Thermoplastic pavement markings in parking areas are not required to be recessed unless otherwise noted on the plans.

END OF SECTION 321723

SECTION 324000 – SITE APPURTENANCES

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. Provide all labor, materials and equipment as necessary to complete all work as indicated on the Drawings and specified herein.

B. This Section Includes:

1. Site Appurtenances such as: Posts, bike loops, and site furnishings.

2. Install Owner-provided Landscape Forms products as shown on Drawings.

3. Normal activities and materials to construct the various items below or additional work not listed below shall be considered incidental and not due additional compensation. To be considered for additional compensation, work items must be identified and noted by the Project Representative, prior to the installation.

C. Sign(s), (manufacturing or installation) for posts or bollards, is not part of the Contract.

1.3 DEFINITIONS

A. MDOT Specification: Michigan Department of Transportation, 2012 Standard Specifications for Construction.

1.4 QUALITY ASSURANCE

A. Refer to Division 01 Section "General Requirements - Quality Requirements."

B. Installation shall meet requirements as indicated by the Project Representative.

PART 2 - PRODUCTS

For this section only, concrete shall meet same requirements of Division 03 Section "033015 - CONCRETE FOR BUILDING CONSTRUCTION;" with a maximum 4-inch slump.

2.1 BENCHES, TABLES AND LITTER RECEPTACLES

A. Provided by Owner

B. Installed by Owner
C. Concrete pad by Contractor
   1. In accordance with manufactures requirements
D. As indicated on Drawings and manufactured by Landscape Forms, Inc. unless otherwise specified.

2.2 BIKE LOOP

A. Provided by Owner
B. Installed by Contractor
C. As indicated on Drawings and manufactured by Wabash Valley Manufacturing

2.3 BOLLARDS

A. BARRIER-FREE PARKING BOLLARD

1. Provided by Owner
2. Installed by Contractor
3. Concrete by Contractor
4. As indicated on Drawings. .
   a. Bollard: 7”x7”x1/4” wall square hot dip galvanized steel.
   b. Sign Post: 2”x2” square hot dipped galvanized steel.
   c. Parking Meter Arm: 2” I.D. round schedule 40 galvanized ste–l

B. GUARD POST BOLLARD

1. Provided by Owner
2. Installed by Contractor
3. Concrete by Contractor
4. Standard weight galvanized steel, 6-inch diameter, 0.25-inch wall thickness, 17.02 pounds. lf painted, Sherwin Williams paint is to be used.
5. Guard Post Cover:
   a. Color: Yellow.
   b. Manufactured by Ideal Shield, 255 Clark Street, Detroit, MI 09210; Phone: 313-842-7290, Fax: 313-842-7290

C. REMOVABLE STEEL BOLLARD

1. Provided by Owner
2. Installed by Contractor
3. Concrete by Contractor
4. As indicated on Drawings and manufactured by Alden Enterprises, 1402 E. Jolly Road, Okemos, MI 48864; 517-349-2443.

D. SIGN POST BOLLARD

1. As indicated on drawings.

a. U-channel sign post(s) and sign(s) provided by owner.
b. Concrete and form by Contractor

2.4 PLAY FIELD EQUIPMENT

A. BASKETBALL POST AND GOAL

1. Provided by Contractor
2. Installed by Contractor

B. VOLLEYBALL POST

1. Provided by Contractor
2. Installed by Contractor

2.5 POST AND CHAIN FENCE

A. Provided by Owner
B. Installed by Contractor

2.6 SIGNS

A. GREEN PANEL SIGNS

1. Provided by Owner
2. Installed by Owner

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be according to Drawings provided. If not provided, installation shall be according to Project Representative's instructions.

3.2 BIKE LOOP INSTALLATION

A. Install as indicated on Drawings. All footings (2 per loop) shall be separate from one another. Top of footing shall be below the bottom of surface of the surrounding pavement.

B. Align loops vertical in both directions and in line with other loops. Since loops vary somewhat in shape, center loops in rows. Review other installations. Loop installation will be approved by the Project Representative prior to pouring the concrete footings.

C. Do not use loops which, are misshapen to the degree that they will not provide a good appearance. Return damaged or misshaped loops to MSU Landscape Services Construction Coordinator

D. One sign loop is to be placed per group of loops. Sign is provided by Owner.

3.3 BOLLARDS

A. BARRIER-FREE PARKING BOLLARD INSTALLATION

1. Install posts and bollards as indicated on Drawings with a 42-inch footing and straight vertical walls.

2. The top of the concrete footing shall be flush with the bottom of the adjacent pavement or if located in the lawn, shall be formed to shed water away from the post.

