MICHIGAN STATE
UNIVERSITY

ELECTRONIC BIDDING

INVITATION ONLY
SPECIFICATION FOR

PARKING RAMP 1 – SHAW LANE AND VARIOUS RAMPS – ANNUAL PARKING RAMP MAINTENANCE '25

PROJECT NUMBER

CP24073

Thursday, March 20, 2025

AT

MICHIGAN STATE UNIVERSITY
EAST LANSING, MICHIGAN

Infrastructure Planning and Facilities
Planning, Design and Construction

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- 079233 CONCRETE JOINT SEALANTS

SCHEDULE OF DRAWINGS

Project Title: **PARKING RAMP 1 – SHAW LANE AND VARIOUS RAMPS – ANNUAL PARKING RAMP MAINTENANCE '25**

Capital Project Number: **CP24073**

No. of Sheets: **14**

ADVERTISEMENT FOR BIDS

DATE: **March 20, 2025**

PROJECT TITLE: **PARKING RAMP 1 – SHAW LANE AND VARIOUS RAMPS – ANNUAL PARKING RAMP MAINTENANCE '25**

PROJECT NUMBER: **CP24073**

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: **Shelly Laughlin** **PHONE: 517-930-4557**

PROJECT MANAGER: **Andy Linebaugh** **PHONE: 517-243-0029**

Walker Consultants
650 Trade Centre, Ste. 325
Portage, MI 49002

BID DUE DATE: Until **3:00 p.m.** on **Thursday, April 10, 2025**, 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 the following work:
Proposal 1 – General Construction Work

This project involves concrete and structural repairs at parking facilities #1-Shaw Lane, #2-Auditorium, #3-Wharton Center, and #4-Kellogg Center. Repair work includes but is not limited to: Full depth precast and unbonded post-tensioned (P/T) slab repair, partial depth P/T slab and ceiling repair, partial depth stair stringer and ceiling repairs, partial depth helix beam repair, vertical and overhead knockdown of loose overhead concrete materials, and P/T tendon repair. Concrete formwork, shoring, steel reinforcement, waterproofing at concrete repairs, etc. is incidental to all work. Please refer to Work Items identified in the Bid Form and Technical Specifications for additional information.

Invitation Only: Bids will only be accepted by the following firms:

1. Bornor Restoration
2. D.C. Byers Co.
3. M One Limited
4. Pullman Services
5. RAM Construction

The substantial construction completion date for the project, as set forth in the project manual and drawings is **August 22, 2025**. 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 new MSU Plan Room or via the MSU Planning, Design and Construction (PDC) 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 **Thursday, March 27, 2025** at **11:30 a.m.**. All interested Contractors or Bidders are encouraged to attend. Interested parties should meet at the **IPF Building – 1147 Chestnut Rd., Rms. 11 and 12, East Lansing, MI 48824**. 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, the Bid Form, other sample bidding and Contract forms and the proposed Contract Documents including any Addenda issued prior to receipt of Bids.

1.2 All definitions set forth in ConsensusDocs 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 Specification shall be completed within the Bid Manager.

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.

4.1.3.1 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.]

4.1.4 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.

4.1.5 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).

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

4.1.7 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 a Zoom meeting. 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 receipt of 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.

7.1.2 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 into Unifier and the initial training necessary to use Unifier. 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. The following are the minimum Unifier user software and hardware requirements. 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 project involves concrete and structural repairs at parking facilities #1-Shaw Lane, #2-Auditorium, #3-Wharton Center, and #4-Kellogg Center. Repair work includes but is not limited to: Full depth precast and unbonded post-tensioned (P/T) slab repair, partial depth P/T slab and ceiling repair, partial depth stair stringer and ceiling repairs, partial depth helix beam repair, vertical and overhead knockdown of loose overhead concrete materials, and P/T tendon repair. Concrete formwork, shoring, steel reinforcement, waterproofing at concrete repairs, etc. is incidental to all work. Please refer to Work Items identified in the Bid Form and Technical Specifications for additional information.**

2. This Contract encompasses the furnishing of all labor, materials, services, equipment, and insurance to complete the following as shown on drawing and specified herein:

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. Temporary and final keying (see Section 087100)

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

   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.

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. 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. Ramps must allow 2-way traffic at all times for access to all levels. Stage traffic topping and other work to allow a minimum of one (1) entry/exit and access to each level open at all times. Construction work in parking ramps shall be coordinatedwith IPF Project Manager, MSU Police, and Parking Owner Activities/Operations (Wharton Center, Kellogg Center, etc.) and Football Home Games (if necessary) . Impact to Parking Ramp Operations on Home Football Weekends shall be kept to a minimum, no major parking stall or access impacts unless approved by IPF Project Manager.

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

3. 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.

1.2 ALLOWANCES

1.3 UNIT PRICES

A. Unit prices will be used to adjust the Lump Sum Bid for work that is added to or subtracted from the project. Unit prices quoted shall include all associated work items required to complete the task specified and shall include all labor fringes, overhead, profit, handling fee and any associated cost related to the work item. Unit prices must be reasonable and customary for the work specified. The successful bidder must be able to support and document the prices quoted as they relate to the quoted Base Bid. ALL UNIT PRICES MUST BE PROVIDED FOR THE BASE BID TO BE CONSIDERED VALID.

1.4 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. A simple bar chart construction schedule shall be prepared by the Contractor and initially submitted to the Owner prior to or at the first Pre-Construction Meeting.

2. 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.

3. 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.

4. 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.

1.3 MILESTONE SCHEDULE REQUIREMENTS

A. The following Milestone Schedule dates for the listed work are provided as part of the contract requirements.

MILESTONE ACTIVITY	START	COMPLETION
Substantial Completion	**Upon Contract**	**August 22, 2025**

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.

B. 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 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.

220500 for Plumbing Permits and Inspection
260500 for Electrical Permits and Inspection

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.
- Manufacturer Maintenance Agreement
- Applicator Agreement
- Sealants
- Expansion Joints Sealants

6. SAMPLES
Samples are required as specified in Section 013000 for the following items:
- Sealants
- Traffic Coatings
- Caulk Sealants
- Expansion Joint Assemblies

7. SHOP DRAWINGS
   Shop drawings are required as specified in Section 013000 for the following items:
   - Concrete Mix Design
   - Restoration Materials
   - Traffic Coatings
   - Expansion Joint Materials
   - Paint
   - Sealants
   - P/T Coupling Materials

8. TEST AND BALANCE REPORTS
   Test and balance reports are required as specified in TESTING, ADJUSTING, AND BALANCING FOR HVAC, Section 230593 (if applicable).

C. 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.

D. 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 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 REGULATORY REQUIREMENTS

A. Applicable Codes, Standards, and Regulations

1. The following list of codes and regulations, establish the minimum requirements applied to work done at MSU. Where the specifications or plans, exceed the applicable code, the specifications and plans shall be followed.

   a. NFPA National Fire Codes.
   b. NFPA National Electrical Code.
   c. ICC International Building Code.
   d. ICC International Plumbing Code.
   e. ICC International Mechanical Code.
   f. State of Michigan Elevator Safety Act - Act 227, P.A. 1967.
   g. State of Michigan Boiler Act - Act 290, P.A. 1965.
   h. State of Michigan Construction Code Act - Act 230, P.A. 1972, as amended.
   i. State of Michigan Occupational Safety and Health Act - Act 154, P.A. 1974, as amended.
   j. Americans With Disabilities Act (ADA) Public Law 101-336.
   k. Regulations of Air Pollution Control Commission State of Michigan, and the Federal Clean Air Act (42 U.S.C. 1857C - 8 © (1)).
   l. Soil Erosion and Sedimentation Control - Act 451 of 1994, parts 31 and 91, as amended.
   m. Environmental Impact Statement Executive Order 1974-4.
   n. State Fire Safety Board's New Rules for Schools, Colleges, and Universities.
   o. State of Michigan Safe Drinking Water Act, P.A. 339 of 1976, and Federal Water Pollution Control Act (33 U.S.G. 1319 ©).
   p. State of Michigan Energy Code (Adopting ASHRAE 90 by reference).

1.2 REFERENCES

A. Abbreviations and Symbols

1. AIA - American Institute of Architects
2. ACI - American Concrete Institute
3. AISC - American Institute of Steel Construction
4. ANSI - American National Standards Institute
5. ASTM - American Society for Testing Materials
6. BOCA - Building Officials and Code Administrators
7. LEED - Leadership in Energy and Environmental Design
7. NFPA - National Fire Protection Association
8. OSHA - Occupational Safety and Health Act
9. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
10. MDOT - Michigan Department of Transportation

11. USGBC - U.S. Green Building Council

1.3 QUALITY CONTROL

A. Testing Laboratory Services

1. All work (materials and installation procedure) shall be tested and inspected by an independent testing and inspection agency, approved by the Project Representative to provide the quality control requirements in accordance with these specifications. Results of these tests and inspections when performed in accordance with these specifications will not be disputed by either party. Failure of the Contractor to provide quality control in accordance with this specification may result in the replacement of the work at the Contractor's expense.

B. Contractor's Responsibilities

1. Submit the name of the proposed testing and inspection agency(s) to the Project Representative for review and approval prior to contracting for such services.

2. Employ and pay the cost of independent testing and inspection as required in this specification. Pay applications from the testing/inspection agency shall be reviewed by the Owner before the Contractor's pay request for testing/inspection services is approved.

3. Advise the testing and inspection agency sufficiently in advance of the work to be inspected in the field to allow time to schedule personnel and equipment to perform the required inspections. Failure of the work to be inspected shall be the sole responsibility of the Contractor regardless of the fault of the testing and inspection agency.

4. Furnish certificates to authenticate the type and or quality of products furnished for installation as required in these specifications.

5. Shall notify the Project Representative in a timely manner when and where testing is to take place to provide sufficient time for the Project Representative to be in attendance.

C. Testing & Inspection Agency Responsibilities

1. Perform all testing and inspection of the work in accordance with these specifications.

2. Furnish qualified personnel and sufficient equipment in a timely manner when required by the Contractor and/or Project Representative to perform all testing and inspection in accordance with these specifications.

3. Provide written reports (2 copies) in a timely manner of the work tested and inspected. The reports shall include complete material test results and for in-place material, a sketch showing the exact location where the test was taken on the project site.

4. The inspection and testing agency and its representatives are not authorized to revoke, alter, relax, enlarge or release any requirements of the Contract Documents, nor to approve or accept any portion of the work.

5. Work will be checked by representatives of the testing agencies as it progresses, but failure to detect any defective work or product will not in any way prevent later rejection when such defect is discovered, nor will it obligate the Owner to final acceptance. When it appears that the work or product furnished is in non-conformance with the Contract Documents, the representative of the testing agency will direct the attention of the Project Representative and Contractor to such non-conformance.

6. Quality control testing items shall include the following:

   c. Concrete testing

D. Authority of the Project Representative

1. May order additional tests and inspection beyond those required, if in their opinion, the subject work may not meet specification. The costs for these tests and inspections shall be borne by the Contractor.

2. May terminate the testing and inspection agency. The Contractor shall then furnish to the Project Representative the name of an additional agency for approval.

3. May perform quality control tests and inspections.

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 barriers, 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.

D. Campus Woody Plant Protection

1. Coordinate all plant protection and site work limits with the Project Representative. SITE WORK CANNOT COMMENCE WITHOUT A PRE-CONSTRUCTION WALK-THROUGH.

   All Contractor employees engaged on the project site shall attend, or are expected to have attended, the Contractor Woody Plant Protection Seminar, hosted by MSU's Landscape Services (formerly Grounds Maintenance) Division. This seminar will be presented on an annual basis at a minimum. Coordinate with the Project Representative for times and locations of the seminar(s).

2. Work by Owner

   a. Tie-back of existing plantings. Pruning, thinning, and sealing of existing plantings. Root pruning and root protection of exposed roots. Watering of existing trees under stress. Salvaging of existing small trees, shrubs, and other plant growth that the Owner wishes to retain.

3. Protection of Plantings

   a. Protect existing trees and other vegetation indicated to remain in place. Prohibited practices include breaking of branches, scraping of bark, or unauthorized cutting; nailing or bolting into trees or plants; use of trees or plants as temporary support (i.e. for cables); unauthorized filling, excavating, trenching or auguring within the root zone; compaction/driving over the root zone; (see definitions below), storage of any materials or vehicles within the root zone; dumping of construction waste or materials (including liquids); unauthorized removal or relocation of woody plants; removal of tree protection barricades or construction fencing prior to completion of project.

   b. Compaction within the root zone is the increasing of the soil density caused by heavy equipment or concentrated foot traffic which significantly alters the soil conditions from that which was present prior to construction.

   c. The root zone of a tree is one and a half the distance of plant crown drip line outward from the stem, along undisturbed grade. Should placement of concrete be specified or authorized by the Owner within the root zone, a sulfur application will be applied by the Owner. The Contractor shall notify the Owner at least 48 hours prior to pouring concrete. Trees to receive sulfur shall be identified by

Owner.

d. Tree protection barricades shall be wood rail fencing constructed of 4" x 4" x 11' posts, at 8' maximum o.c. and two 2" x 6" wood rails, lined with snow fence (or similar approved construction barrier fencing) which meets existing grade. Standard fence height shall be 8'; for variations see site drawings. Failure to install barricades as directed may halt work. Plant damage occurring within installed barricades does not absolve the Contractor from damage assessment.

e. All tree protection shall be installed prior to the beginning of construction and continually maintained. Tree protection shall not come in contact with anything except the construction fence, when shown on the drawings.

4. Damage

a. Damage to campus woody plants shall include any of the items indicated in paragraph 3.a above as determined solely by the Owner. The Owner shall evaluate damage and establish proportional fines up to 100% of the value shown below, regardless of the current disposition of the plant.

b. 100% Value Schedule for Campus Trees

1" - 3" caliper	$200/inch
3" - 6" DBH	$290/inch
6" - 9" DBH	$380/inch
9" - 12" DBH	$480/inch
12" - 15" DBH	$670/inch
15" DBH or greater	$960/inch

c. DBH is the tree trunk diameter at breast height.

d. Replacement value for shrubs, vines, and perennials shall be assessed at three times the current market cost of the plant.

e. Alternatives to the above protective measures, or any variations, must be approved by the staff Landscape Architect and the Project Representative. (Measures may include: thinning and root pruning, fertilization, aeration, boring & jacking, hand excavation, supervision by campus arborist, seasonal schedule recommendations.) Alternatives would be based on the specific requirements of the plant species in question, as determined by the staff Landscape Architect.

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. Quality Assurance

a. Surveyor

1. Engage a Registered Land Surveyor, registered in Michigan, to perform ALL project surveying, including construction layout, as outlined in Section 017000-1.2.B, "Field Engineering."

2. Submittals

a. Project Record Documents

1. Upon completion of Work requiring Field Engineering, submit a record of Work performed and record survey data as required in Section 017000-1.2.B.5.

2. Upon completion of Work requiring Field Engineering, submit a certificate signed by the Registered Land Surveyor, certifying the location and elevation of improvements comply with the Contract Documents.

3. Control Points

   a. The Owner will identify existing control points and property line corner stakes.

   b. Verify layout information shown on the Drawings in relation to the property survey and existing benchmarks before proceeding to lay out the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.

   c. If a discrepancy between the contract drawings and the existing site is found, contact the Project Representative for a resolution BEFORE any actual layout of the work is begun.

   d. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points, or requirements to relocate reference points because of necessary changes in grades or locations.

   e. Promptly replace lost or destroyed control points. Base replacements on the original survey control points.

   f. Establish and maintain a minimum of two permanent benchmarks on the site, referenced to data established by survey control points.

   g. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

   h. The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction.

   i. Prior to construction, verify the location and invert elevation at points of connection to existing utilities.

4. Benchmarks and Markers

   a. Working from lines and levels established by the property survey, establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to properly locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do no scale Drawings to determine dimensions.

   b. Advise entities engaged in construction activities of marked lines and levels provided for their use.

c. As construction proceeds, check every major element for line, level, and plumb.

5. Registered Land Surveyor's Log

a. Maintain a surveyor's log of control and other survey Work. Make this log available for reference.

b. Record deviations from required lines and levels, and **immediately** advise the Project Representative when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.

c. On completion of foundation walls, major site improvements, and other Work requiring field engineering, submit this log and associated Project Drawings to the Project Representative.

6. 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.

7. Site Improvements

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

8. 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:

   a. Post and chain fencing
   b. Catch basin and/or manhole frames and covers
   c. Bike racks and loops
   d. Waste cans
   e. Street and area light fixtures
   f. Face brick for repair
   g. Paver brick
   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.

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

C. Facility Asset Data Exchange (FADE) Log

1. 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 020010 - WORK ITEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Divisions 1, 2, 3, 4, 7, and 9 Specification Sections apply to this Section.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

WI 1.0 GENERAL REQUIREMENTS

A. Scope of Work

1. Work consists of performing all tasks, specifically required and incidental, which are not identified under separate Work Item designation, but necessary to perform the work identified in this project. This work includes, but is not limited to the following items:

WI 1.1 - Mobilization
WI 1.2 - Concrete Formwork
WI 1.3 - Concrete Shores and Reshores
WI 1.4 - Concrete Reinforcement
WI 1.5 - Temporary Signage

WI 1.1 PROJECT MOBILIZATION

A. Scope of Work

1. Work consists of coordinating, scheduling, obtaining and assembling at construction site all equipment, materials, permits, supplies, manpower and other essentials and incidentals necessary to perform Work defined in this Contract. Payment of lump sum amount for mobilization shall be according to following schedule and shall be based on percentage of original contract amount earned.

B. Materials

1. None

C. Execution

1. At execution of agreement by all parties, payment of not more than 25% of mobilization lump sum amount.
2. When amount earned is greater than 10% but less than 25% of original contract amount, an additional amount will be paid to bring total payment for mobilization to 50% of mobilization lump sum amount.
3. When amount earned is equal to or greater than 25% but less than 50% of original contract amount, an additional amount will be paid to bring total payment for mobilization to 75% of mobilization lump sum amount.
4. When amount earned is equal to or greater than 50% of original contract amount, an additional amount will be paid to bring total payment for mobilization to 100% of mobilization lump sum amount.

WI 1.2 CONCRETE FORMWORK

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to install shoring and formwork as required for cast-in-place concrete.

B. Materials

1. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on Drawings.

    a. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form," Class I
    b. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

2. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
3. Form Coatings: Provide commercial formulation form-coating compounds with a maximum VOC of 350 mg/l that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces, including but not limited to water-curing, curing compound, stains, or paints.
4. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units that will leave no metal closer than 1.5 in. to exposed surface.

a. Provide ties that, when removed, will leave holes not larger than 1.0 in. diameter in concrete surface.

5. Shores:

a. Nail Ellis clamps, if used with wood shores, to shores with minimum of two nails to prevent slipping.
b. Wedges: Hardwood or steel. Softwood wedges prohibited.

C. Execution

1. Work shall conform to requirements of ACI 301 “Standard Specifications for Structural Concrete,” ACI 302.1 R “Guide for Concrete Floor Slab Construction,” ACI 318 “Building Code Requirements for Reinforced Concrete,” and ACI 347 “Recommended Practice for Concrete Formwork” except as modified by the following paragraphs.
2. Store all formwork and formwork materials clear of ground, protected, so as to preclude damage.
3. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.
4. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
5. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
6. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
7. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
8. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms and bracing before concrete placement as required to prevent mortar leaks and maintain proper alignment.
9. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds

10. Coat contact surfaces of forms with accepted, nonresidual, low-VOC form-coating compound before reinforcement is placed.
11. Coat steel forms with non-staining, rust-preventive form oil or otherwise protect against rusting. Rust-stained steel formwork not acceptable.
12. For post-tensioned concrete, formwork shall remain in place until post-tensioning has been completed. Do not place additional loads on structure until concrete has been properly reshored.
13. For non-post-tensioned concrete, formwork shall remain in place until concrete has reached minimum two-thirds of 28-day strength. Do not place additional loads on structure until concrete has been properly reshored.
14. Clean and repair surfaces of forms to be re-used in Work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.
15. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Engineer/Architect.