3. In pavement installations, the intent of the installation is for the ability to remove and replace the bollard if the bollard is damaged. Therefore, as indicated on the Drawings, the footing and pavement provides for a larger opening than the size of the bollard. The bollard shall not be used as the form for the footing sleeve and pavement installation. The footing sleeve and pavement opening shall be formed prior to the installation of the bollard.

B. GUARD POST BOLLARD INSTALLATION

1. Install as indicated on Drawings. Post shall be positioned plumb.

C. REMOVABLE STEEL BOLLARD INSTALLATION

1. Install as indicated on Drawings. Protect bollard from damage, including surface scratches, during transport and installation. Should repainting be required, it shall be paid for by the Contractor.

2. The bollard shall be plumb with the padlock access opening positioned parallel to normal pedestrian path of travel.

3.4 PLAY FIELD EQUIPMENT

A. BASKETBALL POST AND GOAL INSTALLATION

1. Install standard MSU basketball goal posts and goals in a square footing 42-inch deep and 3-foot square. Form the top 10 inches of the footing and slope concrete away from the goal post in all 4 directions. Excavation, disposal of excavation, clean up and lawn repair (if any) included.

B. VOLLEYBALL POST INSTALLATION

1. See Drawings for detail of court construction.

2. Work includes removal of sod and topsoil to a depth of 4 inches, place 7 inches of washed sand and grade.

3. Install 2 standard volleyball net posts (furnished) in augured holes with 10-inch x 42-inch concrete footings, site clean-up and repair turf ruts.

3.5 POST AND CHAIN INSTALLATION (2 TYPES OF SYSTEMS)

A. Install as indicated on Drawings. Posts shall be positioned plumb.

B. Space posts as indicated on Drawings.

C. Top of concrete footing shall be below the existing grade as indicated on Drawings.

D. Installation includes installing vinyl coated chain with specified connectors (including weld). Prime and paint connectors after welding with same paint system used on the posts.

3.6 PLAQUE BASES AND PLAQUE INSTALLATION

A. Usually, this will be hand work in a confined area.

B. Excavate as required with a 42-inch deep footing below ground and up to 12 inches above.

C. Form above ground portion with a slight cant and shape to accommodate the provided plaque.

D. Securely install plaque and the plastic concrete, while protecting the plaque surface from contamination from the concrete.

E. Finish above ground surface after removal of forms.

F. Clean up site after removal of forms.

3.7 BASKETBALL GOAL INSTALLATION

A. Work includes delivery of goal to site, disposal of shipping container, assembly of goal and backboard, excavation of footing hole, positioning of post vertical and plumb and at the proper height, installation of compacted backfill and cleanup.

3.8 PARKING CONTROL BOOTH AND GATE CARD ISLANDS

A. Work includes layout as indicated on Drawings, asphalt removal and spade cutting (may not be required in some installations), excavation for integral curb, 4-inch diameter steel posts, steel post installation in frost free footing, forming island, waiting for others to install detector loops, conduit and junction boxes, pouring and finishing concrete, stripping forms and finishing vertical surfaces, painting steel posts with primer and 2 coats of safety yellow, following manufacturer’s instructions and site cleanup.

B. See Drawings for gate card island sizes and number of posts to install.

C. For installations in existing pavement where pavement is in good condition, pavement shall not be overcut.

END OF SECTION 324000

SECTION 334000 – STORM DRAINAGE

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. Provide all labor, materials and equipment as necessary to complete all work as indicated on the Drawings and specified herein.

B. This section includes storm drainage systems.

C. Related sections include the following:

1. Division 01 Section “General Requirements - Temporary Facilities and Controls.”
2. Division 31 Section “Earthwork.”

1.3 DESCRIPTION

A. Storm and sanitary sewers shall be 2 separate systems.

B. New manholes and catch basins shall be precast construction except for bases.

C. Surface drainage shall be to catch basins; no storm water shall pass into a storm sewer without first passing through a catch basin.