WI 1.3 CONCRETE SHORES AND RESHORES

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to install temporary shoring and to maintain shores in place until restoration Work requiring shores and associated concrete has properly cured.

B. Materials

1. Shores shall be steel, rated at a minimum allowable load of 4,500 lb at 12 ft extension or steel shoring towers rated at a minimum allowable load of 40,000 lbs per four leg tower (based on two 20,000 lb crossed braced frames.).

C. Execution

1. For purpose of calculations: Construction Load = 50 psf; Dead Load = 50 psf for the floor slab plus the dead load of beams and girders.
2. Shore/Reshore loads on the structure shall not exceed 40 psf distributed load on the slab or precast double tees, and concentrated loads shall not exceed posted wheel loads or 2,000 lbs., whichever is less. Concentrated bearing pressures shall not exceed 1,200 psi.
3. Shore/Reshore loads on concrete slab-on-grade shall be distributed by steel grillage or timber grillage so as not to exceed soil bearing capacity or 1,500 psf, whichever is smaller.
4. Shore/Reshore loads on asphalt slab-on-grade shall be distributed by steel grillage so as not to exceed asphalt/soil bearing capacity, with consideration of reduced asphalt bearing capacity during extreme hot weather.

5. Shore/Reshore loads shall be distributed horizontally and/or distributed to more than one level to meet shore/reshore load limitations.
6. Shore/Reshore loads shall be distributed to multiple framing members (beams/joists/double tee stems) and extend beyond the immediate work area to ensure proper distribution of loads throughout the structure.

WI 1.4 CONCRETE REINFORCEMENT

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision, and incidentals necessary to fabricate and install all mild steel reinforcement and epoxy coated reinforcement.

B. Materials

1. Reinforcement materials shall be as specified in ACI 301 "Standard Specifications for Structural Concrete."
2. Welded wire reinforcement: provide mats only. Roll stock prohibited.
3. Epoxy Coating Materials for Reinforcement: ASTM A775 and A884:
4. Supplier shall be certified currently under CRSI Fusion Bonded Epoxy Coating Applicator Plant Certification Program.
5. Provide one of following epoxy coatings for reinforcement and steel accessories:

    a. "Scotchkote 413," by 3M Company, St. Paul, MN.
    b. "Nap-Gard 7-2719," by DuPont Powder Coatings, USA, Inc.

6. Use patching material recommended by epoxy powder manufacturer, compatible with epoxy coating and inert in concrete. Acceptable materials are as follows:

    a. "Scotchkote 413/215," by 3M Company, St. Paul, MN.
    b. "MasterEmaco P124," by BASF Building Systems, Shakopee, MN.
    c. "Duralprep AC," by The Euclid Chemical Company, Cleveland, OH.
    d. "Sika Armatec 110 EpoCem," by Sika Corporation, Lyndhurst NJ.

7. Corrosion Inhibiting Coating for Existing Exposed Non-prestressed Steel Reinforcement or Welded wire reinforcement:
    a. "MasterEmaco ADH 326," by BASF Building Systems, Shakopee, MN.
    b. "Euco 452", or "Duralcrete Series" by The Euclid Chemical Company, Cleveland, OH.
    c. "Sikadur 32 Hi-Mod LPL," by Sika Corporation, Lyndhurst, NJ.
    d. "Sika Armatec 110 EpoCem," by Sika Corporation, Lyndhurst NJ.

C. Execution

1. Work shall conform to requirements of ACI 301 "Standard Specifications for Structural Concrete," ACI 315-80 "Details and Detailing of Concrete

Reinforcement,” ACI 318 “Building Code Requirements for Reinforced Concrete,” and Concrete Reinforcing Steel Institute (CRSI), “Manual of Standard Practice.”

2. Submittals required include: Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems and curing compounds.

3. Store concrete reinforcement materials at site to prevent damage and accumulation of dirt or excessive rust.

4. Epoxy Coated Reinforcement:

    a. Contact areas of handling and hoisting systems shall be padded or be made of nylon or other acceptable material.
    b. Use spreader bars to lift bundles of coated steel to prevent bar-to-bar abrasion.
    c. Pad bundling bands or fabricate of nylon or other acceptable material.
    d. Store coated steel on padded or wooden cribbing.
    e. Do not drag coated steel members.
    f. After placement, restrict traffic on coated steel to prevent damage.

5. Reinforcement with any of following defects will be rejected:

    a. Lengths, depths and bends exceeding CRSI fabrication tolerances.
    b. Bends or kinks not indicated on Drawings or final Shop Drawings.
    c. Reduced cross-section due to excessive rusting or other cause.

6. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.

    a. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations.
    b. Examine conditions under which concrete reinforcement is to be placed, and immediately notify Engineer/Architect in writing of unsatisfactory conditions. Do not proceed with Work until unsatisfactory conditions have been corrected in acceptable manner.
    c. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
    d. Fabricate reinforcement to conform to required shapes and dimensions, with fabrication tolerances complying with CRSI MSP. In case of fabricating errors, do not re-bend or straighten reinforcement in manner that will injure or weaken material.
    e. Bends in reinforcement are standard 90° bends unless noted otherwise.
    f. Reinforcement with any of following defects will be rejected:

        1) Lengths, depths and bends exceeding CRSI fabrication tolerances.
        2) Bends or kinks not indicated on Drawings or final Shop Drawings.
        3) Reduced cross-section due to excessive rusting or other cause.

g. Perform all welding of mild steel reinforcement, metal inserts and connections with low hydrogen welding electrodes in accordance with AWS D1.4.
h. Epoxy coated reinforcement: Fabricator and applicator to provide installer with written instructions to handle, store and place epoxy coated reinforcement to prevent damage to coating.
i. Comply with ACI 301, Chapter 3 for placing reinforcement.
j. Use rebar chairs and accessories to hold all reinforcing positively in place. Provide rebar chairs at all formed surfaces, both vertical and horizontal, to maintain minimum specified cover. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Maximum spacing of chairs and accessories shall be per CRSI Manual of Standard Practice. In situations not covered by CRSI, provide support at 4 ft on center maximum each way.
k. Install welded wire reinforcement in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
l. Splices:

    1) Provide standard reinforcement splices by lapping ends, placing bars in contact, and tying tightly with wire. Comply with requirements of ACI 318 for minimum lap of spliced bars.
    2) For mechanical tension splices of reinforcement:

        a) Column bar lengths shall not exceed 30 ft between splices. In any bar, no splices shall occur at any floor level.
        b) Exercise care to assure that no reduction of cross-sectional area of reinforcement occurs.
        c) Use Barsplice Products, Inc., Bar-Grip or Grip-Twist, NMB Splice Sleeve, or Erico LENTON splices.
        d) For all mechanical splices, perform splicing in strict accordance with manufacturer's requirements and instructions.
        e) All splices to develop 125% of specified yield strength of bars, or of smaller bar in transition splices.
        f) Stagger splices in adjacent bars.
        g) Except where shown on Drawings, welding of reinforcement prohibited without prior written authorization by Engineer/Architect.

    3) Compression splices: Mechanically coupled splices in accordance with ACI 318, Chapter 12.

m. Epoxy Coated Reinforcement:

    1) Rest epoxy coated steel members supported from formwork on coated wire bar supports, or on bar supports made of dielectric material or other suitable material.
    2) Coat wire bar supports with dielectric material for minimum distance of 2 in. from point of contact with coated steel member.

3) Fasten epoxy-coated steel members with nylon-, epoxy-, or plastic-coated tie wire, or other suitable material acceptable to Engineer/Architect.
4) Mechanical connections, when required, shall be installed in accordance with splice device manufacturer's recommendations. Repair any damage to coating.
5) All parts of mechanical connections on epoxy-coated steel, including steel splice sleeves, bolts, and nuts shall be coated with same material used for repair of coating damage.
6) Do not cut epoxy-coated steel unless permitted by Engineer/Architect. When cut, coat ends with material used for repair of coating damage.
7) All welding of epoxy-coated steel shall conform to AWS D1.4.
8) Adequate ventilation shall be provided when welding epoxy-coated steel.
9) After welding, repair coating damage as specified in Part 3 heading "Quality Control Testing During Construction," paragraph "Epoxy Coated Material."

WI 1.5 TEMPORARY SIGNAGE

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment and supervision necessary to provide and install and remove following completion of project, temporary signage as required for traffic control and user information during construction and as required by Owner/Engineer/Architect.

B. Materials

1. Temporary signage shall meet following minimum requirements:

a. Minimum size: 48” x 48”
b. Backing material: 0.5 in. medium density overlay plywood.
c. Colors:

1) Background: medium orange or white.
2) Symbols/Lettering: black

d. Lettering: silk screened or die-cut.

1) Font Style: Helvetica or similar.
2) Size: 2 in. high minimum for pedestrian information; 4 in. high minimum for traffic information.

C. Execution

1. Mounting height: 5 ft. to bottom of sign. Provide mounting brackets as required.

2. Contractor shall submit shop drawings detailing sign size, layout, colors, and mounting schemes for approval prior to fabricating signs and mounting brackets.
3. Typical regulatory signs (that is, STOP, YIELD, etc.) and "Handicap" signs shall conform to all Federal, state, and local requirements for sizes, materials, and colors.

WI 3.0 CONCRETE FLOOR REPAIR

A. Scope of Work

1. This Work consists of furnishing all labor, materials, equipment, supervision, and incidentals including shoring necessary to locate existing spalls, locate and remove delaminated and unsound floor concrete, prepare cavities and install new concrete and reinforcing (as required) materials to restore concrete floor slab to original condition and appearance. Refer to Detail Series 3.0 for specific requirements. Ensure all conduits and mechanical equipment are protected at all times. **Protecting exposed PT tendons per WI 20.2 is incidental to this Work.**

B. Materials

1. Concrete repair materials shall be as specified in Division 03 Section “Cast-in-Place Concrete Restoration” and “Prepackaged Repair Mortar”.
2. Conventional steel reinforcement shall be as specified in WI 1.4 and Division 03 Section “Cast-in-Place Concrete Restoration.”

C. Execution

1. Locating, marking, removal, preparation, and inspection of deteriorated concrete and reinforcing steel preparation, repair and installation shall be performed as specified in Division 02 Section "Surface Preparation for Patching and Overlay.”
2. Procedure for delaminated, spalled and unsound concrete removal shall be as specified in Section "Surface Preparation for Patching and Overlay," Article " Preparation." Remove all unsound concrete within marked boundary prior to sawcutting and preparation of patch edges.
3. Engineer shall inspect all cavities for condition according to Section "Surface Preparation for Patching and Overlay," Article "Inspection of Repair Preparation."
4. All steel exposed within cavities shall be cleaned to bare metal by sandblasting as specified in Section "Surface Preparation for Patching and Overlay," Article "Cleaning of Reinforcement within Delamination and Spall Cavities," and damaged and defective reinforcement replaced as specified in Section "Surface Preparation for Patching and Overlay," Article "Reinforcement and Embedded Materials in Repair Areas." Exposed steel shall be epoxy coated with an approved epoxy resin as specified in Section “Cast-in-Place Concrete – Restoration.”

5. Contractor shall prepare cavities for patch placement as specified in Section "Surface Preparation for Patching and Overlay," Article "Preparation of Cavity for Patch Placement."
6. Patch materials and associated reference specifications are listed in Work Item "Concrete Floor Repair," Article " Materials," above. Patch installation procedures shall be in accordance with referenced specifications for selected material.
7. Final surface preparation, concrete placement, finishing and curing shall be performed as specified in concrete repair material specification.
8. Shoring is incidental to work.

WI 3.3 FLOOR REPAIR - FULL DEPTH - PC

A. Refer to Work Item 3.0, “Concrete Floor Repair” for Scope of Work, Material and Execution procedures associated with this Work Item. Refer to Detail 3.3 for specific requirement.

WI 3.3 FLOOR REPAIR - FULL DEPTH - PT

A. Refer to Work Item 3.0, “Concrete Floor Repair” for Scope of Work, Material and Execution procedures associated with this Work Item. Refer to Detail 3.3 for specific requirement. **Protecting exposed PT tendons per WI 20.2 is incidental to this Work.**

WI 3.9 FLOOR REPAIR - FULL DEPTH FLANGE REPLACEMENT

A. Refer to Work Item 3.0, “Concrete Floor Repair” for Scope of Work, Material and Execution procedures associated with this Work Item. Refer to Detail 3.9 for specific requirement.

WI 3.12 FLOOR REPAIR - STAIR STRINGER

A. Refer to Work Item 3.0, “Concrete Floor Repair” for Scope of Work, Material and Execution procedures associated with this Work Item. Refer to Detail 3.12 for specific requirement.

WI 3.13 FLOOR REPAIR – STAIR STRINGER

A. Refer to Work Item 3.0, “Concrete Floor Repair” for Scope of Work, Material and Execution procedures associated with this Work Item. Refer to Detail 3.13 for specific requirement.

WI 4.0 CONCRETE CEILING REPAIR

A. Scope of Work

1. This Work consists of furnishing all labor, materials, equipment, supervision and incidentals including shoring necessary to locate existing spalls, locate and remove delaminated and unsound overhead concrete, prepare cavities and install new concrete and reinforcing (as required) materials to restore overhead concrete to

original condition and appearance. Refer to Detail Series 4.0 for specific requirements.

B. Materials

1. Trowel applied patching material shall be as specified in Division 03 Section "Prepackaged Repair Mortar." This material may be used for shallow removal and repair Work Items only.

C. Execution

1. Locating, marking, removal, preparation, and inspection of deteriorated concrete and reinforcing steel preparation, repair and installation shall be performed as specified in Division 02 Section "Surface Preparation for Patching and Overlay.”
2. Final surface preparation, concrete placement, finishing and curing shall be performed as specified in concrete repair material specification. Manufacturer specifications/requirements on these issues shall also be followed in the event proprietary bag mix repair materials are used.

WI 4.1 CEILING REPAIR - PARTIAL DEPTH – P/T

A. Refer to Work Item 4.0, "Concrete Ceiling Repair" for Scope of Work, materials and procedure associated with this Work Item. Refer to Detail 4.1 for specific requirements.

WI 4.5 CEILING REPAIR - PARTIAL DEPTH - STAIR

A. Refer to Work Item 4.0, "Concrete Ceiling Repair" for Scope of Work, materials and procedure associated with this Work Item. Refer to Detail 4.5 for specific requirements.

WI 5.0 CONCRETE BEAM REPAIR

A. Scope of Work

1. This Work consists of furnishing all labor, materials, equipment, supervision and incidentals including shoring necessary to locate existing spalls, locate and remove delaminated and unsound overhead concrete, prepare cavities and install new concrete and reinforcing (as required) materials to restore concrete beams and joists to original condition and appearance. Refer to Detail Series 5.0 for specific requirements.

B. Materials
1. Cast-in-place concrete repair materials shall be as specified in Division 03 Section “Cast-in-Place Concrete Restoration”, Division 03 Section “Prepackaged Repair Mortar."

2. Conventional steel reinforcement shall be as specified in Division 03 Section “Cast-in-Place Concrete”, Division 03 Section “Cast-in-Place Concrete Restoration” and/or Work Item 1.4, “Concrete Reinforcement.”
3. Trowel applied patching material shall be as specified in Division 03 Section "Prepackaged Repair Mortar." This material may be used for shallow removal and repair Work Items only.

C. Execution

1. Locating, marking, removal, preparation, and inspection of deteriorated concrete and reinforcing steel preparation, repair and installation shall be performed as specified in Division 02 Section "Surface Preparation for Patching and Overlay.” Install shoring at repair locations where required per the Construction Documents prior to starting removals.
2. Final surface preparation, concrete placement, finishing and curing shall be performed as specified in concrete repair material specification. Manufacturer specifications/requirements on these issues shall also be followed in the event proprietary bag mix repair materials are used.

WI 5.2 HELIX BEAM REPAIR - PARTIAL DEPTH

A. Refer to Work Item 5.0, "Concrete Beam and Joist Repair" for scope of Work, materials and procedure associated with this Work Item. Refer to Detail 5.2 for specific requirements.

WI 8.0 PRECAST TEE BEAM REPAIR

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision and incidentals including shoring necessary to locate precast tee beam elements to be repaired, shore surrounding construction supported by tee beam element being repaired, remove delaminated and unsound concrete and sound concrete, prepare cavities and install concrete and reinforcing (as required) to rebuild precast tee beam elements to original condition and appearance. Refer to Detail Series 8.0 for specific requirements.

B. Materials/Equipment

1. Cast-in-place concrete repair materials shall be as specified in Division 03 Section "Cast-in-Place Concrete”, Division 03 Section “Cast-in-Place Concrete Restoration”, Division 03 Section “Prepackaged Repair Mortar”, and/or Division 03 Section “Latex Modified Concrete and Mortar."
2. Conventional steel reinforcement shall be as specified in Division 03 Section “Cast-in-Place Concrete”, Division 03 Section “Cast-in-Place Concrete Restoration” and/or Work Item 1.4, “Concrete Reinforcement.”

3. Trowel applied patching material shall be as specified in Division 03 Section "Prepackaged Repair Mortar." This material may be used for shallow removal and repair Work Items only.
4. Chipping hammers shall be 15 lb or less unless directed by Engineer/Architect.

C. Execution

1. Locating, marking, removal, preparation, and inspection of deteriorated concrete and reinforcing steel preparation, repair and installation shall be performed as specified in Division 02 Section "Surface Preparation for Patching and Overlay.” Install shoring at repair locations where required per the Construction Documents prior to starting removals.
2. Final surface preparation, concrete placement, finishing and curing shall be performed as specified in concrete repair material specification. Manufacturer specifications/requirements on these issues shall also be followed in the event proprietary bag mix repair materials are used.
3. Contractor shall maintain forms and shores in place until concrete has attained at least 75% of 28-day strength.
4. Contractor shall take care to protect adjacent areas from overspray if "Shotcrete" is used. Area adjacent to repair shall be cleaned to Owner's satisfaction prior to leaving site.

WI 8.5 VERTICAL / OVERHEAD KNOCK DOWN

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision and incidentals necessary to locate and remove deteriorated concrete as indicated on the Drawings. Refer to detail 8.5 for specific requirements.

B. Materials

1. Extended Open Time Corrosion Inhibitor Coating: Corrosion inhibitor coating providing up to 24 hours open time. Product shall be capable of achieving bond strength of 2,700 psi per ASTM C 882.
2. Acceptable materials for this Work are:

    a. “MasterEmaco P 124,” by BASF Building Systems, Shakopee, MN.
    b. “Duralprep AC” by The Euclid Chemical Company, Cleveland, OH.
    c. “Sika Armatec 110 EpoCem”, by Sika Corporation, Lyndhurst, NJ.
    d. Other types may be used only with Engineer/Architect's approval in writing prior to bidding.

C. Execution

1. Locating, marking and removal of deteriorated concrete and reinforcing steel preparation shall be performed as specified in Division 02 Section “Surface Preparation for Patching and Overlay.”
2. Prepare repair areas using chipping hammers of 15lb or less as directed by Engineer.
3. All exposed steel within cavities shall be cleaned by sandblasting.
4. Contractor shall allow for Engineer/Architect inspection of all cavities for condition as specified.
5. Contractor shall coat exposed prepared steel and entire removal area with specified corrosion inhibitor coating material.

WI 11.0 CRACK AND JOINT REPAIR

WI 11.4 TOOL AND SEAL JOINTS (INCIDENTAL)

A. Scope of Work

1. Work consists of providing all labor, materials, equipment, supervision and incidentals necessary to provide tooled and sealed control joints in concrete as shown on Drawings. Refer to Detail 11.4 for specific requirements.

B. Materials

1. Sealant materials shall be as specified in Division 07 Section "Concrete Joint Sealants."

C. Execution

1. Contractor shall locate and provide control joints at all column grid lines and at all existing control and construction joints, and at any additional locations shown in the Construction Documents.
2. Control joints shall be tooled and formed in plastic concrete. Sawcutting joints after concrete sets will not be allowed.
3. Tooled joints shall be of proper dimension in plastic concrete.
4. Sealant materials and installation procedures shall be in accordance with referenced specifications for selected material.

WI 11.7 COVE SEALANT

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision and incidentals necessary to prepare concrete surfaces and install cove sealant between floor and vertical surfaces as shown on Drawings. Refer to Detail 11.7 for specific requirements.

B. Materials

1. Joint sealant materials shall be as specified in Division 07 Section Concrete Joint Sealants."

C. Execution

1. Intersection to be sealed shall be thoroughly cleaned by sandblasting to remove all contaminants and foreign material.
2. Entire Work area shall then be cleaned with compressed air to assure that all loose particles have been removed and that intersection is dry.
3. Properly prepared intersection shall be coated evenly and completely with joint primer material on each of intersecting faces in accordance with sealant manufacturer's recommendations.
4. After primer has cured, apply cove sealant to intersection such that sealant extends 0.75 in. onto each of intersecting faces.
5. Work cove sealant into joint so that all air is removed and tool to concave shape such that minimum throat dimension of no less than 0.5 in. is maintained.
6. Remove excess sealant and allow to cure.

WI 16.0 TRAFFIC TOPPING

A. Scope of Work

1. Work consists of furnishing all labor, materials, equipment, supervision and incidentals, including installation of joint sealant materials, necessary to prepare existing floor surfaces and install traffic topping. Coating of all vertical surfaces within Work limits shall be incidental to installation of traffic topping. Refer to Detail series 16.0 for specific requirements.

B. Materials

1. Traffic topping materials shall be as specified in Division 07 Section "Traffic Coatings."

C. Execution

1. Floor surface preparation shall be performed by coating system licensed applicator or under its direct supervision.
2. Shotblast surface preparation is required for floors.
3. Coating system shall be installed by licensed applicators in strict accordance with manufacturer's recommendations and referenced specification section.
4. Coating system shall be thoroughly cured prior to Work areas being returned to service.

WI 16.1 TRAFFIC TOPPING – VEHICULAR – FULL SYSTEM

A. Scope of Work

1. Full system coating work is intended to be incidental to concrete repairs within existing areas of traffic topping.

2. Work consists of furnishing all labor, materials, equipment, supervision and incidentals necessary to prepare surface of concrete patches and/or previously traffic topped areas and install traffic topping on prepared concrete and existing traffic topping. Refer to Detail 16.1 for specific requirements.

B. Materials

1. Traffic topping materials shall be as specified in Division 07 Section "Traffic Coatings" and shall be compatible with existing system. Obtain written approval from new traffic topping manufacturer that existing coating surface is acceptable for installing new coating before beginning Work.

C. Execution

1. All loose existing coating shall be removed and exposed existing concrete surfaces prepared in accordance with manufacturer's recommendations and referenced specifications.
2. Preparation of new concrete patches shall be in strict accordance with manufacturer's recommendations and referenced specifications.
3. Completely solvent wash all existing traffic coating within work limits that is to receive new coating material. Ensure existing coating to remain is adequately bonded to existing concrete slab.

WI 20.0 P/T SYSTEM REPAIR (BUTTONHEAD)

A. Scope of Work

1. This work consists of furnishing all labor, materials, equipment, supervision and incidentals necessary to make P/T tendon splice repairs and P/T end anchorage repairs to the “buttonhead” post-tensioning system. Refer to Detail series 20.0 for specific requirements. Refer to Section “Unbonded Post-Tensioned Concrete” for further requirements.
2. The furnishing and installing of reinforcing steel as shown on the Details is incidental to this work. Concrete removals and replacement is not included in this work and shall be performed and paid for under Work Item series WI 3.0 or WI 4.0 as applicable.

B. Materials

1. Post-Tensioning materials and related materials shall be as specified in Section “Unbonded Post-Tensioned Concrete”.
2. “Buttonhead” Post-tensioning materials:

a. Couplings, anchor plates and stressing shims shall conform to ACI 301 and shall meet or exceed ultimate strength requirements of original tendon.
b. Tendon wire shall conform to ASTM A421 type BA.
c. Bars shall conform to ASTM A722 and shall meet or exceed ultimate strength requirements of original tendon.

3. Reinforcing steel shall be epoxy coated as specified in Work Item 1.4, "Concrete Reinforcement'.
4. Epoxy adhesive for reinforcing dowels shall be Hilti RE-500 or approved equivalent.

C. Prequalified Installers:

1. Refer to Section "Unbonded Post-Tensioned Concrete".

D. Prequalified Suppliers:

1. Refer to section "Unbonded Post-Tensioned Concrete".

E. Execution

1. Prior to concrete removals, submit shoring and bracing plan for engineer review. Engineer review does not absolve contractor's total responsibility for providing the necessary shoring and bracing to maintain the stability of the structure and individual elements. Required post shores are incidental and will not be paid for separately.
2. Refer to Work Item series 20.0 for additional requirements.
3. Below is a general procedure for P/T tendon repairs. The actual repair procedure for each repair location may vary depending on existing conditions and shall be reviewed by the Engineer. Contractor shall coordinate with Engineer.

a. Locate damaged tendon, measure and record length between anchor points.
b. Measure and record cable separation, failure point and offset from nearest column face. Mark adjacent floor slab beyond concrete removal boundary to reference the failed tendon end points.
c. Mark cable path on floor surface between anchors with marking paint.
d. Inspect floor slab top and bottom for cracks, delaminations, and spalls.
e. Remove all unsound and delaminated concrete only from floor and ceiling surfaces along tendon path (see item 1 below).

1) Closely inspect the exposed tendon for damage at all concrete removal sites. If no damage is observed, proceed to step F. If damage is observed, comply with step 2 below.
2) Mark all damaged points for inspection by Engineer. **Do not proceed with further concrete removals until after Engineer's inspection and approval**.

f. As directed by the Engineer, perform full depth removal at tendon anchorage to expose only the **nonstressed** side of the anchor plate. Excavate the anchorage nearest the failure point first then, excavate the opposite end.

Inspect the anchorage for damage. Note that the tendon will probably retain some residual stress from corrosion lock up at the tendon high points. **CONTINUE TO USE EXTRA CAUTION DURING CONCRETE REMOVALS.**

g. Coordinate inspection of end anchors by Engineer.

h. As directed by the Engineer, continue partial concrete removals at tendon high points adjacent to the tendon failure locations. Removal should begin at the high point (closest to the failure) and work successively towards the nearest exposed anchor. **Perform removals a safe distance away from end anchors and intermediate anchors.** Perform removals so as to systematically detension and free up each tendon in small sections between removal points. The Engineer may direct termination of concrete removals if exposed tendons are found to be relaxed and free of corrosion. Cease removals as the Engineer directs, or when damaged tendon is released along its entire length.

i. Perform remaining concrete removals both partial and full depth to accommodate tendon splicing and new end anchor installation.

j. Engineer will determine location, type and extent of tendon repair.

k. Install splice couplings, end anchors, sheathing, new tendons and reinforcing steel per the applicable work item and in accordance with Section "Unbonded Post-Tensioned Concrete". Cleaning and epoxy coating of all exposed reinforcing steel and P/T materials is incidental to concrete work.

l. Install patch concrete both partial and full depth at all locations except at stressing pockets and splice couplings. Concrete work shall be performed and paid for under Work Item series 3.0 or 4.0 as applicable.

m. Stress tendon when concrete has achieved 75 percent of required 28-day compression strength. Do not trim tendons until Engineer has approved stressing logs. Additional stressing shall be performed as required by Engineer and is incidental to the work.

n. Install patch concrete at stressing pocket and splice coupling locations.

o. Refer to Section "Unbonded Post-Tensioned Concrete" for additional requirements.

WI 20.2 PROTECT EXPOSED P/T TENDON(S) (INCIDENTAL)

A. Scope of Work

1. This work consists of furnishing all labor, materials, equipment, supervision and incidentals necessary to remove damaged tendon paper wrap, re-grease (or epoxy coat tendons as approved by Engineer) in damaged area and re-wrap tendon. Concrete work performed in association with this work will be paid separately under Work Item Series 3.0. Refer to Detail 20.2 for specific requirements.

B. Materials

1. Refer to Section "Unbonded Post-Tensioned Concrete".

C. Execution

1. Remove damaged paper wrap materials from exposed tendon.
2. Grease coating:

    a. Apply additional corrosion-inhibiting grease over the damaged area to completely fill any void or surface depression caused by the sheathing damage.

3. Epoxy coating option (use only as approved by Engineer).

    a. Clean tendon to remove grease residue from exposed tendon.
    b. Apply uniform coating of epoxy to exposed tendon.

4. Wrap tape over exposed tendon. Tape shall overlap existing paper wrap by at least two inches at each end.
5. Tape entire length of repair, spirally wrapping tape around tendon to provide at least two layers of tape. Taping shall overlap existing paper wrap by 2 in. at each end.

1. Concrete" for additional requirements.

WI 20.6 TENDON SPLICE COUPLING (CENTER-PULL)

A. Scope of Work

1. This work consists of furnishing all labor, materials, equipment, supervision and incidentals necessary to install a center-pull splice coupling for splicing and stressing of a tendon. Concrete work performed in association with this work will be paid separately under Work Item series 3.0. Refer to Detail 20.6 for specific requirements.

B. Materials

1. Refer to WI 20.0 "P/T System Repair – Buttonhead", Article "Materials" and Section "Unbonded Post-Tensioned Concrete".

C. Execution

1. Detension any remaining wires in tendons designated for repair.
2. Install center-pull splice coupling onto tendon with required overlap/extension and then stress tendon to specified stress. If this Work Item is performed in combination with other P/T repairs along same tendon, then stress tendon after concrete anchor blocks and patches have achieved the specified compressive strength. Refer to Detail series 20.6 for specific requirements.
3. Epoxy coat coupling prior to installation of repair concrete.
4. Grease and wrap new and existing tendons in repair area in accordance with WI 20.2 and is incidental to this work.
5. Refer to WI 20.0 and Section "Unbonded Post-Tensioned Concrete" for additional requirements.

WI 20.8 TENDON SPLICE COUPLING (DOUBLE)

A. Scope of Work

1. This work consists of furnishing all labor, materials, equipment, supervision and incidentals necessary to install two tendon splice couplings and a length of new P/T tendon as Detailed. Concrete work performed in association with this work will be paid separately under Work Item series 3.0. Refer to Detail series 20.8 for specific requirements. This work is performed in conjunction with either Work Item 20.3, 20.5 or 20.6.

B. Materials

1. Refer to Work Item 0.0 "P/T System Repair (Buttonhead)", Article "Materials" and Division 03 Section "Unbonded Post-Tensioned Concrete."

C. Execution

1. Install new splice couplings onto unstressed existing tendons and connect to new tendon. If tendon splice length is greater than that indicated on Detail, then contractor shall be paid for additional length of Tendon per Work Item 20.9.
2. Epoxy coat all exposed splice couplings prior to installation of repair concrete.
3. Grease and wrap new and existing tendon at tendon splice repair area in accordance with Work Item 20.2 and is incidental to this work.
4. Refer to Work Item 20.0 and Division 03 Section "Unbonded Post-Tensioned Concrete" for additional requirements.

WI 20.9 P/T TENDON MATERIAL

A. Scope of Work

1. This work consists of furnishing all labor, materials, equipment, supervision and incidentals necessary to provide and install new P/T tendon.

B. Materials

1. Refer to WI 20.0 "P/T System Repair – Buttonhead", Article "Materials" and Section "Unbonded Post-Tensioned Concrete".

C. Execution

1. Install new tendon within concrete removal areas as needed to replace damaged or defective tendon.
2. Tendon profile shall match existing. Use chairs and tie wire to maintain Tendon position during concrete placement.
3. Refer to WI 20.0 and Section "Unbonded Post-Tensioned Concrete" for additional requirements.

END OF SECTION 02 00 10

SECTION 025130 - GENERAL CONCRETE SURFACE PREPARATION

PART 1 - GENERAL

1.1 DEFINITIONS

A. **DELAMINATIONS**: Fracture planes, "internal cracks," within concrete. Typically these fractures are parallel to the member face and vary in depth.

B. **NEAR-VERTICAL CHIPPED EDGES:** Provide an edge dressed to within 20^{o} of perpendicular of finished surface.

C. **SPALLS:** Potholes, cavities or voids in concrete. Usually result of delamination migrating to face of concrete member. When fracture finally reaches surface, concrete encompassed by delamination breaks away, resulting in spall.

D. **UNSOUND CONCRETE:** Concrete exhibiting one or more of:

1. Incipient fractures present beneath existing delaminated or spalled surfaces.
2. Honeycombing.
3. Friable or punky areas.
4. Deterioration from freeze-thaw action.

E. **SCALING:** Deterioration which attacks mortar fraction (paste) of concrete mix. First appears as minor flaking and disintegration of concrete surface. Scaling eventually progresses deeper into concrete, exposing aggregate which breaks away.

F. **SHOTBLASTING:** Scarification of concrete surfaces using an abraded metal shot-rebound. See ICRI Guideline 03732 “Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.”

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 025130

SECTION 025140 - SURFACE PREPARATION FOR PATCHING AND OVERLAY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the provision of all labor, materials, equipment, supervision and incidentals necessary to locate and remove all delaminated and unsound concrete, all existing failed patches, all existing surface spalls and potholes, and preparation of cavities created by removal to receive concrete patching material.

B. This Section includes the provision of all labor, materials, equipment, supervision and incidentals necessary to prepare existing sound concrete slab surfaces to receive bonded concrete overlay.

C. Related Sections: Following Sections contain requirements that relate to this Section:

1. Division 03 Section “Cast-in-Place Concrete – Restoration”
2. Division 03 Section “Prepackaged Repair Mortar.”

1.3 REFERENCES

A. "Specifications for Structural Concrete for Buildings" (ACI 301) by American Concrete Institute, herein referred to as ACI 301, is included in total as specification for this structure except as otherwise specified herein.

B. Comply with provisions of following codes, specifications and standards except where more stringent requirements are shown on Drawings or specified herein:

1. ”Concrete Repair Guide” (ACI 546R-14)

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 INSPECTION

A. Floor Slabs:

1. Floor slab delaminations: locate by sounding surface with hammer, rod, or chain drag.
2. When delaminated area is struck, distinct hollow sound is heard.
3. Contractor: sound all designated floors for delaminations.
4. Certain structural systems that contain thin slab thicknesses with Welded Wire Reinforcement or other small diameter reinforcing, such as waffle slab or precast tees, may have significant deterioration without evidence of delaminations. These structural systems require qualified personnel to provide additional inspections, primarily visual in nature, to define the extent of deterioration.
5. Contractor: Visually inspect thin slab thicknesses with small diameter reinforcing for deterioration.

B. Vertical and Overhead Surfaces:

1. Vertical and overhead surface delaminations: locate by sounding appropriate member with hammer or rod.
2. Cracks, usually horizontal in orientation along beam faces, and vertical in orientation near column corners are indicators of delaminated concrete.
3. Contractor: sound only vertical and overhead surfaces that show evidence of cracking and/or salt and water staining.

C. Delaminated areas, once located by Contractor, shall be further sounded to define limits. Mark limits with chalk or paint.

D. Contractor: locate spalls by visual inspection and mark boundaries with chalk or paint after sounding surface.

E. Engineer/Architect will define and mark additional unsound concrete areas for removal, if required.

F. Areas to be removed shall be as straight and rectangular as practical to encompass repair and provide neat patch.

G. Contractor: Locate and determine depth of all embedded REINFORCEMENT and ELECTRICAL CONDUIT in repair area and mark these locations for reference during concrete removal. Do **NOT** nick or cut any embeds unless approved by Engineer/Architect.

H. For overlay installation, boundaries of overlay areas will be as defined in project drawings and verified by Engineer/Architect.

3.2 PREPARATION

A. **Temporary shoring may be required at concrete floor repair areas exceeding 5 sq ft and at any beam, joist, or column repair. Contractor: Review all marked removal and preparation areas and request clarification by Engineer/Architect of shoring requirements in questionable areas. Shores shall be in place prior to concrete removal and cavity preparation in any area requiring shores**.

B. Delaminated, spalled and unsound concrete floor areas: mark boundaries. All concrete shall be removed from within marked boundary to minimum depth of 0.75 in. using 15 to 30 lb chipping hammers equipped with chisel point bits. When directed by Engineer/Architect, chipping hammers less than 15 lb shall be used to minimize damage to sound concrete. Near vertical chipped edge shall be provided along perimeter of repair area where shown on drawings. Areas to be removed shall encompass repair and proved uniform cavity surface. If delaminations exist beyond minimum removal depth, chipping shall continue until all unsound and delaminated concrete has been removed from cavity.

C. Where embedded reinforcement or electrical conduit is exposed by concrete removal, exercise extra caution to avoid damaging it during removal of unsound concrete. If bond between exposed embedded reinforcement and adjacent concrete is impaired by Contractor's removal operations, Contractor shall perform additional removal around and beyond perimeter of reinforcement for minimum of 0.75 in. along entire length affected at no cost to Owner.

D. If rust is present on embedded reinforcement where it enters sound concrete, additional removal of concrete along and beneath reinforcement required. Additional removal shall continue until non-rusted reinforcement is exposed, or may be terminated as Engineer/Architect directs.

E. Sawcut patch and overlay boundaries to depth of 0.75 in. into floor slab, unless otherwise noted. No sawcutting required at overlay boundaries abutting existing vertical surface (wall, beam, curb, etc.).For vertical and overhead surfaces marked boundary may be sawcut, ground or chipped to depth of 0.5 in. to 0.625 in. into existing concrete, measured from original surface. All edges shall be straight and patch areas square or rectangular-shaped. Diamond blade saw or grinder with abrasive disk suitable for cutting concrete is acceptable for performing work. Edge cut at boundary shall be dressed perpendicular to member face. It shall also be of uniform depth, for entire length of cut. Exercise extra caution during sawcutting to avoid damaging existing reinforcement) and electrical conduit and any other embedded items near surface of concrete. Any damage to existing reinforcement during removals shall be repaired by Contractor with Engineer/Architect-approved methods at no additional cost to Owner.

F. All sound surfaces (surfaces not requiring spall or delamination repair as previously discussed in this section) to receive overlay shall be heavy abrasive blasted or heavy shotblasted prior to overlay placement, to produce a final concrete surface profile matching ICRI CSP.

3.3 INSPECTION OF REPAIR PREPARATION

A. After removals are complete, but prior to final cleaning, exposed concrete surfaces and exposed reinforcement shall be inspected by Contractor and verified by Engineer/Architect for compliance with requirements of this Section. Where Engineer/Architect finds unsatisfactory surface or cavity preparation, Engineer/ Architect shall direct Contractor to perform additional removals. Engineer/Architect shall verify areas after additional removals.

B. Contractor shall inspect embedded reinforcement and conduits exposed within cavity for defects due to corrosion or damage resulting from removal operations. Contractor shall notify Engineer/Architect of all defective and damaged reinforcement or conduits. Replacement of damaged or defective reinforcement or conduits shall be performed according to this Section and as directed by Engineer/Architect.

C. After inspections of exposed surfaces and reinforcement are complete, Engineer/ Architect and Contractor shall measure and document removal and replacement quantities for payment, as required.