D. Concrete storm sewer pipe shall use a rubber "O" ring joint.

E. Manholes and catch basins shall be constructed as specified herein and indicated on Drawings.

1.4 REFERENCES

A. Except as herein specified or as indicated on the Drawings the work of this section shall comply with the following:

1. AASHTO Standards M36 – Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains

2. M218 – Sheet Steel, Zinc-Coated (Galvanized) for Corrugated Steel Pipe.

3. MDOT:

a. 2012 MDOT Standard Specifications for Construction.
b. MDOT Standard Plans.

1.5 SUBMITTALS

A. Before commencing work, the Contractor shall provide an affidavit from the material manufacturers, that their materials meet the Specifications.

PART 2 - PRODUCTS

2.1 PRECAST CONCRETE SECTIONS

A. ASTM C-478: Cone section shall be eccentric to allow for a straight vertical ladder.

2.2 STRUCTURE BLOCK AND BRICK

A. Block: ASTM C-139.

B. Brick: ASTM C-139.

2.3 COVERS AND GRATES:

A. As specified on Drawings, or as indicated below:

1. Curb Inlet: EJIW 7045, M1 grate.

2. Square Inlet: EJIW 5105, M1 grate (for valley gutter pans).

3. Round Inlet – Light Duty: EJIW 1130, M3 grate.

4. Round Inlet – Heavy Duty: EJIW 1040, M1 grate for parking lots, M3 grate for walks – ADA compliant.

5. Manhole Structure: EJIW 1040, Type B – Vented cover.

6. Rolled Curb: EJIW 7065, M1 grate.

2.4 TRENCH DRAIN

A. Klassik Drain by Acodrain KS1005; or approved equal.

1. Drains: Part Number K1 through K3 sloped channels.
2. Universal Plastic Coatings: Part Number 96825.
3. Grates: ADA stainless grate DIN 19580 Class A.

B. Square Inlet: EJIW 5105, M1 grate (for valley gutter pans).

2.5 ADJUSTING RINGS

A. The inside diameter shall not be less than the diameter of the casting for which it is used.

B. Allowable types include:

1. Precast Reinforced Concrete: Without cracks. 2-inch to 6-inch thick, minimum 3000 psi. Reinforcement rod shall not be visible on the surface.

2.6 MANHOLE STEPS

A. EJIW 8500.

2.7 PORTLAND CEMENT

A. ASTM C150 Type 1.

2.8 HYDRATED LIME

A. ASTM C207.

2.9 SAND AND GRAVEL AGGREGATE

A. ASTM C33.

2.10 CONCRETE

A. Refer to Division 32 Section “Concrete Pavement.”

2.11 MASONRY CEMENT

A. ASTM C91.

2.12 CORRUGATED PERFORATED POLYETHYLENE DRAIN TILE

A. ASTM F405 with heavy sock.

2.13 PVC GASKETED DRAIN PIPE

A. Storm sewer less than 12-inch diameter.

1. SDR 26, ASTM D2241.
2. Other products as specified.
3. Rubber boot to connect pipe to structure.

2.14 REINFORCED CONCRETE PIPE

A. Storm Sewer 12-inch Diameter and Larger: ASTM C76.

2.15 CORRUGATED METAL PIPE

A. Manufacturers: Contec, Republic; or approved equal.

B. Pipe Material:

1. Galvanized (AASHTO M36) Zinc Coated Sheets (AASHTO M218).

2. Corrugations: Helical corrugations for shall form a minimum 45 degree angle with the longitudinal axis.

3. Pitch and Depth: 2-2/3-inch x 1/2-inch.

4. Wall Thickness: MDOT Class B.

5. Coupling Bands: Coating and wall thickness shall match pipes being connected. Type options:

a. Corrugated band with sleeve gasket.
b. Semi-corrugated band with O-ring.
c. Flat band with O-ring.

6. End Section: Flared end section.

2.16 INLET STRUCTURE SILT SCREEN

A. Silt-Saver sold by Price and Company, Inc. 425 36th St., SW, Wyoming, MI 49548; 800-248-8230, 616-530-8230; or approved equal.

1. SS-100A: Fits round structures to 48-inch ID.
2. SS-200A: Fits square structures to 60-inch OD.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Connections and changes in direction or grade shall be made in manholes.

B. Structure bases shall be cast-in-place concrete, transit mixed with minimum compressive strength of 3000 psi at 28 days, formed and finished level. Precast bases may be used with written approval of the Project Representative and where required by extremely difficult site conditions. Base slab shall be fully cured before precast portions are set.