3.4 REINFORCEMENT AND EMBEDDED MATERIALS IN REPAIR AREAS

A. All embedded reinforcement exposed during surface preparation that has lost more than **15**% (**10**% if 2 or more consecutive parallel bars and/or tendons are affected) of original cross-section due to corrosion shall be considered DEFECTIVE. All non-defective exposed reinforcement that has lost section to extent specified above as direct result of Contractor's removal operations shall be considered DAMAGED.

B. **Embedded materials** including, but not limited to, electrical conduit, corrosion protection systems and snow/ice melting equipment **shall be protected by Contractor** during removal operations. **Damage due to removal operations shall be repaired by Contractor in accordance with national code requirements at no cost to Owner.** Embedded materials which are defective due to pre-existing conditions may be repaired or replaced by Contractor or abandoned at Owner's option and cost.

C. Supplement defective or damaged embedded reinforcement by addition of reinforcement of equal diameter with Class "B" minimum splice per ACI 318 beyond damaged portion of reinforcement. Secure new reinforcement to existing reinforcement with wire ties and/or approved anchors. Supplemental reinforcement shall be ASTM A615 Grade 60 steel installed in accordance with Division 03 specification Sections. Tendon supplement or repair materials, when applicable, shall be as required by Section "Work Items."

D. Loose and supplemental reinforcement exposed during surface preparation shall be securely anchored prior to concrete placement. Loose reinforcement shall be adequately secured by wire ties to bonded reinforcement or shall have drilled-in anchors installed to original concrete substrate. Drilled-in anchors shall be Powers “Tie-Wire Lok-Bolt” anchors, ITW Ramset/Red Head “TW-1400” anchor, or approved equivalent. Supplemental reinforcing needed to be held off substrate shall be adequately secured

by drilled-in anchors installed to original concrete substrate with Powers “Tie-Wire Spike”, ITW Ramset/Red Head Redi-Drive “TD4-112” anchors, or approved equivalent. Engineer/Architect will determine adequacy of wire ties and approve other anchoring devices prior to their use. Securing loose and supplemental reinforcement is incidental to surface preparation and no extras will be allowed for this Work.

E. Concrete shall be removed to provide minimum of 3/4 in. clearance on all sides of defective or damaged exposed embedded reinforcement that is left in place. Minimum of 1.5-in. concrete cover shall be provided over all new and existing reinforcement. Concrete cover over reinforcement may be reduced to 1 in. with Engineer/Architect's approval if coated with an approved epoxy resin.

F. Supplemental reinforcement and concrete removals required for repairs of defective or damaged reinforcement shall be paid for as follows:

1. Concrete removals and supplemental reinforcement required for repairs of DEFECTIVE reinforcement shall be paid for by Owner at unit price bid.
2. Concrete removals and supplemental reinforcement required for repairs of DAMAGED reinforcement shall be paid for by Contractor.

3.5 CLEANING OF REINFORCEMENT WITH DELAMINATION AND SPALL CAVITIES

A. All exposed steel shall be cleaned of rust to bare metal by sandblasting. Cleaning shall be completed immediately before concrete placement to insure that base metal is not exposed to elements and further rusting for extended periods of time. Clean entire bar diameter be cleaned.

B. After all sandblasting operations and cleanup are completed, paint all exposed steel with an approved epoxy. Protect prepared surfaces from damage prior to and during concrete placement.

3.6 PREPARATION OF CAVITY FOR PATCH PLACEMENT

A. Floor slab and cavity surfaces will be examined prior to commencement of concrete placement operations. Sounding surface shall be part of examination. Any delamination noted during sounding shall be removed as specified in this Section.

B. Cavities shall be sandblasted. Airblasting is required as final step to remove sand. All debris shall be removed from site prior to commencement of patching.

C. All patches shall be prepared to ICRI CSP as required by product manufacturer but not less than ICRI CSP 5.

END OF SECTION 025140

SECTION 033021 - CAST-IN-PLACE CONCRETE RESTORATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies cast-in-place concrete, including reinforcement, concrete materials, mix design, placement procedures, and finishes.

B. Work in other Sections related to Cast-in-Place Concrete:
   1. Division 7 Section “Traffic Coatings.”
   2. Division 7 Section “Expansion Joint Assemblies.”
   3. Division 7 Section “Concrete Joint Sealants.”
   4. Division 9 Section “Pavement Marking.”

1.3 SUBMITTALS

A. General: In addition to the following, comply with submittal requirements in ACI 301.

B. Product Data: For each type of manufactured material and product indicated.

C. Design Mixes: For each concrete mix.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

C. Source Limitations: Obtain each type of cement of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

D. Comply with ACI 301, "Specification for Structural Concrete," including the following, unless modified by the requirements of the Contract Documents.
   1. General requirements, including submittals, quality assurance, acceptance of structure, and protection of in-place concrete.
   2. Formwork and form accessories.
   3. Steel reinforcement and supports.
   4. Concrete mixtures.
   5. Handling, placing, and constructing concrete.

PART 2 - PRODUCTS

2.1 FORMWORK

A. Furnish formwork and form accessories according to ACI 301.

2.2 STEEL REINFORCEMENT

A. Epoxy-coated Reinforcing Bars: ASTM A775

B. Epoxy-Coated Welded Wire Fabric: ASTM A884, fabricated from as-drawn steel wire into flat sheets, mats only. Roll stock prohibited.

C. Provide bar supports according to CRSI's "Manual of Standard Practice." Use all-plast bar supports when in contact with exposed concrete surface.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Types I or II or Type I/II.

B. Fly Ash: ASTM C618, Class F.

C. Ground-Granulated Blast Furnace Slag: ASTM C989, Gr. 100 or higher.

D. Silica Fume: ASTM C1240.

E. Normal-Weight Aggregate: ASTM C 33, uniformly graded, not exceeding ¾ inch nominal size.

F. Water: Potable and complying with ASTM C 1602.

2.4 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain no more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures. Do not use admixtures containing calcium chloride.

B. General: Admixtures certified by manufacturer that all admixtures used are mutually compatible.

C. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing or high-range water reducing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, fiber reinforced concrete, and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
   4. Use non-corrosive accelerator for all concrete, less than 8 inches thick, placed at air temperatures below 50 degrees Fahrenheit.
   5. Use high range water reducing admixture and viscosity modifying admixture, where required, in Self-Consolidating Concrete (SCC).
   6. Use corrosion-inhibiting admixture in parking structure slabs and other areas so noted on the drawings. The dosage shall be 3 gallons per cubic yard.
   7. Use alkali-silica reactivity inhibitor unless ready mix company confirms that the aggregates to be used on the job are non-reactive.

D. Normal Water-Reducing Admixture: ASTM C 494, Type A.

E. Mid Range Water-Reducing Admixture: ASTM C 494, Type A.

F. High-Range, Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F.

G. High-Range Water-Reducing Admixture (Superplasticizer) for Self-Consolidating Concrete, ASTM C 494 Type F.

H. Viscosity Modifying Admixture for Self-consolidating Concrete:

   1. Products: Subject to compliance with requirements, provide one of the following:
      a. "Visctrol" or "Eucon ABS," Euclid Chemical Co.
      b. "Rheomac VMA Series," BASF Construction Chemicals.
      c. "Sika Stabilizer Series," Sika Corporation.
      d. "AWA-C61," Russ Tech Admixtures, Inc.
      e. "V-MAR," W.R. Grace & Co.

I. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

J. Air Entraining Admixture: ASTM C260.

K. Non-Chloride, Non-Corrosive Water-Reducing, Accelerating Admixture: ASTM C 494, Type C or E.

1. Products: Subject to compliance with requirements, provide one of following:
   a. "Eucon AcN-Series," "Accelguard 80," "Accelguard NCA," or "Accelguard 90," by Euclid Chemical Company.
   b. "DCI," "PolaraSet," "Lubricon NCA," "Daraset" or "Gilco," by W.R. Grace & Co.
   c. "Pozzutec 20+" or "Pozzolith NC 534," by BASF Construction Chemicals.
   d. "Sika Set NC," "Plastocrete 161FL", or "Sika Rapid-1," by Sika Corporation.
   e. "Catexol 2000 RHE,"by Axim Concrete Technologies.
   f. "Polychem NCA" or "Polychem Super Set," General Resource Technology.
   g. "LCNC-166," Russ Tech Admixtures, Inc.

L. Water-Reducing or Retarding Admixture: ASTM C 494, Type D or B.

1. Products: Subject to compliance with requirements, provide one of following:

   a. "Eucon Retarder-75", "Eucon DS" or "Eucon W.O." Euclid Chemical Co.
   b. "Daratard-17" or "Recover," W.R. Grace & Co.
   c. "Pozzolith Series" or "Delvo Series," BASF Construction Chemicals.
   d. "Sikatard Series," or "Plastiment Series" or "Plastocrete Series," Sika Corporation.
   e. "Polychem R," General Resource Technology.
   f. "LC-400 Series" or "LC-500 Series," Russ Tech Admixtures, Inc.

M. Corrosion Inhibiting Admixture shall be capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. "Eucon CIA" or "Eucon BCN," Euclid Chemical Company.
   b. "DCI" or "DCI-S," W.R. Grace.
   c. "Rheocrete CNI," BASF Construction Chemicals.
   d. "Sika CNI," Sika Corporation.
   e. "Catexol 1000 CN-CI," Axim Concrete Technologies.
   f. "Polychem CI," General Resource Technology.
   g. "Russ Tech RCI," Russ Tech Admixtures, Inc.

2. Add at rate of 3 gal/cu yd of concrete, which shall inhibit corrosion to 9.9 lb of chloride ions per cu. yd. of concrete. Calcium Nitrite based corrosion inhibitor shall have a concentration of 30 percent, plus or minus 2 percent of solids content.

N. Shrinkage Compensating Admixture:

1. Design requires using materials with combined drying shrinkage characteristic of 0.04 percent maximum at 28 days. Proposed concrete Mixture(s), using actual aggregates, admixtures and cement of the proposed mix for Project as detailed herein and in Drawings, shall meet criteria. Submit ASTM C 157 (may be modified by curing period duration) results for at least 3 specimens. Test takes 28 days minimum. Begin tests as soon as possible so final test results available for submittal to Engineer.
2. Provide powdered admixture used for the compensation and reduction of shrinkage in Portland Cement concrete. Its functional mechanism shall be based on the formation of an expansive Type G component, which produces a calcium hydroxide platelet crystal system based on calcium aluminate/calcium hydroxide, as specified in ACI 223.
3. Acceptable Product:
   a. Conex by The Euclid Chemical Company.
   b. “Eclipse Plus,” W.R. Grace & Co.
   c. “Tetraguard AS 20,” BASF Construction Chemicals.
   d. “Sika Control 40,” Sika Corporation.
   e. “SRA-157,“ Russ Tech Admixtures, Inc.

2.5 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry. Materials must be free of harmful substances, such as sugar or fertilizer, or substances that may discolor the concrete. To remove soluble substances, burlap should be thoroughly rinsed in water before placing it on the concrete.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

F. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

G. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.6 CONCRETE MIXES

A. Comply with ACI 301 requirements for concrete mixtures.

B. Prepare design mixes, proportioned according to ACI 301, for normal weight concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Compressive Strength (28 Days): 5000 psi.
2. Maximum w/cm ratio: See Drawing Notes.
3. Air Content: See Drawing Notes.
4. Maximum Permissible Cementitious Material Content:
   a. Fly Ash: 25 per cent
   b. Slag: 50 per cent
   c. Silica Fume: 10 per cent
   d. Fly Ash plus Slag plus Silica Fume: 50 per cent
   e. Fly Ash plus Silica Fume: 35 per cent

5. Slump: 4 inches (100 mm).
   a. Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 8 inches (200 mm) after adding admixture to plant- or site-verified, 2- to 3-inch (50- to 75-mm) slump.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with ASTM C 94 and ASTM C 1116.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

2.8 MATERIAL ACCESSORIES

A. Extended Open Time Epoxy Bonding Agent: Three component, water based, epoxy modified portland cement bonding agent and corrosion inhibitor coating providing the

recommended Manufacturer's open time in which to apply repair mortar. Product shall be capable of achieving bond strength of 2,700 psi per ASTM C 882.

1. Acceptable materials for this Work are:
   a. "Duralprep A.C." by The Euclid Chemical Company, Cleveland, OH.
   b. "Sika Armatec 110 EpoCem", by Sika Corporation, Lyndhurst, NJ.
   c. Other types may be used only with Engineer/Architect's approval in writing prior to bidding.

B. Epoxy Adhesive: 2 or 3 component, 100 percent solids, 100 percent reactive compound suitable for use on dry or damp surfaces. Product shall be capable of achieving bond strength of 1,800 psi per ASTM C 882.

1. Acceptable materials for this Work are:
   a. "MasterEmaco P 124" or "MasterEmaco ADH 326," by BASF Construction Chemicals, Shakopee, MN.
   b. "Kemko 001 or 008", by ChemCo Systems, Inc., Redwood City, CA.
   c. "Euco #452 Epoxy Series," or "Duralcrete Epoxy Series", by The Euclid Chemical Company, Cleveland, OH.
   d. Sikadur 32 Hi-Mod LPL", by Sika Corporation, Lyndhurst, NJ.
   e. Other types may be used only with Engineer/Architect's approval in writing prior to bidding.

C. Joint Fillers

1. Joint filler in slabs and curbs per ASTM D1751 Asphalt impregnated fiber board; as shown on Drawings. Acceptable products as follows:
   a. "Flexcell," Knight-Celotex Corp.
   b. "Fibre Expansion Joint," W.R. Meadows, Inc.

2. Joint filler used vertically to isolate walls from columns or other walls: White molded polystyrene beadboard type.

3. Joint cover used to bridge gap between columns and grade walls, retaining walls, or basement walls: Minimum width: Gap width plus 4 in. For gaps over 3 in. wide, protect cover with protection board sized to span gap satisfactorily. Acceptable products:

   a. "Sealtight Premoulded Membrane Vapor Seal," W.R. Meadows, Inc., Elgin, Illinois.

2.9 TOOLS

A. Slab Jointing

1. Concrete groovers: For tooled joints in concrete:

a. For concrete not exceeding 4 in. thickness, use groover with 1 in. deep v-cut bit, 0.5 in. surface width and 3/16 in. to 1/4 in. edge radius.

b. For concrete exceeding 4 in. thickness, use groover with 1.5 in. deep v-cut bit, 0.5 in. surface width and 3/16 in. to 1/4 in. edge radius.

2. Saw Cut Joints:
   a. Acceptable tool: “Soff-Cut Saw Model 310” or “Model G2000,” Soff-Cut International, Corona, CA.

      1) Cut joint as soon as concrete will support weight of operator and saw without deforming.
      2) Joint shall be 1 in. deep for concrete thickness of 4 in. or less. Joint shall be 1.5 in. deep for concrete exceeding 4 in. thickness. Do not cut reinforcement.
      3) Extend joint to adjacent vertical surface within 30 minutes of cutting.
      4) Retool or grind sawcut joint before installing sealant to provide equivalent dimensions, shape and volume as joint obtained by tooled joint. Surface width shall be 0.5 in. with 3/16 to 1/4 in. edge radius.

B. All joints subject to acceptance by sealant installer. Concrete contractor to rework rejected joints until acceptable to sealant installer.

PART 3 - EXECUTION

3.1 PRECONSTRUCTION MEETING

A. Conduct a preconstruction meeting addressing the concrete preparation, installation, protection, quality control, and acceptance of Work.

3.2 FORMWORK

A. Design, construct, erect, shore, brace, and maintain formwork according to ACI 301.

3.3 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.4 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Locate and install so as not to impair strength or appearance of concrete, at locations indicated or as approved by Engineer.

C. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint filler full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

3.5 CONCRETE PLACEMENT

A. Comply with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

B. Do not add water to concrete during delivery, at Project site, or during placement.

C. Consolidate concrete with mechanical vibrating equipment.

3.6 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch (6 mm) in height rubbed down or chipped off.

1. Apply to concrete surfaces not exposed to public view.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.7 FINISHING NON-FORMED SURFACES

A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on the surface.

1. Do not further disturb surfaces before starting finishing operations.

C. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.8 TOLERANCES

A. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

3.9 CONCRETE PROTECTION AND CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305R for hot-weather protection during placement. Keep concrete continually moist prior to final curing by evaporation retarder, misting, sprinkling, or using absorptive mat or fabric covering kept continually moist.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.1 lb/sq. ft. x h before and during finishing operations. Apply material according to manufacturer's written instructions one or more times after placement, screeding and bull floating concrete, but prior to float finishing. Repeated applications are prohibited after float finishing has begun.

1. Acceptable evaporation retarder materials for this Work are:
   a. "Cimfilm", by Axim Concrete Technologies.
   b. "MasterKure ER 50," by BASF Construction Chemicals, Shakopee, MN.
   c. "Aquafilm", by Conspec Marketing & Manufacturing Co., Inc.
   d. "Sure-Film (J-74)', by Dayton Superior Corporation.
   e. "Eucobar", or "Tamms Surface Retarder", by The Euclid Chemical Company, Cleveland, OH.
   f. "E-Con", by L&M Construction Chemicals, Inc.
   g. "EVRT", by Russ Tech Admixtures, Inc.
   h. "SikaFilm", by Sika Corporation, Lyndhurst, NJ.

C. Immediate upon conclusion of finishing operation cure concrete in accordance with ACI 308 for duration of at least seven days by moisture curing or moisture retaining covering. Dissipating curing compounds complying with ASTM C309 may be used in accordance with recommendations of ACI 506.7, "Specification for Concrete." Provide additional curing immediately following initial curing and before concrete has dried.

1. Continue method used in initial curing.
2. Material conforming to ASTM C171.
3. Other moisture retaining covering as approved by Engineer/Architect.
4. During initial and final curing periods maintain concrete above 50°.
5. Prevent rapid drying at end of curing period.

D. Concrete surfaces to receive slab coatings or penetrating sealers shall be cured with moisture curing or moisture-retaining cover**.**

E. Dissipating Curing Compound [(VOC Compliant, less than 350 g/l)]: Comply with ASTM C 309, Type 1, Class A or B. Moisture loss shall be not more than 0.55 kg/m^2 when applied at 200 sq. ft/gal. Manufacturer's certification is required. Silicate based compounds are prohibited.

1. Subject to project requirements provide one of the following products:
   a. "Kurez DR VOX" or "Kurez RC," or "Kurez RC Off," The Euclid Chemical Company.
   b. "RxCure WB," or "RxCure VOC" or "W.B. Cure VOC," Conspec Marketing & Manufacturing.
   c. "MasterKure CC 200 WB" or "MasterKure CC 160 WB," BASF Construction Chemicals.

2. Additional requirements:
   a. With product submittal provide plan and procedures for removal of residual curing compound prior to application of sealers, coatings, stains, pavement markings and other finishes.
   b. Provide a summary of testing to show adequate surface preparation for successful application of sealers, coatings, stains, pavement markings, and other finishes.

F. Curing Methods: Cure formed and non-formed concrete moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.10 FIELD QUALITY CONTROL

A. Testing Agency**:** Owner shall engage a qualified independent testing and inspecting agency acceptable to the Engineer to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article. Perform tests according to ACI 301.

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

2. Determine strength at 7 and 28 days. Each test shall consist of two 6-inch diameter cylinders or three 4-inch diameter cylinders. Testing shall be in accordance with ASTM C39.

3.11 EVALUATION AND ACCEPTANCE OF WORK

A. Acceptance of Repairs (ACI 301):

1. Acceptance of completed concrete Work will be according to provisions of ACI 301.

2. Repair areas shall be sounded by Engineer and Contractor with hammer or rod after curing for 72 hours. Contractor shall repair all hollowness detected by removing and replacing patch or affected area at no extra cost to Owner.