C. Precast concrete shall be used to construct structures. Only when precast sections are not manufactured in the size and shape required will block constructed structures be permitted. The Project Representative shall be notified prior to construction of block structures. Set precast sections in full mortar bed.

D. Trench drains shall be constructed so that they sit on a foundation of a minimum depth of 42 inches, measured from finish grade to bottom of structure.

E. Adjustment to Casting Elevations:

1. Concrete rings shall be used wherever possible to adjust casting elevations. Rings shall be set in full mortar bed. Use a maximum of 3 rings.

F. Tile shall be laid through the manhole and 3000 psi concrete shall be placed around the tile up to half of the diameter. The concrete shall slope from the walls of the manhole to the sewer. When there is a change in grade, direction, or pipe size, the flow channel shall be built from bricks and 3000 psi concrete to make a uniform, smooth change in grade, direction or pipe size.

G. Vertical elevation of the invert shall be within plus or minus 0.04 foot (1/2-inch) of required elevation. Horizontal alignment must meet the same tolerance.

H. Pipe Connections to Structures:

1. Connections with existing sewers shall be made at points and in a manner indicated on the Drawings and approved by the Project Representative.

2. Sewers being disconnected shall be sealed off with concrete.

3. If PVC pipe connects to an existing or new structure, the pipe shall connect with an appropriately sized rubber boot.

I. Catch basin sump shall extend 2 feet below the pipe outlet invert.

J. Construct a peripheral sub-drainage system for catch basins.

1. Install 4-inch diameter perforated polyethylene corrugated drain pipe with a heavy duty sock covering around each new structure and existing structure, if at least 4 vertical feet is exposed or the outlet pipe is exposed.

2. Pipe shall enter catch basin with a tee connector, 2 inches above and directly opposite the outlet invert.

3. The peripheral drain pipe shall be positioned at 1/4-inch to provide positive drainage to the catch basin. The peripheral drain pipe shall be placed over the outlet pipe. Do not cut and cap the drain pipe at the outlet pipe.

4. Backfill the drain pipe with properly compacted Class II sand to the finish subgrade.

3.2 TESTING AND INSPECTION

A. Internal Television Inspection of Storm Sewers:

1. General:

a. Inspect storm sewers using a closed-circuit color television pan and tilt camera.

b. Provide Engineer with videos in digital format and written logs to document the internal television inspection:

1) Written logs shall note the location of sewer laterals and pipe deficiencies by distance from the upstream manhole.

2) The video tape shall include audio commentary regarding the sewer condition.

c. Engineer will review the videos and written logs to verify that the storm sewers were constructed in accordance with the Contract Documents.

d. The videos shall verify that the storm sewers are clean and free of sediment and debris to the satisfaction of Engineer. Storm sewers not satisfactorily cleaned shall be promptly cleaned and reinspected by closed-circuit color television camera.

e. Television inspection shall be completed, documentation of television inspection shall be provided and Engineer shall determine that the sewers were constructed in accordance with the Contract Documents before payment for completed sections of sanitary sewer will be recommended to Owner.

2. Performance Requirements:

a. Inspection procedures and equipment shall meet the applicable standards as presented in the National Association of Sewer Service Companies (NASSCO) Recommended Specifications for Sewer Collection System Rehabilitation.

b. Each section of sanitary sewer between manholes shall be television inspected separately utilizing a video camera and related equipment specifically designed for the purpose of internal sewer inspection.

c. The camera speed shall not exceed 30 feet per minute.

d. The camera shall be stopped for no less than 10 seconds at the entrance manhole, each service lateral, exit manhole, and at points where the sewer is damaged or deficient.

e. Lighting for the camera shall be adequate to allow a clear picture of the entire periphery of the sewer and shall be varied as required to be effective for all pipe diameters inspected.

f. Cables and equipment used to propel the camera shall not obstruct the camera view or interfere with the documentation of the sewer conditions.

g. The video recording shall be continuous video file.

h. The mobile recording studio shall have adequate space to accommodate up to 3 persons for the purpose of viewing the video monitor while the inspection is in progress.

i. Whenever possible, the camera shall move in a downstream direction.

j. The location of the camera in the sewer shall be monitored by an accurate measuring system which records the distance traveled from the upstream manhole on the video.

k. Video and written logs shall be clearly labeled with the Project name and location identification.

l. If sewer has dirt and debris which prohibits video inspection, the sewer shall be cleaned and re-televised at no expense to Owner.

END OF SECTION 334000