3. If shrinkage cracks appear in repair area when initial curing period is completed, repair shall be considered defective, and it shall be removed and replaced by Contractor at no extra cost.

END OF SECTION 033021

APPENDIX:

I. GENERAL INFORMATION:	
Project:	City:
General Contractor:	
Concrete Supplier:	
Mixture Identification No.:	Concrete Grade:
Use (Describe)[1]:	

[1] example: Footings, interior flatwork, floor slabs, wear slabs, columns, etc.

II. MIXTURE PROPORTIONING DATA:		
Proportioning Based on (Check only one): Standard Deviation Analysis: _____(see section VIII) or Trial Mix Test Data: _____ (see Section IX)		
Mixture Characteristics: (see Mixtures in Drawings General Notes)	Density: pcf;	Air: % specified
	Slump ____ in. before superplasticizer	Slump ____ in. after superplasticizer Or for SCC: Spread ____ in.
	Strength: _____ psi (28 day);	

WALKER SUBMITTAL STAMP

CONTRACTOR

SUBMITTAL STAMP

III. MATERIALS:		
Aggregates: (size; type; source; gradation report; specification)		
Coarse:		
Fine:		
Other Materials:	Type	Product-Manufacturer (Source)
Cement:		
Fly ash, or slag,		
HRM		
Air Entraining Agent:		
Water Reducer		
High Range Water Reducer (HRWR / superplasticizer)		
Non-Corrosive Accelerator		
Retarder		
Fibers		
Other(s):		

IV. MIX PROPORTIONS (2)		
	WEIGHT (lbs.) (per yd^3)	ABSOLUTE VOL. (cu. ft.) (per yd^3)
Cement:		
Fine Aggregate: (3)		
Coarse Aggregate: (3)		
Fly ash or slag		
HRM		
Water: (.4) (gals. & lbs.)		
Entrained Air: (oz.)		
Fibers:		
(Other) _____:		

TOTALS:		

NOTES:
(2) Mix proportions indicated shall be based on data used in section VII or IX.
(3) Based on saturated surface dry weights of aggregates.
(4) Includes ALL WATER, including added water and free water contained on aggregates.

V. RATIOS			VI. SPECIFIC GRAVITIES
Water[1]	=	lb. =	Fine Aggregate:
Cementitious Material[2]		lb.	Coarse Aggregate:
Fine Agg.	=	lb. =	
Total Agg.		lb.	

NOTES:
[1]Includes ALL water, including added water and free water contained on aggregates.
[2]Cementitious materials include cement, fly ash, slag, silica fume, HRM, Processed Ultra-Fine Fly Ash or other pozzolan.

VII. ADMIXTURES				
Air Entraining Agent (A.E.A.):	___ oz.	per yd^3	___ oz.	per 100# cement
Superplasticizer	___ oz.	per yd^3	___ oz.	per 100# cement
Water Reducer	___ oz.	per yd^3	___ oz.	per 100# cement
Non-corrosive Accelerator	___ oz.	per yd^3	___ oz.	per 100# cement
Retarder	___ oz.	per yd^3	___ oz.	per 100# cement
Other	___ oz.	per yd^3	___ oz.	per 100# cement
Lithium Nitrate	___ gal.	per yd^3		

VIII. STANDARD DEVIATION ANALYSIS:	Yes	N/A
(Complete this section only if Mixture was developed using standard deviation analysis of previous project test results. If other method was used, check "N/A".)		
Number of Tests Evaluated: (One test is average of two cylinder breaks) Attach copy of test data considered:	Standard Deviation: (Single Group) Standard Deviation: (Two Groups)	
Required average compressive strength: f'cr = f'c + _____ psi		
NOTE: Mixture shall be proportioned in accordance with ACI 301 section 4.2.3 to achieve average compressive strength f'cr equal to or greater than the larger of one of the following equations: (4.-3) f'cr = f'c + 1.34ks [s= calculated standard deviation] or (4-4) f'cr = f'c + 2.33ks – 500 or (4-5) f'cr = 0.9f'c + 2.33ks (for f'c> 5,000 psi) (Refer to ACI 301 for required average when data are not available to establish standard deviation. For post-tensioning projects, see also special requirements for strength required to apply initial post-tensioning.)		
MIXTURE CHARACTERISTICS (As shown on drawings)		
Slump = _____ in.	Air Content = _____ %	
Unit Wet Wt. = _____ pcf	Unit Dry Wt. = _____ pcf	
MIXTURE CHARACTERISTICS (Based on proportioning data)		
Initial Slump = _____ in.	Final Slump _____ in.	
Unit Wet Wt.= _____ pcf.	Unit Dry Wt. = _____ pcf.	
Air Content = _____ %		

IX. TRIAL MIXTURE TEST DATA:	Yes	N/A
(Complete this section only if Mixture Proportion is based on data from trial test mixture(s) batched by testing agency or Contractor. If other method was used, check "N/A".)		

Age (days)	Mix #1 (comp. str.)	Mix #2 (comp. str.)	Mix #3 (comp. str.)
7			
7			
28			
28			
28			
28 day average compressive strength, psi			

NOTE:
Mixture shall be proportioned in accordance with ACI 301 section 4.2.3 to achieve average compressive strength f'cr equal to or greater than the larger of one of the following equations:

(Less than 3000) f'cr = f'c + 1000
or
(3000 to 5000) f'cr = f'c + 1200
or
(Over 5000) f'cr = 1.1f'c + 700

For post-tensioning projects, see also special requirements for strength required to apply initial post-tensioning.

MIXTURE CHARACTERISTICS (as shown on drawings)	
Slump = _____ in.	Air Content = _____ %
Unit Wet Wt. = _____ pcf	Unit Dry Wt. = _____ pcf

MIXTURE CHARACTERISTICS (Based on proportioning data)	
Initial Slump = _____ in.	Final Slump _____ in.
Unit Wet Wt.= _____ pcf.	Unit Dry Wt. = _____ pcf.
Air Content = _____ %	

X. OTHER REQUIRED TESTS		
Water Soluble Chloride Ion Content of mix:	_____ %(by weight of cement)	ASTM C 1218
Hardened Air Content (per ASTM C457):		
Air content: _____%	Air void spacing Factor ____in.	Specific surface: ____in^2/in^3
Chloride Ion Content of Concrete Mixture: ASTM C 1218		
Shrinkage (Length Change, Average) per ASTM C157:		
_____% @ 4 days	_____% @ 7 days	_____% @ 14 days
_____% @21 days	_____% @28 days	

XI. Remarks:

Ready Mix Concrete Supplier Information
Name:
Address:
Phone Number:
Date:
Main Plant Location:
Miles from Project Site:
Secondary or Backup Plant Location:
Miles from Project Site:

My signature below certifies that I have read, understood, and will comply with the requirements of this Section.
Signature_____

Typed or Printed Name

REQUIRED ATTACHMENTS	
	Coarse aggregate grading report
	Fine aggregate grading report
	Concrete compressive strength data used for calculation of required average strength and for calculation of standard deviation
	Chloride ion data and related calculations
	Admixture compatibility certification letter
	Shrinkage information per ASTM C157
	ASTM C 457
	Alkali Content Data and Calculations OR ASTM C1293, ASTM C1260, ASTM C 1567 or CE CRD-C662 Test report for each aggregate

SECTION 033760 – PREPACKAGED REPAIR MORTAR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the provision of all labor, materials, supervision and incidentals necessary to prepare deteriorated or damaged concrete surfaces and install concrete repair mortar to formed horizontal, vertical and overhead surfaces to restore original surface condition and integrity. Repairs to be form and pour/pump. All cementitious materials shall have an integral corrosion inhibitor.

B. Related Sections: Following Sections contain requirements that relate to this Section:

1. Division 01 Section "Submittal Procedures."
2. Division 02 Section "Work Items."
3. Division 02 Section "General Concrete Surface Preparation."
4. Division 02 Section "Surface Preparation for Patching."
5. Division 07 Section "Joint Sealants."

1.3 QUALITY ASSURANCE

A. Work shall conform to requirements of ACI 301 as applicable except where more stringent requirements are shown on Drawings or specified in this Section.

1.4 REFERENCES

A. "Standard Specification for Structural Concrete" (ACI 301) by American Concrete Institute, herein referred to as ACI 301, is included in total as specification for this structure except as otherwise specified herein.

B. Comply with provisions of following codes, specifications and standards except where more stringent requirements are shown on Drawings or specified herein:
1. "Building Code Requirements for Structural Concrete" (ACI 318), American Concrete Institute, herein referred to as ACI 318.
2. "Hot Weather Concreting" reported by ACI Committee 305.
3. "Cold Weather Concreting" reported by ACI Committee 306.

4. “Standard Specification for Curing Concrete” (ACI 308.1)

C. Contractor shall have following ACI publications at Project construction site at all times:
   1. "Standard Specifications for Structural Concrete (ACI 301) with Selected ACI and ASTM References," ACI Field Reference Manual, SP15.
   2. "Hot Weather Concreting" reported by ACI Committee 305.
   3. "Cold Weather Concreting" reported by ACI Committee 306.

D. American Society for Testing and Materials (ASTM):
   1. ASTM C109, "Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)."
   2. ASTM C31, “Test Method for Compressive Strength of Cylindrical Concrete Specimens.”
   3. ASTM C1583, “Standard Test Method for the Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method)”

1.5 SUBMITTALS

A. Make submittals in accordance with requirements of Division 01 and as specified in this Section.

B. Contractor: At preconstruction meeting, submit procedures for demolition, surface preparation, material batching, placement, finishing, and curing of application. Provide procedure to protect fresh patches from severe weather conditions.

C. Testing Agency: Promptly report all mortar test results to Engineer and Contractor. Include following information:

   1. See Article "Quality Assurance," paragraph "Testing Agency shall submit...."
   2. Strength determined in accordance with ASTM C109.

D. See requirements of Division 01 Section, “Submittal Procedures,” Part 1 heading, “Submittal Procedures,” for limits to re-submittals.

E. See requirements of Division 01 Section, “Submittal Procedures,” Part 2 heading, “Requests for Information,” for RFI constraints.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of following, only where specifically named in product category:
   1. BASF Building Systems (BASF), Shakopee, MN

2. Euclid Chemical Corporation (Euclid), Cleveland, OH
3. King Construction Products (King), Burlington, ON
4. Mapei Corporation (MAPEI), Deerfield Beach, FL
5. Sika Corporation (Sika), Lyndhurst, NJ.
6. J.E. Tomes (Tomes), Blue Island, IL

2.2 MATERIALS

A. Horizontal Repair and Form and Pour Mortar: Shall be prepackaged cementitious repair mortar capable of horizontal and form and pour partial depth applications**,** achieving a minimum 3,000 psi compressive strength at 7 days and 5,000 psi compressive strength at 28 days per ASTM C39 as certified by manufacturer with maximum lineal shrinkage of 0.10% at 28 days. Extend per manufacturer's instructions as required for deeper placements.
   1. Acceptable cementitious repair materials for this Work are as follows:
      a. "MasterEmaco S440," by BASF Corporation.
      b. "Eucocrete," by Euclid.
      c. "FA-S10 Concrete," by King.
      d. "Sikacrete 211," by Sika.
      e. Other types may be used only with Engineer's approval in writing prior to bidding.
   2. Acceptable polymer modified materials for this Work are as follows:

      a. "MasterEmaco T310 CI" by BASF Corporation.
      b. "Sika Repair 222 with Latex R," "SikaTop 111 Plus", or "Sikacrete 211 SCC+," by Sika
      c. "Duraltop" by Euclid
      d. Form-Flo P-38 by Tomes
      e. Other types may be used only with Engineer/Architect's approval in writing prior to bidding.

B. Rapid Strength Repair Mortar: Shall be prepackaged, cementitious repair mortar. Repair mortar shall be capable of application achieving a minimum 3,500 psi compressive strength at 1 day and 5,000 psi compressive strength at 28 days per ASTM C39 as certified by manufacturer. Extend per manufacturer's instructions as required for deeper placements.
   1. Acceptable materials for this Work are as follows:
      a. "MasterEmaco T430," by BASF Corporation.
      b. "Speedcrete 2028," by Euclid.
      c. "HP-S10 Concrete," by King.
      d. "Sikaquick 1000," by Sika.
      e. "Aprisa P-80," by Tomes.
      f. Other types may be used only with Engineer's approval in writing prior to bidding.

C. Trowel Applied Repair Mortar: Shall be prepackaged, cementitious repair mortar capable of vertical/overhead application by trowel achieving a minimum 3,000 psi compressive strength at 7 days and 4,500 psi compressive strength at 28 days per ASTM C 109 as certified by manufacturer.
   1. Acceptable materials for this Work are as follows:
      a. “MasterEmaco N425,” by BASF Corporation.
      b. “Verticoat Supreme,” by Euclid.
      c. “Super-Top,” by King.
      d. “Sikaquick VOH,” by Sika.
      e. “CT-40 Do All Mortar,” by Tomes.
      f. Other types may be used only with Engineer's approval in writing prior to bidding.

D. Section ‘033021’ for concrete reinforcing and formwork requirements.

2.3 MATERIAL ACCESSORIES

A. Extended Open Time Epoxy Bonding Agent: Not applicable to project

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Cavity surfaces shall be clean and dry prior to commencement of patch installation. Preparation of cavity to receive new mortar shall be in accordance with Section "Surface Preparation for Patching” and manufacturer's instructions.

3.2 INSTALLATION

A. Repair Mortar Bonding Grout:

   1. If contractor chooses to use a mortar bonding grout, mix and apply repair/patching mortar bonding grout in strict accordance with manufacturer's recommendations.
   2. If repair/patching mortar bonding grout dries, cavity shall not be patched until it has been cleaned again and prepared as specified in Section "Surface Preparation for Patching." Repair mortar/patching grout shall not be applied to more cavities than can be patched within 0.25 hr by available manpower.

B. Mortar Placement: Mortar materials shall be placed immediately following repair/patching mortar bonding grout application in strict accordance with manufacturer's instructions. Properly proportioned and mixed mortar material shall be placed using tools to consolidate mortar so that no voids exist within new material and

continuous contact with base concrete is achieved. Fresh repair/patching mortar bonding grout is required between successive lifts of mortar material.

C. Form and Pour/Pump Repair Mortar Placement: All vertical and overhead repair patches shall be formed and poured/pumped unless directed otherwise by engineer/architect. Mortar materials shall be placed [a minimum of 2 hours and no more than the Manufacturer’s recommended open time after application of the extended open time epoxy bonding agent immediately following the bonding grout application]. Mix and apply in strict accordance with manufacturer’s written instructions, to achieve a maximum 9” slump.

D. Vertical and Overhead Repairs: Mortar materials shall be placed in strict accordance with manufacturer's instructions. Properly proportioned and mixed mortar material shall be placed using tools to consolidate mortar so that no voids exist within new material and continuous contact with base concrete is achieved. Supplemental wire mesh shall be required for delamination and spall repairs greater than two inches in depth. **Fresh bonding grout is required between successive lifts of patching material.**

E. Finishing:
1. Apply a nonslip broom finish to top of floor patches and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Provide a surface finish similar to adjacent surfaces for vertical and overhead partial depth repairs.
3. Finish formed surfaces similar to adjacent surfaces.

3.3 CONCRETE PROTECTION AND CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305R for hot-weather protection during placement. Keep concrete continually moist prior to final curing by evaporation retarder, misting, sprinkling, or using absorptive mat or fabric covering kept continually moist.

B. Immediate upon conclusion of finishing operation cure concrete in accordance with ACI 308.1 for duration of at least **[three] [seven]** days by curing methods listed below. Provide additional curing immediately following initial curing and before concrete has dried.
1. During initial and final curing periods maintain concrete above 50°.
2. Prevent rapid drying at end of curing period.

C. Concrete surfaces to receive slab coatings or penetrating sealers shall be cured with moisture curing or moisture-retaining-cover curing.

D. Curing Methods: Cure formed and non-formed concrete moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing compound: Apply curing compound in accordance with manufacturer's instructions.

3.4 FIELD QUALITY CONTROL

A. Testing Agency**:** Owner shall engage a qualified independent testing and inspecting agency acceptable to the Engineer to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article. Perform tests according to ACI 301.

B. Testing Frequency: Perform one set of strength testing and one bond test for each product used for each day's work. Prepare samples in accordance with ASTM C31.

C. Compressive Strength Concrete Testing: Determine strength at 3, 7, and 28 days. Each test shall consist of two 6-inch diameter cylinders or three 4-inch diameter cylinders. Testing shall be in accordance with ASTM C39.

D. Compressive Strength Mortar Testing: Determine strength at 3, 7, and 28 days. Each test shall consist of three 2-inch cubes. Testing shall be in accordance with ASTM C109 using as placed mortar.

E. Bond Testing: Bond testing shall be performed at 7 days in accordance with ASTM C1583.

3.5 EVALUATION AND ACCEPTANCE OF WORK

A. Acceptance of Repairs (ACI 301):
   1. Acceptance of completed concrete Work will be according to provisions of ACI 301.
   2. Repair areas shall be sounded by Engineer and Contractor with hammer or rod after curing for 72 hours. Contractor shall repair all hollowness detected by removing and replacing patch or affected area at no extra cost to Owner.

3. If shrinkage cracks appear in repair area when initial curing period is completed, repair shall be considered defective, and it shall be removed and replaced by Contractor at no extra cost.
4. Patches shall be considered defective if average strength does not meet minimum strength at 28 days or if average bond strength does not meet minimum requirements of 150 psi.

END OF SECTION 033761

SECTION 03 38 18 - UNBONDED POST-TENSIONING REPAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. In accordance with Contract Documents, provide all materials, labor, equipment, and supervision to fabricate and install all post-tensioning repair Work. Non-prestressed reinforcement shall conform to Division 03 Section, "Cast-in-Place Concrete."

B. Meet the requirements of ACI 301, ACI 318, ACI 423.7, CRSI MSP-2, and Contract Documents. In case of a conflict, meet the more stringent requirement.

1.3 REFERENCES

A. Field Reference: Keep a copy of the following reference in the Contractor’s field office.

1. PTI’s “Field Procedures Manual for Unbonded Single Strand Tendons”

B. American Concrete Institute (ACI):

1. ACI 301, “Specification for Structural Concrete.”
2. ACI 318, "Building Code Requirements for Structural Concrete."
3. ACI 347, "Recommended Practice for Concrete Formwork."
4. ACI 362.1R-97, “Guide for the Design of Durable Parking Structures.”
5. ACI 423.3R, "Recommendations for Concrete Members Prestressed with Unbonded Tendons."
6. ACI 423.7, “Specification for Unbonded Single-Strand Tendon Materials and Commentary.”

C. American Society for Testing and Materials (ASTM):

1. ASTM A416, "Specification for Uncoated Seven-Wire Strand for Prestressed Concrete."
2. ASTM A421, “Standard Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete.”
3. ASTM E328, "Recommended Practice for Stress-Relaxation Tests for Materials and Structures."

D. Concrete Reinforcing Steel Institute (CRSI):

1. CRSI MSP-2, "Manual of Standard Practice."

E. Post-Tensioning Institute (PTI):

1. PTI, "Guide Specifications for Post-Tensioning Materials."
2. PTI, "Performance Specification for Corrosion Preventive Coating."
3. PTI, "Specification for Unbonded Single Strand Tendons."
4. PTI, "Field Procedures Manual for Unbonded Single Strand Tendons."
5. PTI, “Guide for evaluation and Repair of Unbonded Post-Tensioned Concrete Structures.”

F. International Code Conference (ICC):

1. ICC, "International Existing Building Code."
2. ICC, "International Existing Building Code Standards."

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the tendon and anchor locations with Work of other Sections, including “Cast-in-Place Concrete.” Immediately inform Engineer/Architect of any potential interference.

B. Sequencing:

1. Deviations in the construction and stressing sequence shown on the Drawings are not permitted without written acceptance from Engineer/Architect.

C. Make submittals in accordance with requirements of Division 01 Section, “Submittal Procedures:”

1. See requirements of Division 01 Section, “Submittal Procedures,” Part 1 heading, “Submittal Procedures,” for limits to resubmittals.
2. See requirements of Division 01 Section, “Submittal Procedures,” Part 2 heading, “Requests for Information,” for RFI constraints.

D. Submittals and Resubmittals:

1. Engineer will review each submittal the initial time and, should resubmittal be required, one additional time to verify that reasons for resubmittal have been addressed by Contractor and corrections made.
2. Circle resubmittal changes/revisions/corrections. Engineer will review only circled items and will not be responsible for non-circled changes, revisions, corrections or additions.
3. Should additional resubmittals be required, reimburse Owner for all costs incurred, including the cost of Engineer’s services made necessary to review such additional resubmittals. Owner will in turn reimburse Engineer.

E. Requests For Information

1. Engineer reserves the right to reject, unprocessed, any Request for Information (RFI) that the Engineer, at its sole discretion, deems frivolous.
2. Engineer reserves the right to reject, unprocessed, any RFI that the Engineer, at its sole discretion, deems already answered in the Contract Documents.
3. Do not use RFI process to request substitutions. Procedures for substitutions are clearly specified elsewhere in the contract documents.

1.5 ACTION SUBMITTALS

A. Product Data: For each product as indicated.

1. Corrosion Inhibiting Coating: Type and chemical analysis.
2. Sheathing: Type, material, density and thickness.
3. Anchorage Device: Type, material and size.
4. Coupler Device: Type, material and size.
5. Intermediate Stressing Coupler Device: Type, material, and size.
6. Pocket Former: Type, material and size.
7. Sheathing Repair Tape: Type, material and width.
8. Encapsulation System: Type and materials.

B. Shop Drawings: Include the following prepared by or under the supervision of a qualified professional engineer, if requested by Engineer:

1. Number, arrangement and designation of tendons.
2. Tendon profile and method of tendon support. Show tendon profiles at sufficient scale to clearly indicate tendon high and low points.
3. Tendon anchorage details including bundled tendon flaring.

C. Delegated-Design: For post-tensioning system.

1. Signed and sealed calculations prepared by a qualified structural engineer indicating method of elongation. Include values used for friction coefficients, anchorage seating loss, elastic shortening, creep, relaxation, wobble and shrinkage.

D. Stressing Records: Same day as stressing operation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Supplier and Installer **at least 14 days prior to bid date** using the forms at the end of this section.

B. Mill Test Reports: Certified mill test reports for each coil or pack of strand used on Project, indicating that strand is low relaxation and including the following information:

1. Heat number and identification.
2. Minimum breaking strength.
3. Yield strength at 1 percent extension under load.
4. Elongation at failure.
5. Modulus of elasticity.
6. Diameter and net area of strand.

C. Test and Evaluation Reports: Indicating compliance with the following requirements:

1. Tests required by ACI 301, Section “Post-Tensioned Concrete.”
2. Relaxation loss tests required by ACI 423.7 for low relaxation prestressing steel.

D. Field Quality-Control Reports: Within 72 hours of inspection.

E. Stressing Jack Calibration: Calibration certificates for jacks and gages to be used on Project. Calibrate each jack-and-gage set as a pair.

F. Warranty: Proposed warranty prior to the start of construction.

1.7 QUALITY ASSURANCE

A. Supplier Qualifications:

1. Use a fabricating plant certified by PTI.
2. Successfully provided all materials for at least 5 post-tensioning repair projects in parking structures in the United States with a structural system similar to Project within the previous 5 years. Provide all information requested on the form at the end of this section.

B. Installer Qualifications:

1. Certified by PTI.
2. Successfully performed at least 5 post-tensioning repair projects in parking structures in the United States with a structural system similar to Project within the previous 5 years. Provide all information requested on the form at the end of this section.
3. Use a full-time Project superintendent that has supervised at least 5 projects of similar magnitude.
4. Use PTI Certified Field Installers to install and stress post-tensioning system.

C. Prior to bid, Engineer/Architect will accept, tentatively accept, or reject Supplier or Installer based on compliance with criteria referenced in this section. Engineer/Architect's decision is final. Engineer/Architect may issue an addendum indicating accepted and tentatively accepted Suppliers prior to bid date. Engage only accepted or tentatively accepted Suppliers. Following a qualifications check, tentatively accepted Suppliers will be notified of acceptance or rejection at or before shop drawing stage. Contractor is responsible for delays due to such rejection.

D. Suppliers, who do not meet the qualification requirements above, shall be rejected:

E. Comply with requirements in ACI 301, Section “Post-Tensioned Concrete.”

F. Perform all post-tensioning Work under the supervision of a Project Superintendent who is present during all operations including installation, concrete placement, stressing and finishing.

1.8 DELIVERY, STORAGE AND HANDLING

A. Assign all tendons in same member the same heat number and identify accordingly.

B. Package each tendon bundle at source to prevent physical damage to tendon during transportation and storage, and to protect strand from moisture. Use heavy padding; cardboard is not permitted. Do not use wire binding or other materials that could cut the sheathing or tendon.

C. Deliver, store and handle post-tensioning materials according to ACI 423.7.

D. Immediately remove damaged components from Project site and replace at no cost to Owner.

E. Do not remove sheathing on stressing end until the day of stressing.

F. Materials Stored on Slabs:

1. Prior to final stressing of beams and slabs, do not store any materials on slab.
2. After final stressing of beams and slabs but before concrete has reached the specified 28 day strength, do not store materials on slab such that the weight exceeds 50 percent of the design live load.
3. After final stressing and after concrete has reached the specified 28 day strength, do not store materials on slab such that the weight exceeds the design live load.

1.9 WARRANTY

A. The Contractor shall guarantee against any and all defects in workmanship and materials for newly installed tendon strands, splices, anchorages, and anchoring hardware for a period of **5** years.

1. Removal and patching of concrete necessary to remedy distress of post-tensioning repairs covered by warranty.
2. Repair or replacement, to satisfaction of Owner, of other work or items which may have been displaced or damaged as consequence of defective work.
3. Warranty Period: **5 years** after Substantial Completion date.

PART 2 - PRODUCTS

2.1 POST-TENSIONING SYSTEM CRITERIA

A. Post-tensioning repair anchorage and hardware described in this Section intended to satisfactorily perform in ACI 362.1R-97 without long-term corrosion or other distress.

1. PT repairs are to be based on the following: Do not exceed the maximum tensile stress in the tendon during the stressing operation. The maximum tensile stress is 74 percent of the specified tensile strength of the tendon.

2. Do not exceed 64 percent of the specified tensile strength after the anchors are seated.

2.2 PRESTRESSING TENDONS

A. Prestressing Strand: ASTM A416, Grade 270, uncoated, seven-wire, low-relaxation strand with minimum ultimate strength of 270 ksi.

1. Manufactured by a single source.
2. Strands manufactured outside United States subject to Engineer/Architect's approval based on evidence of satisfactory performance in the United States during the previous 5 years.
3. Use of high stress bar system instead of strand system is not permitted unless accepted in writing by the Engineer.
4. Conform to ACI 423.7 for relaxation loss requirements.

B. Tendon Sheathing: Seamless and extruded high density polypropylene or seamless and extruded high density polyethylene with a specific gravity greater than 0.95 conforming to ACI 423.7.

1. Sufficient strength to withstand damage during fabrication, transport, installation, concrete placement and stressing.
2. Minimum thickness of 50 mils (–0 mils +15 mils)
3. Minimum inside diameter 0.03 inches greater than maximum strand diameter.
4. Chemically stable without becoming brittle or softening over anticipated temperature range and service life of structure.
5. Non-reactive with concrete, steel and corrosion inhibiting coating.
6. Contrasting color of corrosion inhibiting coating to enhance visibility of damage. Black/dark colored sheathing is not acceptable.
7. Annular space between sheathing and strand completely filled with corrosion inhibiting coating.
8. Watertight including all connections and components over entire length.

C. Tendon Anchor: Non-porous casting free of sand, blow holes, voids and other defects meeting the testing and material requirements of ACI 423.7.

1. Plastic coated bearing plates sized in accordance with ACI 423.7, unless certified test reports substantiate comparable or superior performance, for transfer at minimum stressing concrete strength.
2. Capable of complying with PTI Guide Specification requirements for aggressive environments.
3. Capable of developing at least 95% of the actual ultimate strength of tendon.
4. Minimum wedge cavity opening of at least 0.19 inches larger than tendon diameter. Reaming of anchor wedge cavity is not permitted.
5. Wedges capable of precluding failure of tendon due to notching or pinching effects during static and fatigue load tests stipulated in ACI 423.7.
6. Provisions for a plastic cap which fits tightly and seals barrel end on stressing side of anchor.
7. Provisions for a plastic sleeve which prevents moisture infiltration into anchor casting or tendon sheathing on bearing side of anchor.

D. Coupler Assembly: Assembly of strands and wedges meeting the testing and material requirements of ACI 301.

1. Capable of complying with PTI Guide Specification requirements for aggressive environments.
2. Capable of developing at least 95 percent of the ultimate strength of tendon.
3. Wedges capable of precluding failure of tendon due to notching or pinching effects during static and fatigue load tests stipulated in ACI 423.7.

E. Encapsulation System for New Prestressing Steel: Watertight encapsulation along the entire length of new tendon, including new anchorages and new couplers, when subjected to hydrostatic testing required in ACI 423.7 for aggressive environments.

1. Sleeve: Translucent plastic with a positive mechanical connection to anchorages capable of resisting 100 lbs. pulling force. Minimum 10 inches long and 4 inches overlap with sheathing, completely filled with corrosion inhibiting coating.
2. Anchor Cap: Translucent plastic with a positive mechanical connection to anchorages capable of resisting 100 lbs. pulling force. At intermediate anchorages, open to allow passage of strand.
3. Subject to the requirements provide one of the following systems:

   a. “Zero Void,” General Technologies, Inc.
   b. “Hayes Posi-Lock Plus,” Hayes Industries, Ltd.
   c. Accepted equivalent.

2.3 ACCESSORIES

A. Pocket Formers: Capable of completely sealing wedge cavity from intrusion of concrete or cement slurry; sized to provide at least a 2 inch recess and allow access for cutting strand tail.

1. If Zero Void encapsulation system in used, the “Zero Void Nail-Less Pocket Former” is required.

B. Anchorage Fasteners: Stainless-steel ring nails. Subject to the requirements use one of the following:

1. Clendenin Brothers, Baltimore, MD.
2. Swan Secure Products, Baltimore, MD.
3. R.J. Leahy Co., San Francisco, CA.
4. Accepted equivalent.

C. Sheathing for Repair at Existing Prestressing Steel :

1. Watertight, chemically-stable, and non-reactive with prestressing steel, corrosion inhibiting PT coating, and reinforcing steel.
2. Color shall contrast with PT coating so that sheathing tears will be readily visible.
3. Polypropylene or polyethylene tubing:

    a. Minimum thickness of 0.050 inches.
    b. Inside diameter at least 0.030 inches greater than prestressing steel diameter.
    c. Slit tubing longitudinally for sheathing repairs at continuous prestressing steel.

D. Sheathing at New Intermediate Anchorage and Couplers:

1. Heat-shrink tubing to encapsulate couplers and splicing hardware at intermediate stressing locations.
2. Heat shrink tubing shall be: watertight, chemically-stable, and non-reactive with prestressing steel, corrosion-inhibiting PT coating, and reinforcing steel.
3. Use one of following or approved equal:

E. Protection at New End and Intermediate Anchorages:

1. Epoxy coating field-applied to all surfaces of wires, plates, anchor washers, etc. at locations of end and intermediate anchorages and center stressing splices.

F. Sheathing Repair Tape: Elastic, self-adhesive, moisture-proof tape with a minimum width of 2 inches in contrasting color to tendon sheathing, and that is non-reactive with sheathing, corrosion inhibiting coating, or tendon. Subject to the requirements use one of the following:

1. “3M Tape No. 226,” 3M, St. Paul, MN.
2. “Polyken 826,” Berry Plastics Corp, Evansville, IN
3. “Tyco Adhesives No. 398,” Tyco Adhesives, Franklin, MA

G. Sheathing Repair Material: For nicks and cuts less than 0.25 inches use one of the following:

1. “Scotch-Weld DP-8005,” by 3M.

H. Corrosion inhibiting coating: Capable of meeting the requirements of ACI 423.7. Subject to the requirements use one of the following

1. "Greasrex K-218," ExxonMobil Oil Corp., Irving, TX.
2. “Red-i PT Coating Grease,” Lubricating Specialties Co., Pico Rivera, CA
3. “Renolit PTG,” Fuch’s Lubricant Co., Harvey, IL
4. “Royal PT-1 and PT-2 Corrosion Inhibiting Grease,” Troco Oil Co., Tulsa, OK
5. “Strand Shield,” Martin Specialty Lubricants, North Kansas City, MO

I. Tendon supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening tendons in place. Use tendon supports capable of meeting the requirements in CRSI’s “Manual of Standard Practice” and as follows:

1. Clearly marked to differentiate by height.
2. Capable of resisting overturning during construction operations.
3. Minimal contact with forms where concrete is exposed to view.
4. Do not cause voids or damage to surrounding concrete.
5. All-plastic supports conforming to CRSI Class 1 protection requirements and with a compressive strength higher than concrete.
6. Acceptable manufacturers:

    a. Aztec Concrete Accessories, Inc.
    b. General Technologies, Inc.
    c. Accepted equivalent.

2.4 GROUT MATERIALS

A. Premixed, nonmetallic, noncorrosive, non-staining grout product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with ASTM C 1107, Grade B, with fluid consistency and a 30-minute working time.

B. Non-reactive with prestressing strand, anchorage materials, or concrete and without chlorides or other chemicals known to be deleterious to prestressing strand.

C. Subject to compliance with requirements, provide one of the following:

1. Sure Grip Grout, Dayton Superior.
2. Euco N.S., Euclid Chemical Co.
3. Masterflow 928/SikaGrout®-928, Master Build Solutions/Sika.

2.5 EQUIPMENT

A. Stressing Equipment: Hydraulic jacks with calibrated pressure gauges, capable of gripping prestressing steel and stressing prestressing steel to specified level. Maintain equipment in safe, working condition.

1. Provide certified pressure gauges with means to cross check accuracy constantly. Second gauges are recommended for larger projects.
2. Provide at Site current, not to exceed 6 months, calibration chart for each jack relating gauge pressure to jacking force.
3. Exercise care in handling of stressing equipment.

B. Necessary equipment to detension, cut, and splice prestressing strands.

C. Calibration of hydraulic equipment and gauges.

D. The Contractor shall provide the equipment, and use appropriate methods to expose the embedded post-tensioning sheathing. The demolition to expose embedded post-tensioning sheathing shall not compromise the structural integrity of the slab and shall minimize damage to the tendon sheathing. The following equipment, or an approved equal, may be used on this project.

1. Chipping hammers of nominal 15-lb. class or less for removal of concrete to expose tendon sheathing.
2. Compressed air equipment capable of removing dust and dirt from concrete repair areas.

E. All equipment is to be operated and maintained according to the manufacturer's recommendations or the approved testing procedures.

F. Operation of stressing equipment shall be performed by tradesman experienced in this work with a PTI level 1 Unbonded – Field Installation certification.

PART 3 - EXECUTION

3.1 PRECAUTIONS

A. Prestressing steel under stress has significant stored energy. Exercise 1 care in detensioning and stressing.

1. Erect and maintain work platforms in safe condition, in conformance with Government regulations.
2. Protect areas around, adjacent to, and below work area, including vehicular traffic, from damage.
3. Protect construction personnel and passersby from injury.

    a. Do not allow anyone to stand in front of, behind, over or beneath hydraulic jack, or anywhere along the tendon during stressing or prestressing steel to be detensioned.
    b. After stressing, when releasing jack pressure to transfer force to wedges, laborers’ fingers shall be kept clear of assembly. .

B. Close off area around, adjacent to, and below work area or use canopies and barriers as necessary to protect public.

C. Detensioning shall be performed by cutting, preferably while tendon is still embedded in concrete, by use of specialty detensioning equipment, or by other approved means.

3.2 PREPARATION

A. Prior to concrete removal, locate prestressing steel using non-destructive testing (NDT) methods at locations along the length of each tendon in each bay, or by other approved means.

B. Identify and clearly mark fractured, corroded, or otherwise damaged sections of prestressing steel. Create exploratory openings in concrete as necessary to locate fractured or corroded sections. Engineer will inspect tendon and determine appropriate repair method before replacement. Tendons with fractured or severely corroded wires shall be replaced for its entire length or repaired by splicing in sections of new tendons similar in kind and size and restressing of tendons.

C. Where significant concrete removal is required or a significant number of tendons require spliced repair and restressing, install shoring and/or sequence repairs as directed by Engineer. This shoring must be designed by an Engineer competent in shoring design.

D. Remove unsound concrete as specified in Division 03, Section “Cast-in-Place Concrete,” and as approved by Engineer. Exercise care to avoid damaging prestressing steel, sheathings, anchorages, and remaining sound concrete. Do not remove concrete at post-tensioning anchorages unless directed to do so by Engineer.

E. Maintain tendon profile. Use grout or other means as necessary to securely maintain tendon position during Work.

F. Identify damaged sheathing and document locations.

3.3 SHEATHING REPAIR

A. At locations of damaged sheathing, remove concrete to expose sheathing at least 4 inches beyond damaged portion and to create space between the sheathing and the concrete. Exercise care to avoid further damage to sheathing. Concrete removal beneath a stressed tendon shall be minimized where the profile of the tendon may be affected.

B. At small localized areas of sheathing damage, as determined by Engineer(Note: Items 1 through 4 below are the repair procedure for isolated punctures, holes and slits where sheathing is mostly intact with minimal damage):

1. Remove rough portions of existing sheathing at damaged area.
2. Fill sheathing with corrosion-inhibiting PT coating.

3. Clean and prepare surface of existing sheathing per tape manufacturer’s recommendations. Outer surface of sheathing shall be dry and free of corrosion-inhibiting PT coating.
4. Tape damaged area of sheathing. Wrap tape spirally around sheathing to provide at least layers of tape at all locations. Extend tape at least 2 inches beyond damaged area.

C. Remove damaged portion of sheathing.

D. Lightly sandblast exposed prestressing steel to remove rust. Protect existing sheathing from damage (at least a minimum of 4 in. of existing sheathing should be protected at each end of the exposed portion of the sheathing within a repair opening).

E. Coat exposed prestressing steel or pressure-inject with corrosion-inhibiting PT coating. PT coating must extend to, but not cover, 4 in. of intact existing sheathing at ends of the exposed portion of sheathing.

F. Clean and prepare the existing sheathing per tape manufacturer’s recommendations. At a minimum, the surface of the sheathing shall be dry, clean, and free of corrosion-inhibiting PT coating.

G. Install new slit tube sheathing (For sheathing repairs where slit tube sheathing does not completely cover the stand, use waterproof tape in place of split sheathing).

1. Place slit tubing around prestressing strand. Position slit on side of prestressing steel, with shingle overlap (i.e., with upper portion overlapping lower portion).
2. Extend new sheathing at least 2 inches over existing sheathing.
3. Tape new sheathing. Wrap tape spirally around sheathing to provide at least 2 layers of tape. Extend tape at least 2 inches onto existing sheathing.

H. Install new wrapped sheathing (For sheathing repairs where slit tube sheathing of sufficient width to be placed around the entire circumference of the prestressing strand/wires is not available).

1. Wrap polyethylene sheeting around prestressing strand/wires, continuing around the prestressing steel at least three times to provide 3 layers of sheeting at all locations.
2. Position edge of sheeting on side of prestressing steel, with shingle overlap (i.e., with upper portion overlapping lower portion).
3. Extend new sheeting at least 2 inches over existing sheathing.
4. Wrap specialty sheathing tape spirally around sheathing to provide at least 2 layers of tape at all locations. Extend tape at least 2 inches onto existing sheathing.

I. Sheathing at couplers, central stressing splices (for 7-wire strand tendons), shall consist of heat shrink tubing. Place heat-shrink tubing over coupler, central stressing splice, or tendon during assembly of spliced tendon repair. Do not heat shrink tubing into final position until stressing is completed. Shrink tubing using a heat gun as approved by the Engineer, open flames shall not be permitted. Provide 2 in. minimum overlap with sheathing for adjacent section of tendon.

J. Protection of Anchorages (and Center Stressing Splices)

1. All new end anchor castings shall be supplied fully encased in 1 protective plastic cover, with plastic trumpet and plastic-covered encapsulation cap, to provide for full encapsulation of the new anchor.

K. Sheathing repairs shall be watertight.

3.4 SPLICING PRESTRESSING STEEL

A. Scope:

1. Repair tendons with broken or severely corroded wires at the locations determined by the Engineer by splicing in sections of new strands/tendons similar in kind, tensile strength, and size.
2. Restress the spliced tendons to obtain their design long-term effective post-tensioning force, 0.64 Pu (or other force determined by the Engineer after seating losses. Typically, to obtain 64% of specified tensile strength in tendon after the anchors are seated, the jacking force should not exceed 74% of the specified tensile strength of the strand.)

B. Detension prestressing steel as necessary by cutting, preferably while still embedded in concrete, or by the use of specialty detensioning equipment or by other approved means. Where detensioning of only a portion of the tendon length is desired, install lock-off anchor at location determined by Engineer.

C. Remove concrete as required to expose sufficient length of prestressing steel that is not deteriorated, on both sides of deteriorated strand section, and to permit installation of splice hardware allowing adequate room for movement of the splice during elongation of the prestressing steel. Exercise care to avoid damaging remaining sound concrete and sheathing.

D. If prestressing steel drapes into or across the area of concrete removal, discuss method of removing prestressing steel with Engineer. Maintain the design tendon profile.

E. Remove deteriorated section of prestressing steel.

F. Discuss splicing procedure with Engineer to ensure that remaining concrete is not overstressed during stressing. (It is very important to ensure that the prestressing force gets into the concrete. As a result, it is generally desirable to limit the size of the tendon repair openings so that a significant portion of the member cross-section remains available to resist the prestressing force as it is restored to the structure. This is particularly critical at anchorage zones of repaired end anchors, but extent of concrete removal should be considered at all cross-sections along a member being repaired.)

G. Form as necessary and cast concrete repairs that are necessary for stressing prestressing steel. (This will include the anchorage zone in front of new tendon end anchors, and may include other locations along the tendon length as appropriate for

restoring the member cross-section prior to stressing. Note that prestressing steel will elongate, so repair openings must not be recast prior to stressing in a manner that would inhibit movement of the tendon and its couplers and central stressing splices. A common technique is to leave “boxouts” of sufficient size around couplers and central stressing splices to allow them to move during stressing.) Do not stress prestressing steel until repair concrete has achieved at least 3,000 psi. Concrete repair areas shall be prepared per Section 02 51 40, the exposed prestressing steel addressed per Paragraph I below, and the repair opening formed and cast per Division 03, Section “Cast-In-Place Concrete.”

H. Install splice materials.

1. Pull ends of existing prestressing steel (strand/wires/tendon) taut.
2. Install couplers, new end anchors, and central stressing 1 splices with new section of prestressing strand.
3. New sheathing may need to be placed on the tendon during splicing operations.

I. Prepare existing prestressing steel.

1. Coat exposed existing prestressing steel with corrosion-inhibiting PT coating.
2. Install slit-tube sheathing (or wrapped sheathing for button-head wire tendons) over existing prestressing steel, and wrap with specialty waterproof tape as described above in Section 3.3.

J. At locations of couplers (and center stressing splices for 7-wire strand tendons) (and sections of new tendon wires for button-head wire tendons), use heat shrink tubing to make sheathing continuous across repair opening. Install per Paragraph above.

K. Stress PT tendon per below.

L. When stressing operation has been completed and following tendon force verification, prepare repair openings, and form and cast repair openings with concrete.

1. Inspect anchors for correct installation.
2. Inspect sheathing for damage and for continuous seal between sheathing and anchor.

    a. Repair sheathing damage to watertight condition and correct anchor deficiencies.
    b. Do not leave tendons and repair area exposed to weather without protection prior to concrete placement. The Contractor shall propose to the Engineer the plan to guarantee a full protection of the PT system to weather aggression.

3. Apply PT coating to exposed prestressing tendons/strands/wires, including strand tails at anchorages, and restore sheathing per Paragraph 3.3.
4. Shrink heat-reactive tubing into position to encapsulate prestressing steel. Seal ends of new sheathing with specialty moisture-proof sheathing tape.

5. Sandblast clean exposed concrete and steel surfaces. Protect tendons from damage.
6. Coat other exposed steel, epoxy, galvanized coating, or approved method.
7. Install dowels into sides of full-depth repair openings as required, anchoring with epoxy.
8. Add supplemental reinforcing as directed by Engineer.
9. Install encapsulation caps over strand tails and secure. Fill stressing anchorage pockets with grout. When grout will be visible, trowel smooth and rub to match adjoining surface.

3.5 EXTRACTION AND THREADING OF NEW POST-TENSIONING STRAND/WIRES

A. Provide access to tendon to be removed at appropriate locations. (Excavate access openings at high and low points and/or and end anchors: Remove external cover; etc.)

B. Detension post-tensioning strand/wires as necessary by sawcutting, preferably while still embedded in concrete, or specialty detensioning equipment. Provide protection at the end anchorages to prevent anchorage, wedges, or tendon from rebounding during detensioning and causing damage to property or passerby.

C. Extract existing strand and thread new strand through existing sheathing. If existing strand is wet when exposed, dry sheathing. At the Engineer discretion, clean sheathing with clean rags until two clean passes are achieved. Rags may be saturated with an approved cleaning solvent prior to use. Fill sheathing with new corrosion inhibiting grease. Thread new strand through existing sheathing.

D. Install new end anchorages and repair concrete. Provide new wedges and hardware compatible with new end anchor.

E. Stress new strand per Paragraph 3.6.

F. Restore access openings at the completion of re-stressing.

3.6 STRESSING PRESTRESSING STEEL

A. Stressing operations shall be performed by personnel experienced in this Work with a minimum of PTI level 1, or under direct supervision of stressing equipment supplier's representative with a minimum of PTI level 1. Exercise care in handling stressing equipment to maintain accuracy of calibration.

B. Before stressing, verify that prestressing steel is free-moving along its length. Orient anchorage wedges in the cavity perpendicular to the jack position during stressing.

C. Stress tendon to provide a final tensile force after seating loss of 0.64 P_u or (Insert value by Engineer Typically, to obtain 64% of specified tensile strength in tendon after the anchors are seated, the jacking force should not exceed 74% of the specified tensile strength of the strand).

1. Calculate elongation for specified tensile stress for each tendon.
2. Sequence stressing as necessary.
3. Monitor hydraulic pressure and convert to jacking force with jack calibration curve.
4. Measure prestressing steel elongation and compare with calculated elongation. If difference is more than 7 percent notify the Engineer for direction. When specified tensile stress has been attained, anchor prestressing steel with wedges).
5. If required, perform lift-off test in presence of Engineer after stressing and seating of wedges (for 7-wire strand tendons). As an example, Liftoff testing may be required if the elongations do not meet the 7% as shown above.
6. Maintain stressing records during stressing operations.

D. If turnbuckle-type cable splice is used, stress tendon per the manufacturer’s recommendations.

1. Calculate elongation for specified tensile stress for each tendon.
2. Restress tendon using calibrated torque wrench. Stress to designated tensile force using calculated correlation between applied torque and tensile force.
3. Measure prestressing steel elongation at various levels of stressing force and compare with calculated elongation.
4. If measured and calculated elongations differ by more than 7 percent, cease stressing operations until cause of deviation is found and corrected.
5. Record applied torque, determine calculated tensile force, and submit to Engineer for review and approval.

E. After Engineer has accepted stressing records, prepare repair openings for concrete placement per Paragraph 3.4.L above.

1. Cut off tails of prestressing strand.
2. Clean prestressing steel, anchorages, and concrete pockets of corrosion-inhibiting grease. Use non-corrosive solvent.
3. Cut end of prestressing steel within pocket, providing for at 1 least 3/4 inches of concrete cover at remaining steel.

    a. Do not damage prestressing steel, anchorage, or concrete. Leave prestressing steel end clean and free of burrs.
    b. Do not cut strands less than ½ inch from wedges.

4. Install protective cap on cut ends where possible to prevent moisture infiltration.
5. Prestressing steel ends shall be accessible for inspection prior to and during cutting, and prior to placement of protective caps and grout.

3.7 FIELD QUALITY CONTROL

A. Stressing records shall be filled out during retensioning operations, and then be submitted to the Engineer for review and verification, per PTI M-10. The following data shall be recorded as a minimum:

1. Name of the project

2. Tendon number correlated to a plan view identifying tendon locations
3. Gauge pressure to achieve required force as per supplied calibration chart
4. Calculated elongation, and allowable range of elongations, at design tensile force.
5. Actual elongation achieved
6. Actual gauge pressure at end of stressing
7. Date of stressing operation
8. Name and signature of the stressing operator or inspector
9. Serial or identification number of jacking equipment
10. Date of approved shop drawings used for installation and stressing

B. Maintain drying records documenting changes in moisture content during drying operations, and submit to Engineer.

C. Contractor shall inspect tendons after installation. Reject, repair or replace nonconforming work.

D. Inspect sheathing for unrepaired damage, for watertight seal between sheathing and anchor, and for correct installation of anchors, before concrete is placed around tendons.

E. Engineer or testing agency retained by Owner will inspect installed Work prior to concrete placement:

END OF SECTION 03 38 18

POST-TENSIONING SUPPLIER QUALIFICATION FORM

GENERAL INFORMATION:	
Project:	City:
Supplier:	
General Contractor:	

SAMPLE PROJECT #1	Date Completed:
Project Name:	$ Value of PT Sub-contract:
City and State:	Tonnage of PT tendons:
Engineer of Record	General Contractor
Name:	Project Manager:
Firm:	Firm:
Phone Number:	Phone Number:
Email:	Email:

SAMPLE PROJECT #2	Date Completed:
Project Name:	$ Value of PT Sub-contract:
City and State:	Tonnage of PT tendons:
Engineer of Record	General Contractor
Name:	Project Manager:
Firm:	Firm:
Phone Number:	Phone Number:
Email:	Email:

POST-TENSIONING SUPPLIER QUALIFICATION FORM

SAMPLE PROJECT #3	Date Completed:
Project Name:	$ Value of PT Sub-contract:
City and State:	Tonnage of PT tendons:
Engineer of Record	General Contractor
Name:	Project Manager:
Firm:	Firm:
Phone Number:	Phone Number:
Email:	Email:

SAMPLE PROJECT #4	Date Completed:
Project Name:	$ Value of PT Sub-contract:
City and State:	Tonnage of PT tendons:
Engineer of Record	General Contractor
Name:	Project Manager:
Firm:	Firm:
Phone Number:	Phone Number:
Email:	Email:

POST-TENSIONING SUPPLIER QUALIFICATION FORM

SAMPLE PROJECT #5	Date Completed:
Project Name:	$ Value of PT Sub-contract:
City and State:	Tonnage of PT tendons:
Engineer of Record	General Contractor
Name:	Project Manager:
Firm:	Firm:
Phone Number:	Phone Number:
Email:	Email:

REQUIRED ATTACHMENTS	
	Quality plan for manufacture, delivery, and detailing of post-tensioning system.
	Verification letter stating that the post-tensioning system will be manufactured in a plant with a current PTI certification and that all materials conform with ACI 301, ACI 318, and are approved by the International Code Council (International Building Code.)

POST-TENSIONING INSTALLER QUALIFICATION FORM

GENERAL INFORMATION:	
Project:	City:
Installer:	
General Contractor:	

SAMPLE PROJECT #1	Date Completed:
Project Name:	$ Value of PT Contract:
City and State:	
Engineer of Record	General Contractor
Name:	Project Manager:
Firm:	Firm:
Phone Number:	Phone Number:
Email:	Email:

SAMPLE PROJECT #2	Date Completed:
Project Name:	$ Value of PT Contract:
City and State:	
Engineer of Record	General Contractor
Name:	Project Manager:
Firm:	Firm:
Phone Number:	Phone Number:
Email:	Email:

POST-TENSIONING INSTALLER QUALIFICATION FORM

SAMPLE PROJECT #3	Date Completed:
Project Name:	$ Value of PT Contract:
City and State:	
Engineer of Record	General Contractor
Name:	Project Manager:
Firm:	Firm:
Phone Number:	Phone Number:
Email:	Email:

SAMPLE PROJECT #4	Date Completed:
Project Name:	$ Value of PT Contract:
City and State:	
Engineer of Record	General Contractor
Name:	Project Manager:
Firm:	Firm:
Phone Number:	Phone Number:
Email:	Email:

POST-TENSIONING INSTALLER QUALIFICATION FORM

SAMPLE PROJECT #5	Date Completed:
Project Name:	$ Value of PT Contract:
City and State:	
Engineer of Record	General Contractor
Name:	Project Manager:
Firm:	Firm:
Phone Number:	Phone Number:
Email:	Email:

REQUIRED ATTACHMENTS	
	Resume of Project Superintendent indicating required experience.
	Letter from post-tensioning Supplier accepting Installer.
	Verification letter stating that the Installer has a current PTI certification and that PTI Certified Field Installers will be used to install and stress post-tensioning system.

SECTION 07 18 00 – TRAFFIC COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. A single installer shall be responsible for providing complete water proofing system including all products specified in following Sections:

1. Division 07 Section, “Traffic Coatings”
2. Division 07 Section, “Concrete Joint Sealants”
3. Division 07 Section, “Expansion Joint Assemblies”

B. Materials shall be compatible with materials or related Work with which they come into contact, and with materials covered by this Section.

C. Related Sections: Following Sections contain requirements that relate to this Section.

1. Division 03 Section, "Cast-in-Place Concrete."
2. Division 07 Section, “Expansion Joint Assemblies”

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Distribute reviewed submittals to all others whose Work is related.

B. Pre-installation Conference: Meet at project site well in advance of time scheduled for Work to proceed to review requirements for Work and conditions that could interfere with successful coating performance. Require every party concerned with coating Work, or required to coordinate with it or protect it thereafter, to attend. Include manufacturer's technical representative and warranty officer.

C. Submittals and Resubmittals: Engineer will review each of Contractor’s shop drawings and/or submittal data initial time and, should resubmittal be required, one additional time to verify that reasons for resubmittal have been addressed by Contractor and corrections made. Resubmittal changes/revisions/corrections shall be circled. Engineer will review only circled items and will not be responsible for non-circled changes/revisions/ corrections and additions. Should additional resubmittals be required, Contractor shall reimburse Owner for all costs incurred, including cost of Engineer’s services made

necessary to review such additional resubmittals. Owner shall in turn reimburse Engineer.

D. Requests For Information

1. Engineer reserves right to reject, unprocessed, any Request for Information (RFI) that Engineer, at its sole discretion, deems frivolous and/or deems already answered in the Contract Documents.
2. RFI process shall not be used for requesting substitutions. Procedures for substitutions are clearly specified elsewhere in Contract documents.

1.4 MOCK-UP

A. Contractor is required to install a mock-up at least 100 SF in area. The intent of the mock-up is for the Owner to verify correct coarseness of aggregate and color that match the contractor provided samples during the submittals stage of the project. If the mock-up is accepted by the Owner, it will be incorporated into the final coating product.

1.5 ACTION SUBMITTALS

A. Product Data: For each system indicated, submit the following at least 60 days prior to application.

1. Product description, technical data, appropriate applications and limitations.
2. Primer type and application rate
3. Material, and wet mils required to obtain specified dry thickness for each coat.
4. Type, gradation and aggregate loading required within each coat.

B. Samples:

1. One 4 in. by 4 in. stepped sample showing each component for each system indicated.

C. Sample Warranty: For each system indicated.

1.6 INFORMATION SUBMITTALS

A. Certificates

1. Certification that products and installation comply with applicable federal, state where project is located, and local EPA, OSHA and VOC requirements regarding health and safety hazards.
2. Evidence of applicator's being certified by manufacturer. Evidence shall include complete copy of manufacturer’s licensing/certification document, spelling out repair responsibility for warranty claims.

3. Certification from Manufacturer that finishes as specified are acceptable for system to be installed at least 1 month before placement of any concrete which will receive traffic coating.
4. Certification stating static coefficient of friction meets minimum requirements of Americans with Disabilities Act (ADA).
5. Certification stating materials have been tested and listed for UL 790 Class "A" rated materials/system by UL for traffic coating application specified on project. Containers shall bear UL labels.
6. Certification from manufacturer confirming compatibility with existing underlying coatings and/or substrate.

B. Manufacturer’s Instructions: for each system indicated.

1. Crack treatment and surface preparation method and acceptance criteria.
2. Method of application of each coat.
3. Maximum and minimum allowable times between coats.
4. Final cure time before resumption of parking and/or paint striping.
5. Any other special instructions required to ensure proper installation.

C. Field Quality Control:

1. Quality Control Plan as defined in Part 3.
2. Two copies each of manufacturer's technical representative's log for each visit.
3. Testing agency field reports.

D. Qualification Statements

1. Manufacturer’s qualifications as defined in “Quality Assurance” article.
2. Installer’s qualifications as defined in “Quality Assurance” article.
3. Signed statement from applicator certifying that applicator has read, understood, and shall comply with all requirements of this Section.

1.7 CLOSEOUT SUBMITTALS

A. Three copies of System Maintenance Manual.

B. Five copies of snow removal guidelines for areas covered by Warranty.

C. Final executed Warranty.

1.8 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Owner retains right to reject any manufacturer.

1. Evidence of acceptable previous work on WALKER-designed projects. If none, so state.
2. Evidence of financial stability acceptable to Engineer/Architect.

3. Listing of 20 or more projects completed with submitted system, to include:

    a. Name and location of project.
    b. Type of system applied.
    c. On-Site contact with phone number.

B. Manufacturer's technical representative, acceptable to Engineer/Architect, shall be on site during surface preparation and initial stages of installation.

C. Installer’s Qualifications: Owner retains right to reject any manufacturer.

1. Evidence of compliance with Summary article paragraph "A single installer. . ."
2. Evidence that installer has successfully performed or has qualified staff who have successfully performed at least 5 verifiable years of installations similar to those involved in this Contract, and minimum 10 projects with submitted system.
3. Listing of 5 or more installations in climate and size similar to this Project performed by installer’s superintendent.

D. Testing Agency: Independent testing laboratory employed by **Owner** and acceptable to Engineer/Architect.

E. Certifications

1. Traffic coating shall satisfy current National Volatile Organic Compound (VOC) Emission Standards for Architectural Coatings.
2. Licensing/certification document from manufacturer that confirms system installer is a licensed/certified applicator for the manufacturer and is legally licensed to perform work in the state this project is being constructed.
3. Licensing/certification agreement shall include following information:

    a. Applicator’s financial responsibility for warranty burden under agreement terms.
    b. Manufacturer’s financial responsibility for warranty burden under agreement terms.
    c. Process for dispute settlement between manufacturer and applicator in case of system failures where cause is not evident or cannot be assigned.
    d. Authorized signatures for both Applicator Company and Manufacturer.
    e. Commencement date of agreement and expiration date (if applicable).

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials to site in original, unopened containers, bearing following information:

1. Name of product.
2. Name of manufacturer.
3. Date of preparation.
4. Lot or batch number.

B. Store materials under cover and protect from weather. Replace packages or materials showing any signs of damage with new material at no additional cost to Owner.

C. Do not store material on slabs to be post-tensioned before final post-tensioning of slabs is accomplished. At no time shall weight of stored material being placed on slab area, after post-tensioning is completed and concrete has reached specified 28 day strength, exceed total design load of slab area. Between time final post-tensioning is accomplished and time concrete has reached specified 28 day strength, weight of stored material placed on slab area shall not exceed half total design load of slab area.

1.10 FIELD CONDITIONS

A. Weather and Substrate Conditions: Proceed with work only when existing and forecast weather and temperature of concrete substrate will permit work in accordance with manufacturer's recommendations.

1.11 WARRANTY

A. System Manufacturer **New Application and Complete System Recoating**: Furnish Owner with written total responsibility Joint and Several Warranty, detailing responsibilities of manufacturer and applicator with regard to warranty requirements (Joint and Several). Warranty shall provide that system will be free of defects, water penetration and chemical damage related to system design, workmanship or material deficiency, consisting of:

1. Any adhesive or cohesive failures.
2. Spalling surfaces.
3. Weathering.
4. Surface crazing (does not apply to traffic coating protection course).
5. Abrasion or tear failure resulting from normal traffic use.
6. Failure to bridge cracks less than 0.0625 in. or cracks existing at time of traffic coating installation on double tees only.

B. System Manufacturer **Partial System Recoating**: Furnish Owner with written total responsibility Joint and Several Warranty, detailing responsibilities of manufacturer and applicator with regard to warranty requirements (Joint and Several). Warranty shall provide that system will be free of defects, chemical damage related to system design, workmanship or material deficiency, consisting of:

1. Any adhesive or cohesive failures.
2. Spalling surfaces.
3. Weathering.
4. Surface crazing (does not apply to traffic coating protection course).
5. Abrasion or tear failure resulting from normal traffic use.

C. If material surface shows any of defects listed above, supply labor and material to repair all defective areas and to repaint all damaged line stripes.

D. Warranty period shall be a 5 year Joint and Several Warranty commencing with date of acceptance of work.

E. Perform any repair under this warranty at no cost to Owner.

F. Address following in terms of Warranty: length of warranty, change in value of warranty – if any- based on length of remaining warranty period, transferability of warranty, responsibilities of each party, notification procedures, dispute resolution procedures, and limitations of liability for direct and consequential damages.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of 1 of following, only where specifically named in product category:

1. Advanced Polymer Technology (APT), Harmony, PA
2. BASF Building Systems (BASF), Shakopee, MN
3. Deneef Construction Chemicals (Deneef), Houston, TX.
4. Lymtal International Inc. (Lymtal), Lake Orion, MI.
5. Neogard Division of Jones-Blair Company (Neogard), Dallas, TX.
6. Pacific Polymers, Inc. a Division of ITW (Pacific Polymers), Garden Grove, CA
7. Polycoat Products Division of Amer. Polymers (Polycoat), Santa Fe Springs, CA.
8. Pecora Corporation (Pecora), Harleysville, PA
9. Sika Corporation (Sika), Lyndhurst, NJ.
10. Technical Barrier Systems, Inc. (TBS), Oakville, Ontario.
11. Tremco (Tremco), Cleveland, OH.

2.2 MATERIALS, TRAFFIC COATING

A. Acceptable [**low odor**] coatings are listed below. Coatings shall be compatible with all other materials in this Section and related work.

1. Hybrid VOC Compliant, Extreme Low Odor, High-Solids, Heavy Duty Coating System:

    a. AutoGard E, Neogard.
    b. Iso-Flex 750EU HVT, Lymtal.
    c. Kelmar FCW III, Exposure 3, TBS.
    d. MasterSeal Traffic 2530, BASF.
    e. Qualideck (152/252/532E/512), APT
    f. Sikalastic 22 Lo-Mod Hybrid (720/22 LM/745 AL), Sika.
    g. Vulkem EWS, Tremco

B. Provide ultraviolet screening for all traffic coating placed on this project.

C. Finish top coat shall be colored grey. If multiple shades of grey are available from the manufacturer, contractor shall provide Owner available colors for selection.

D. Aggregate shall be #3 flint. Aggregate shall be broadcast to rejection.

E. Substitutions: **None** for this project. Contact Engineer/Architect for consideration for future projects.

2.3 MATERIALS, CRACK SEALER

A. Repair for isolated random horizontal cracks 0.01 in. to 0.06 in. wide. Acceptable products:

1. Denedeck Crack Sealer, Deneef.
2. Iso-Flex 609 Epoxy Crack Sealer, Lymtal.
3. MasterSeal 630, BASF.
4. Sikadur 55 SLV Epoxy Crack Healer/Sealer, Sika.
5. SikaPronto 19TF, Sika.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive Work and report immediately in writing to Engineer/Architect any deficiencies in surface which render it unsuitable for proper execution of Work.

B. Coordinate and verify that related Work meets following requirements before beginning surface preparation and application:

1. Concrete surfaces are finished as acceptable for system to be installed. Correct all high points, ridges, and other defects in a manner acceptable to Engineer/Architect.
2. Curing compounds used on concrete surfaces are compatible with system to be installed.
3. Concrete surfaces have completed proper curing period for system selected.
4. Joint Sealants are compatible with traffic coatings.

3.2 PREPARATION

A. Seal all openings to occupied space to prevent cleaning materials, solvents and fumes from infiltration. All protective measures and/or ventilating systems required to prevent infiltration are incidental to this Work.

B. Acid etching is prohibited.

C. Remove all debonded traffic coatings. Remove all laitance and surface contaminants, including oil, grease and dirt, by shotblasting and appropriate degreasers, or as specified by manufacturer's written recommendations to provide warranty. Prepare by sandblasting all surfaces inaccessible to shotblast equipment. Mechanically remove bonded thermoplastic directional arrows where required.

D. Before applying materials, apply system to small area to assure that it will adhere to substrate and joint sealants and dry properly and to evaluate appearance.

E. All cracks on concrete surface shall be prepared in accordance with manufacturer's recommendations.

F. All random cracks on concrete surface less than 0.03 in. wide and showing no evidence of water and/or salt water staining on ceiling below shall receive detail coat unless more complete treatment required in accordance with manufacturer's recommendations. Rout and seal random cracks, construction joints and control joints prior to installation of primer or base coat. Crack preparation including installation of joint sealant material, where required, is incidental to traffic coating work.

G. Mask off adjoining surfaces not to receive traffic coating and mask off drains to prevent spillage and migration of liquid materials outside membrane area. Provide neat/straight lines at termination of traffic coating.

3.3 INSTALLATION/APPLICATION

A. Installation should include all of the following steps:

1. Surface Preparation: Prepare concrete for system application.
2. Crack/Construction/Control/Cove Joint Sealing: Detail for crack bridging.
3. Primer Coat: Insure proper adhesion of membrane to substrate.
4. Base Coat: Provide crack spanning in conjunction with Crack Detail noted above.
5. Aggregate Coat – to hold aggregate in system, providing skid and wear close up resistance.
6. Aggregate: Correct size, shape, hardness and amount necessary to insure proper skid and wear resistance.
7. Top Coat: Lock aggregate into place, provide a maintainable surface and provide resistance to ponding water, UV degradation, color loss and chemical intrusion.

B. Do all Work in accordance with manufacturer's written instructions and specifications including, but not limited to, moisture content of substrate, atmospheric conditions (including relative humidity and temperature), coverages, mil thicknesses and texture, and as shown on Drawings.

C. A primer coat is required for all systems. No exception.

D. Cease material installation under adverse weather conditions, or when temperatures are outside manufacturer's recommended limitations for installation, or when temperature of work area or substrate are below 40ºF.

E. **All adjacent vertical surfaces shall be coated with traffic coating minimum of 4 in. above coated horizontal surface. Requirement includes, but is not limited to pipes, columns, walls, curbs (full height of vertical faces of all curbs) and islands**.

F. Complete all Work under this Section before painting line stripes.

G. Clean off excess material and material smears adjacent to joints as work progresses using methods and materials approved by manufacturers.

3.4 FIELD QUALITY CONTROL

A. Develop a quality control plan for assured specified uniform membrane thickness that utilizes grid system of sufficiently small size to designate coverage area of not more than 5 gallons at specified thickness. In addition, employ wet mil gauge to continuously monitor thickness during application. Average specified wet mil thickness shall be maintained within grid during application with minimum thickness of not less than 80% of average acceptable thickness. Immediately apply more material to any area not maintaining these standards.

B. Testing Agency employ wet mil gauge to periodically monitor thickness during application.

C. Install 1 trial section of coating system for each duty grade [**and/or recoat system**] specified. Do not proceed with further coating application until trial sections accepted in writing by Engineer/Architect. Remove and replace rejected trial sections with acceptable application. Trial section shall also be tested for:

1. Wet mil thickness application.
2. Adhesion to concrete substrate **[and/or existing coating(s)**].
3. Overall dry mil thickness.

END OF SECTION 07 18 00

SECTION 07 92 33 –CONCRETE JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. A single installer shall be responsible for providing complete water proofing system including all products specified in the following Sections:
   1. Division 07 Section, "Joint Sealants"

B. This Section includes the following:

   1. Exterior joints in the following horizontal traffic bearing surfaces:

      a. Construction joints in cast-in-place concrete.
      b. Control joints in slab-on-grade, pour strips, slabs and topping slabs.
      c. Joints between precast concrete units.
      d. Perimeter of floor penetrations identified on the Drawings.
      e. Other joints as indicated on the Drawings.

   2. Exterior joints in the following vertical and horizontal non-traffic surfaces:

      a. Construction joints in cast-in-place concrete.
      b. Joints between precast concrete units.
      c. Cove joints at intersection of horizontal and vertical concrete.
      d. Exterior horizontal joints between precast and cast-in-place concrete. Color to match precast concrete.
      e. Vertical and horizontal joints between precast beams and columns at tiers exposed directly to weather.
      f. Other joints as indicated on the Drawings.

1.3 ACTION SUBMITTALS

A. Product Data: For each system indicated at least 7 days prior to application.

   1. Product description, technical data, appropriate applications and limitations.
   2. Primer type and application rate

B. Sample Warranty: For each system indicated.

1.4 INFORMATION SUBMITTALS

A. Certificates:

1. Evidence of installer's being certified by manufacturer. Evidence shall include complete copy of manufacturer’s licensing/certification document, spelling out repair responsibility for warranty claims.
2. Certification from the Manufacturer that joint details as specified are acceptable for system to be installed at least 1 month before placement of any concrete which will receive joint sealant.

B. Qualification Statements:

1. Manufacturer’s qualifications as defined in the “Quality Assurance” article.
2. Installer’s qualifications as defined in the “Quality Assurance” article.
3. Signed statement from this Section applicator certifying that applicator has read, understood, and shall comply with all requirements of this Section.

1.5 CLOSEOUT SUBMITTALS

A. Final executed Warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Owner retains right to reject any manufacturer.

1. Evidence of acceptable previous work on WALKER-designed projects. If none, so state.
2. Evidence of financial stability acceptable to Engineer/Architect.
3. Listing of 20 or more projects completed with submitted sealant, to include:

    a. Name and location of project.
    b. Type of sealant applied.
    c. On-Site contact with phone number.

B. Installer’s Qualifications: Owner retains right to reject any installer or subcontractor.

1. Installer shall be legally licensed to perform work in the state of Michigan. Evidence of compliance with Summary article paragraph "A single installer. . ."
2. Evidence that installer has successfully performed or has qualified staff who have successfully performed at least 5 verifiable years of installations similar to those involved in this Contract, and minimum 10 projects with submitted sealant.
3. Listing of 5 or more installations in climate and size similar to this Project performed by installer’s superintendent.

C. Certifications:

1. Licensing/certification document from system manufacturer that confirms sealant installer is a licensed/certified applicator for the manufacturer and is legally licensed to perform work in the state of Michigan
2. Licensing/certification agreement shall include following information:

    a. Applicator's financial responsibility for warranty burden under agreement terms.
    b. Manufacturer's financial responsibility for warranty burden under agreement terms.
    c. Process for dispute settlement between manufacturer and applicator in case of system failures where cause is not evident or cannot be assigned.
    d. Authorized signatures for both Applicator Company and Manufacturer.
    e. Commencement date of agreement and expiration date (if applicable).

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials to site in original, unopened containers, bearing following information:

1. Name of product.
2. Name of manufacturer.
3. Date of preparation.
4. Lot or batch number.

B. Store materials under cover and protect from weather. Replace packages or materials showing any signs of damage with new material at no additional cost to Owner.

C. Do not store material on slabs to be post-tensioned before final post-tensioning of slabs is accomplished. At no time shall weight of stored material being placed on slab area, after post-tensioning is completed and concrete has reached specified 28 day strength, exceed total design load of slab area. Between time final post-tensioning is accomplished and time concrete has reached specified 28 day strength, weight of stored material placed on slab area shall not exceed half total design load of slab area.

1.8 FIELD CONDITIONS

A. Weather and Substrate Conditions: Proceed with work only when existing and forecast weather and temperature of concrete substrate will permit work in accordance with manufacturer's recommendations.

1.9 WARRANTY

A. Manufacturer: Furnish Owner with written total responsibility Joint and Several Warranty, detailing responsibilities of manufacturer and installer with regard to warranty requirements (Joint and Several). The warranty shall provide that sealant will be free

of defects, water penetration and chemical damage related to system design, workmanship or material deficiency, consisting of:

1. Any adhesive or cohesive failures.
2. Weathering.
3. Abrasion or tear failure resulting from normal traffic use.

B. If material surface shows any of defects listed above, supply labor and material to repair all defective areas and to repaint all damaged line stripes.

C. Warranty period shall be a 5 year Joint and Several Warranty commencing with date of acceptance of work.

D. Perform any repair under this warranty at no cost to Owner.

E. Address the following in the terms of the Warranty: length of warranty, change in value of warranty – if any- based on length of remaining warranty period, transferability of warranty, responsibilities of each party, notification procedures, dispute resolution procedures, and limitations of liability for direct and consequential damages.

F. Snowplows, vandalism, and abnormally abrasive maintenance equipment are not normal traffic use and are exempted from warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of 1 of following, only where specifically named in product category:
1. Dow Corning Corp. (Dow Corning), Midland, MI.
2. Lymtal International Inc. (Lymtal), Lake Orion, MI.
3. Pecora Corporation (Pecora), Harleysville, PA.
4. Sika Corporation (Sika), North Canton, OH.
5. Tremco (Tremco), Cleveland, OH.

2.2 MATERIALS, JOINT SEALANT SYSTEM

A. Provide complete system of compatible materials designed by manufacturer to produce waterproof, traffic-bearing control joints as detailed on Drawings.

B. Compounds used for sealants shall not stain masonry or concrete. Aluminum pigmented compounds not acceptable.

C. Color of sealants shall match adjacent surfaces.

D. Closed cell or reticulated backer rods: Acceptable products:

1. "Sof Rod," Nomaco Inc., 501 NMC Drive, Zebulon, NC 27597. (800) 345-7279 ext. 341.
2. "ITP Soft Type Backer Rod," Industrial Thermo Polymers Limited, 2316 Delaware Ave., Suite 216, Buffalo, NY 14216. (800) 387-3847.
3. "MasterSeal 921 Backer Rod," BASF.

E. Bond breakers and fillers: as recommended by system manufacturer.

F. Primers: as recommended by sealant manufacturer.

G. Acceptable sealants are listed below. Sealants shall be compatible with all other materials in this Section and related work.

H. Acceptable polyurethane control joint sealants (traffic bearing):
1. MasterSeal SL-2 or MasterSeal SL-2 SG, BASF.
2. Iso-flex 880 GB or Iso-flex 881, Lymtal.
3. Dynatrol II-SG or Urexpan NR 200, Pecora.
4. Sikaflex-2c SL or Sikaflex-2c NS TG, Sika.
5. THC-901, Vulkem 45SSL, Dymeric 240 FC or Dymonic 100, Tremco.

I. Acceptable polyurethane vertical and cove joints sealants (non-traffic bearing):

1. Sikaflex-2c NS, Sika.
2. MasterSeal NP-2, BASF.
3. Dymeric 240/240FC, Dymonic 100 or THC 901 (cove only), Tremco.
4. Dynatred, Pecora.
5. Iso-flex 881, Lymtal.

J. Acceptable silicone vertical and cove joint sealants (non-traffic bearing):

1. Spectrem 1 or Spectrem 4-TS, Tremco.
2. 311-NS, Pecora.
3. Dow Corning NS Parking Structure Sealant, Dow Corning.

K. Proposed Substitutions: None for this project. Contact Engineer/Architect for consideration for future projects.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive Work and report immediately in writing to Engineer/Architect any deficiencies in surface which render it unsuitable for proper execution of Work.

B. Coordinate and verify that related Work meets following requirements before beginning installation

1. Concrete surfaces are finished as acceptable for system to be installed.
2. Curing compounds used on concrete surfaces are compatible with system to be installed.
3. Concrete surfaces have completed proper curing period for system selected.

3.2 PREPARATION

A. Seal all openings to occupied space to prevent cleaning materials, solvents and fumes from infiltration. All protective measures and/or ventilating systems required to prevent infiltration are incidental to this Work.

B. Correct unsatisfactory conditions before installing sealant system.

C. Acid etching is prohibited.

D. Grind joint edges smooth and straight with beveled grinding wheel before sealing. All surfaces to receive sealant shall be dry and thoroughly cleaned of all loose particles, laitance, dirt, dust, oil, grease or other foreign matter. Obtain written approval of method from system manufacturer before beginning cleaning.

E. Check preparation of substrate for adhesion of sealant.

F. Prime and seal joints and protect as required until sealant is fully cured. A primer coat is required for all systems.

3.3 INSTALLATION/APPLICATION

A. Do all Work in strict accordance with manufacturer's written instructions and specifications including, but not limited to, moisture content of substrate, atmospheric conditions (including relative humidity and temperature), thicknesses and texture, and as shown on Drawings.

B. Completely fill joint without sagging or smearing onto adjacent surfaces.

C. Self-Leveling Sealants: Fill horizontal joints slightly recessed to avoid direct contact with wheel traffic.

D. Non-Sag Sealants: Tool joints concave: Wet tooling not permitted.

E. Clean off excess material and material smears adjacent to joints as work progresses using methods and materials approved by manufacturers.

F. Cease material installation under adverse weather conditions, or when temperatures are outside manufacturer's recommended limitations for installation, or when temperature of work area or substrate are below 40ºF.

3.4 FIELD QUALITY CONTROL

A. Contractor and Engineer/Architect will jointly determine which one of following 2 methods of sealant testing to verify sealant profile:

1. Contractor, at Engineer/Architect's direction, shall cut out lesser of 1% of total lineal footage placed or total of 100 lineal ft of joint sealant at isolated/random locations (varying from in. to ft of material) for Engineer/Architect and Manufacturer's Representative inspection of sealant profile.
2. Contractor, at Engineer/Architect's direction, shall install 3 trial joint sections of 20 ft each. Contractor shall cut out joint sections, as selected by Engineer/Architect, for Engineer/Architect and Manufacturer's Representative inspection. Additional isolated/random removals may be required where sealant appears deficient. Total cut out sealant shall not exceed lesser of 1% of total lineal footage placed or total of 100 lineal ft of joint sealant at isolated/random locations (varying from in. to ft of material) for Engineer/Architect and Manufacturer's Representative inspection of sealant profile.

B. Repair all random joint sealant "cut out" sections at no cost to Owner.

END OF SECTION 07 92 33